**Malaysian Communications and Multimedia Commission**

# Review of Access Pricing

**Public Inquiry Paper**

**6 October 2017**

This Public Inquiry Paper was prepared in fulfilment of sections 55(2), 55(4), 58 and 61 of the Communications and Multimedia Act 1998

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# PREFACE

The MCMC invites submissions from industry participants, other interested parties and members of the public on the questions and issues raised in this Public Inquiry Paper (PI Paper) concerning the **Review of Access Pricing**. In this PI Paper, the MCMC sets out a number of preliminary views. Submissions are welcome on the preliminary views where comment is specifically sought. Submissions are also welcome on the rationale and analysis in this PI Paper where no specific questions have been raised. All submissions should be substantiated with reasons and, where appropriate, evidence or source references. Written submissions, in both hard copy and electronic form, should be provided to the MCMC in full by **12 noon, 20 November 2017**.

Submissions should be addressed to:

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| | |
|---|---|
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In the interest of fostering an informed and robust consultative process, the MCMC proposes to make submissions received available to interested parties upon request. The MCMC also reserves the right to publish extracts or entire submissions received. Any commercially sensitive information should be provided under a separate cover clearly marked '**CONFIDENTIAL**'. However, for any party who wishes to make a confidential submission, a "public" version of the submission should also be provided.

The cost models developed for this Public Inquiry are available, upon written request, to interested licensees for their own examination. Any confidential data has been removed.

The MCMC thanks interested parties for their participation in this consultative process and looks forward to receiving written submissions.

# EXECUTIVE SUMMARY

The MCMC is conducting this Public Inquiry to determine cost-based prices for the facilities and services in the Access List for the period 2018-2020 and to use these prices to set regulated rates for some of these facilities and services. The previous revision to cost-based prices occurred in 2012.

This PI Paper sets out the MCMC's preliminary views on which facilities and services in the Access List should be subject to price regulation and, where relevant, provides tables of proposed regulated prices for the period 2018-2020. The Public Inquiry seeks feedback from interested parties on a number of specific issues including the MCMC's approach to developing economic cost models for specific services, particularly on use of the Long-Run Incremental Cost methodology.

The fundamental guiding principles for price regulation are also described in this PI Paper. The MCMC considers price regulation to be important for some facilities and services in order to promote the long-term benefit of end users of communications services and to support continuing competition in the industry.

The MCMC has been working with licensees since February 2017 to collect relevant data and to develop economic cost models that were used to calculate appropriate cost-based prices. For this Public Inquiry, the Access List facilities and services have been classified into 4 major categories:

(a) Fixed Services;
(b) Mobile Services;
(c) Infrastructure Sharing; and
(d) Digital Terrestrial Broadcasting Multiplexing Service.

Fixed Services covers Fixed Origination and Termination Services, Line Rental Services (including Bitstream and HSBB Services), Transmission Services, Co-location and Access to Duct and Manhole Services. For Fixed Origination and Termination, the proposed regulated prices have been calculated based on a bottom-up Long-Run Incremental Cost model of the core network. They are, on average, lower than the current rates. Line Rental Services combine the costs of the access network and the core network. The core network costs were calculated using the same model as the Fixed Origination and Termination Services, the access network costs have been calculated based on a bottom-up Long-Run Incremental Cost model of a copper and fibre access network, with asset prices adjusted to reflect the presence of fully depreciated assets. These prices are also generally lower than the rates set previously.

Mobile Services covers the Mobile Origination and Termination Services. The MCMC proposes to continue price regulation for Mobile Origination and Termination voice services and the average rates are lower than the previously regulated rates. The prices have been calculated based on a bottom-up Long-Run Incremental Cost model of a mobile network.

Infrastructure Sharing which include mobile towers and base station site costs have been calculated based on current asset cost provided primarily by the tower and state-backed companies.

The Digital Terrestrial Broadcasting Multiplexing Service has been costed using a bottom up current asset cost which has been provided by licensee.

The issues on which the MCMC particularly seeks comment are summarized at the beginning of this PI Paper. Written feedback on these and other relevant issues are welcome before the end of the Public Inquiry period. At the conclusion of this Public Inquiry, the MCMC will issue a PI Report and may regulate prices for some facilities and services in the Access List for the period 2018-2020.

## SUMMARY OF ISSUES FOR COMMENT

The MCMC welcomes comment particularly on the following questions and issues raised in this PI Paper:

**Table 1: Summary of questions and issues for comment**

| Number | Section | Question/Issue |
|---|---|---|
| 1 | 5.2.1 | Do you think that the criteria for ex-ante determination of access prices presented remain appropriate? |
| 2 | 5.2.2 | Do you think that the approach to pricing which has been adopted is appropriate? Are there any other criteria that should be considered? |
| 3 | 5.2.3 | Do you have any comments on the appropriateness of setting regulated prices for the period up to and including 2020? |
| 4 | 6.9 | Do you have any further comments on the proposed costing methodologies? |
| 5 | 7.8 | Do you have any further comments on the elements of cost modelling which the MCMC proposes to adopt? |
| 6 | 7.9 | Do you have any comments on the choice of costing methodology adopted? |
| 7 | 7.10 | Do you have any comments on the appropriateness of using glide paths and the method by which the glide paths have been calculated? |
| 8 | 7.11 | Do you have any comments on the appropriateness of using the cost model results in arbitrating disputes over access pricing? |
| 9 | 7.14 | Do you have any comments on the approach to setting prices for installation charges? |
| 10 | 8 | Do you have any further comments on the proposed approach to regulating MVNO Access? |
| 11 | Part C Introduction | Do you have any comments on the approach to calculating the appropriate levels of WACC? |
| 12 | 9 | Do you have any comments on the proposed common parameters to be included in the WACC calculations? |
| 13 | 10.5 | Do you have any comments on the WACC values proposed for the Fixed Network Services? |
| 14 | 11.4 | Do you have any comments on the WACC values proposed for the Mobile Network Services? |

| Number | Section | Question/Issue |
|---|---|---|
| 15 | 12.4 | Do you have any comments on the WACC values proposed for the Towers Services? |
| 16 | 13.5 | Do you have any comments on the WACC values proposed for the DTT Transmission Services? |
| 17 | 15 | Do you have any comments on the range of WACC values proposed? |
| 18 | 16 | Do you have any comments on the approach adopted for the fixed model? |
| 19 | 17 | Do you have any comments on the proposed prices for the fixed services in the Access List? |
| 20 | 18.2 | Do you have any comments on the proposed assumptions for the Notional Operator's services and volumes? |
| 21 | 18.3 | Do you have any comments on the proposed approach to the radio spectrum and coverage assumptions? |
| 22 | 18.8 | Do you have any comments on the design assumptions for the mobile model? |
| 23 | 18.9 | Do you have any comments on the service costs calculated by the mobile model? |
| 24 | 18.12 | Do you have any comments on the 3G/4G only operator, local/national call rates and submarine cable issues? |
| 25 | 18.20 | Do you have any comments on the sensitivity analysis? |
| 26 | 18.21 | Do you have any comments on the proposed regulated prices? |
| 27 | 19.3 | Do you have any comments on the approach to the modelling of tower costs? |
| 28 | 19.4 | Do you have any comments on the sensitivities and outputs from the towers cost model? |
| 29 | 19.7 | Do you have any comments on the proposed regulated prices? |
| 30 | 19.8 | Do you have any comments on the approach to modelling in-building common antenna system? |
| 31 | 20.3 | Do you have any comments on the approach to the modelling of the DTT multiplex costs? |
| 32 | 20.5 | Do you have any comments on the proposed regulated prices? |

## SUMMARY OF MCMC VIEWS ON REGULATED ACCESS PRICES

The following Table 2 summarises the MCMC's preliminary views on which facilities and services in the Access List should be subject to price regulation.

The MCMC stresses that this PI Paper only sets out the MCMC's preliminary views. The MCMC invites comments in response to those preliminary views and the questions raised in this PI Paper in order to finalise an appropriate list of Access Prices. A more detailed explanation of the MCMC's reasoning for reaching the preliminary views are set out in the discussions below:

**Table 2: Summary of MCMC's preliminary views**

| Service | MCMC's preliminary view |
|---|---|
| Fixed Network Origination Service | Price regulation |
| Fixed Network Termination Service | Price regulation |
| Mobile Network Origination Service | Price regulation |
| Mobile Network Termination Service | Price regulation |
| Interconnect Link Service | Price regulation |
| Wholesale Local Leased Circuit Service | Price regulation |
| Mobile Infrastructure Sharing Service (Towers) | Price regulation |
| Domestic Connectivity to International Services | Price regulation specifically on connection services to the submarine cable system |
| Network Co-Location Service | No price regulation |
| Full Access Service | No price regulation |
| Line Sharing Service | No price regulation |
| Bitstream Services, including (a) Bitstream with Network Service and (b) Bitstream without Network Service | No price regulation |
| Sub-loop Service | No price regulation |
| Digital Subscriber Line Resale Service | No price regulation |
| Digital Terrestrial Broadcasting Multiplexing Service | Price regulation |

| Service | MCMC's preliminary view |
| --- | --- |
| Wholesale Line Rental Service | No price regulation |
| Layer 2 HSBB Network Service with QoS | Price regulation |
| Trunk Transmission Service | Price regulation |
| Duct and Manhole Access | Price regulation |
| Layer 3 HSBB Network Service without QoS | Price regulation |
| End-to-End Transmission Service | Price regulation |
| MVNO Access | No price regulation |

# PART A: BACKGROUND

## 1. Introduction

Since January 2017, the MCMC has been developing new cost models in order to determine cost-based prices for the facilities and services in the Access List for the period 2018-2020. The previous revision to cost-based prices occurred in 2012.

In February 2017, the MCMC made the industry and key stakeholders aware that it was about to embark on a new cost modelling process. The MCMC issued data requests to a wide range of licensees to seek data on communications networks and the costs of providing services. A Methodology Questionnaire was also issued to seek inputs from stake holders on a range of issues relating to the cost modelling exercise. Responses to this informal consultation were received from eighteen stakeholders. The stakeholders who responded to the informal consultation were Altel Communication Sdn Bhd (Altel), Measat Broadcast Network Sdn Bhd (Astro), Celcom Axiata Bhd (Celcom), Ceres Telecom Sdn Bhd (Ceres), Digi Telecommunications Sdn Bhd (Digi), edotco Malaysia Sdn Bhd (edotco), Fibercomm Network (M) Sdn Bhd (Fibercomm), Fiberail Sdn Bhd (Fiberail), Maxis Berhad (Maxis), Merchantrade Asia Sdn Bhd (Merchantrade), MYTV Broadcasting Sdn Bhd (MYTV), Persatuan Penyedia Infrastruktur Telekomunikasi Malaysia (PPIT), REDtone Engineering and Network Services Sdn Bhd (REDtone), Telekom Malaysia Berhad (TM), TT dotcom Sdn Bhd (TIME), U Mobile Sdn Bhd (U Mobile), Webe Digital Sdn Bhd (Webe) and YTL Communications Sdn Bhd (YTL). There was agreement from many of the responders to most of the questions posed. The responses have been taken into consideration in developing the cost models and also in preparing this PI Paper. The issues covered in the informal consultation together with the range of responses received are included in the relevant sections of this PI Paper.

During the period of January to June 2017, the MCMC analysed network and cost data from local and international sources. Substantial and detailed responses to the data requests were received from all major licensees. Further meetings with network operators were held in March 2017 to clarify items in those data responses and to request further data in some cases. Subsequent discussions took place with network operators to clarify and collect additional data.

Further meetings with licensees were held in June 2017 to present the models and to clarify any issues with its construction. After careful analysis of all data received, the MCMC released a series of cost models in July 2017 for viewing and analysis to permit the licensees which provided the initial data to give detailed feedback on the interpretation of the data and the construction of the models. In some cases, real data was removed from the released models in order to ensure that any confidential information was not disclosed, and dummy data was provided. Accompanying each model was an operational manual, which described the model calculations in detail, and a brief description of how the input data for the model had been derived. Detailed written responses to the model viewing were received from Celcom, Digi, edotco, Maxis, Media Prima, MYTV, PPIT, Sacofa, TM, U Mobile, Altel and Webe in July 2017. Many of these comments related to the data used within the models and where appropriate these have resulted in changes to the input data for the models. Subsequently, the fixed model with fully populated data was released to TM in order to obtain feedback on the assumptions adopted in the model. The more substantive comments received from the consultations are discussed in the sections below within this PI Paper.

In preparing for this Public Inquiry, the MCMC has carefully considered all feedback received from licensees and, in several instances, has amended the models and updated its views on appropriate cost-based prices. This PI Paper provides the preliminary results of the MCMC's deliberations and seeks further comment from interested parties.

## 1.1. Legislative Context

The Communications and Multimedia Act 1998 (CMA) governs the communications and multimedia industry in Malaysia and establishes the regulatory and licensing framework applicable to the industry.

The relevant provisions of the CMA for the purposes of this Review of Access Pricing are as follows:

(a) section 55 – the general processes for the MCMC to follow in making a determination under the CMA, including the requirement for the MCMC to hold an inquiry;
(b) section 58 – the discretion of the MCMC to hold a public inquiry on any matter which relates to the administration of the CMA, either in response to a written request from a person or on its own initiative if the MCMC is satisfied that the matter is of significant interest to the public or to the industry;
(c) section 60 – the discretion for the MCMC to conduct an inquiry as and when the MCMC thinks fit and to exercise any or all of its investigation and information-gathering powers in Chapters 4 and 5 of Part V under the CMA;
(d) section 61 – the requirement for the inquiry to be public and for the MCMC to invite and consider submissions from members of the public relating to the inquiry;
(e) sections 62 and 63 – the discretion of the MCMC to conduct an inquiry (or parts of an inquiry) in private in certain cases, to direct that confidential material presented to the inquiry or lodged in submissions not be disclosed or that its disclosure be restricted; and

(f) section 65 – the requirement to publish a report into any inquiry undertaken under the previous sections of the CMA within 30 days of the conclusion of the inquiry.

In accordance with section 58(2), a Public Inquiry will be held as part of this Review of Access Pricing, as the review is of significant interest to the public or industry. This process accords with international regulatory best practice.

## 1.2. Structure of this PI Paper

This PI Paper is structured into seven (7) parts and one (1) Annexure, as follows:

**Part A: Background**

Sections 1 to 4 are an introduction to this review, covering the processes and context in which the review is conducted.

**Part B: General Regulatory Pricing Principles**

Sections 5 to 8 describe the underlying regulatory principles that have guided the MCMC's development of costs models and the associated decisions on which prices should be directly regulated.

**Part C: Weighted Average Cost of Capital (WACC)**

Sections 9 to 15 describe the MCMC's approach to determining the appropriate WACC and presents the calculations and range of values which it determines as appropriate for the different services.

**Part D: Fixed Services**

Sections 16 and 17 describe the MCMC's preliminary conclusions on the regulated prices to be set for fixed network services. These include Fixed Origination and Termination services, Transmission-related services, Fixed Access services, Bitstream services, HSBB services, network co-location services and access to duct and manhole. The conclusions are based on a cost model for fixed services developed and analysis of the data received from licensees. The cost model and its results are presented in these chapters.

**Part E: Mobile Services**

Section 18 describes the MCMC's preliminary conclusions on the regulated prices to be set for Mobile Origination and Termination services. The conclusions are based on a cost model for Mobile services developed and analysis of the data received from licensees. The cost model and its results are presented in these chapters.

**Part F: Infrastructure Sharing**

Section 19 describes the MCMC's preliminary conclusions on the regulated prices to be set for tower structures. The conclusions are based on a cost model for tower costs together with analysis of the data received from tower and mobile licensees.

**Part G: Digital Terrestrial Broadcasting Multiplexing Service**

Section 20 describes the MCMC's preliminary conclusions on the regulated prices to be set for the Digital Terrestrial Broadcasting Multiplexing Service. The conclusions are based on a cost model for the Digital Terrestrial Broadcasting Multiplexing Service and analysis of the data received from the licensee.

**Annexure**

The Annexure provides an abbreviation of the terms used within this PI Paper.

## 2. Purpose of this Public Inquiry

This PI Paper has been issued by the MCMC to solicit views from industry participants, other interested parties and members of the public to assist the MCMC to determine:

(a) which facilities and services in the Access List should be subject to price regulation through the setting of access prices; and
(b) the level of access prices to be set each year for the relevant facilities and services in the Access List.

After considering the results of this Public Inquiry, the MCMC may make one or more Determinations on the regulated access prices for some or all of the facilities and services in the Access List.

## 3. Matters outside scope

Matters that are outside the scope of this review include:

(a) determinations on which facilities and services should be included in the Access List;
(b) determinations on non-pricing terms and conditions; and

(c) consideration of exemptions from the standard access obligations (SAOs), which are subject to the grant by the Minister.

## 4. Issues for comment

Throughout this PI Paper, the MCMC has identified specific questions and issues particularly relevant to its final determinations. The MCMC encourages comments on these questions in particular and welcomes comments on any other related issues that stakeholders believe are relevant.

It should be noted that where the MCMC has provided a "preliminary view" on any matter relevant to this Public Inquiry, this view is provided in the following context:

(a) it is a proposition only that invites views from parties on whether they agree or disagree, and why; and
(b) it is not to be taken as a final view of the MCMC.

# PART B: GENERAL REGULATORY PRICING PRINCIPLES

## 5. Introduction

The economic cost modelling exercise will determine costs for facilities and services in the Access List and enable the derivation of access prices for facilities and services in the Access List. The MCMC will determine regulated access prices for those facilities and services potentially requiring price regulation, including fixed and mobile voice services, SMS, data and broadband services as well facility sharing and infrastructure sharing services. The proposed regulated prices and the method by which they are to be determined are the subject of this Public Inquiry.

As established in previous studies of access prices, the MCMC applies three criteria when assessing the need for intervention and access pricing regulation.

The criteria are:

(a) The presence of non-transitory high barriers to entry;
(b) The continuing absence of a trend towards effective competition; and
(c) Ex-post regulatory controls are unlikely to be sufficient to address concerns regarding access to fair and reasonable access prices.

After seeking comments in the previous Public Inquiry, the MCMC concluded that these were appropriate criteria for access pricing regulation[1].

These criteria and related matters are further discussed below.

### 5.1. Legislative Objectives

In performing its statutory functions under the CMA, the MCMC is guided by the National Policy Objectives (NPOs) set out in subsection 3(2) of the CMA and, in particular, objective 3(2)(d) to regulate for the long-term benefit of the end user (LTBE). The LTBE is promoted by achieving the following objectives:

(a) Promoting competition in relevant markets;
(b) Achieving any-to-any connectivity in relation to communications services; and
(c) Encouraging the economically efficient use of and investment in communications infrastructure.

[1] See MCMC, *Public Inquiry Report: Review of Access Pricing*, 14 December 2012, p. 26.

The LTBE is therefore promoted by sustainable lower prices, higher quality of service and greater choice of products and services.

In its Public Inquiry on access pricing in 2012[2], the MCMC stated that the use of a system where access prices are either determined in a competitive market or are set on the basis of efficiently incurred costs supports most, if not all, of the NPOs. In particular, the correct pricing of access services will:

(a) Benefit the Malaysian communications industry by providing the appropriate signals for investment and opportunities for new entry into the market place;
(b) Lead to a more efficient allocation of resources; and
(c) Promote sustainable long-term competition rather than short-term competition based on arbitrage opportunities.

Part VI of the CMA contains provisions on economic regulation including access to services. Section 149 within Part VI requires access providers to provide access to facilities and services on reasonable terms and conditions, which, in the MCMC's view, include the prices that an access provider sets.

In addition to Part VI, Part VIII of the CMA contains provisions on consumer protection including the following principles on rate setting[3]:

(a) Rates must be fair and, for similarly situated persons, not unreasonably discriminatory;
(b) Rates should be oriented toward costs and, in general, cross-subsidies should be eliminated;
(c) Rates should not contain discounts that unreasonably prejudice the competitive opportunities of other providers;
(d) Rates should be structured and levels set to attract investment into the communications and multimedia industry; and
(e) Rates should take account of the regulations and recommendations of the international organisations of which Malaysia is a member.

As stated in previous Public Inquiries, the conclusion drawn is that the CMA provides adequate provisions to allow the MCMC to address the pricing of facilities and services in the Access List and prices should be oriented towards cost.

[2] *Public Inquiry Paper: Review of Access Pricing*, 1 October 2012, Section 3.2
[3] Communications and Multimedia Act 1998, Section 198.

## 5.2. Principles in Setting Access Prices

### 5.2.1. Ex-ante Determination of Access Prices

The Public Inquiry on Access Pricing conducted by the MCMC in 2012 and subsequent discussion dealt with the potential for allowing commercial negotiation of access pricing to take precedence over the setting of prices by the regulator.

The MCMC has generally agreed with the concept of allowing commercial negotiations on price to take precedence in this way. It has also recognized the key risk of an access provider who controls essential facilities and deliberately prolongs commercial negotiations to gain or protect an unfair first-mover advantage. In a fast moving industry like communications, a first-mover advantage may be difficult for a potentially competitive access seeker to overcome and ex-post intervention by the MCMC may not provide a sufficient remedy to this type of abuse of dominance. Intervention by the MCMC in access pricing cannot therefore be conditional only on the failure of commercial negotiations and there is a role for ex-ante regulation of prices.

The MCMC recognizes that operators are free to enter into commercially negotiated agreements for facilities or services. However, there are circumstances in which access seekers may be denied recourse to fair and reasonable access prices. These circumstances are:

(a) Presence of high barriers to entry: high barriers to entry potentially allow a service provider to delay competition by setting unreasonably high wholesale prices and thus gaining a first mover advantage in downstream markets; and
(b) Absence of a trend towards effective competition: lack of sufficient competition in the provision of access facilities can lead to bottleneck conditions for the supply of wholesale services.

In these cases, the setting of maximum regulated prices for the facilities or services in the Access List should help provide commercial certainty in the market and aid commercial negotiations.

**Question 1:**

Do you think that the criteria for ex-ante determination of access prices presented remain appropriate?

### 5.2.2. Access Pricing Guidelines

Where the MCMC has determined that setting maximum regulated prices for facilities or services in the Access List is necessary, then they should be set based on appropriate criteria. These criteria are:

(a) Appropriate Cost Recovery:
- Recovery of legitimate costs;
- Recovery of reasonably efficiently incurred costs;
- Reasonable rate of return on capital employed; and
- Appropriate time period.

(b) Promotion of economic efficiency in investments:
- Ensuring the right build/buy decisions are made;
- Incentives to reduce costs and improve efficiency;
- Incentives for innovation; and
- Incentives to meet suitable levels of quality.

These criteria are described in more detail in the following subsections. The specific calculation methods for calculating access prices are described in later chapters.

#### *5.2.2.1. Appropriate cost recovery*

As a general principle, service providers should be able to recover all the costs legitimately incurred in providing a service. This should include some part of fixed and common costs if they are necessarily incurred to support the service. If a regulated price does not provide appropriate cost recovery, then a service provider may lack the incentive to provide the service or may provide it with insufficient quality or timeliness.

In practice, however, what constitutes a legitimate cost may be open to question and debate. Service providers will often have a wholesale division that "markets" interconnection and other regulated wholesale services to access seekers. The efficient operations in this wholesale division i.e. those operations that are required to provide the regulated service, result in legitimate costs being incurred, but any activity associated with promotion of the service or with non-regulated wholesale services should be excluded. The underlying principle is that the activities should be necessary to provide the regulated service.

Costs should also be reasonably efficiently incurred. That is, only those activities that, taken as a whole, are sufficient to provide the service should be included; efficient costs for those activities should be included in the cost base. The definition of what constitutes "reasonably efficient" can take several forms. Some National Regulatory Authorities (NRA) have undertaken benchmarking of activities or prices in similar jurisdictions in order to assess if an internationally comparable level of efficiency is being achieved. An NRA can also collect data on the costs incurred by service providers within its jurisdiction and compare costs of providing the same service if the same services are provided by multiple operators. The NRA can use the sources of information it has to assume a level of efficiency in its cost modelling and regulated pricing, therefore achieving consistency through modelling and price setting. The latter approach is what the MCMC has followed.

Any service provider is likely to finance its operations through a mixture of equity and debt. Its revenue must cover its operating expenses and the costs of its capital investments and it will also seek to make further profit. The regulated price should cover the (reasonably efficiently incurred) operating expenses and cost of capital but not the further profit (because the profit is not necessary for the service provision). The cost of capital, however, must take into account the returns required for continued financing of the service provider; i.e. the returns that equity and debt providers require in order to continue investing.

For the costing of regulatory products and services, the approach to covering the financing costs of the service provider is to define a WACC that includes, on average, appropriate returns for equity and debt holders. The WACC is then used to calculate the required annual return on the capital investments to cover the costs of financing. In calculating regulated prices for a service, it is necessary to estimate an efficient WACC value. The calculation of the WACC values is described later in this PI Paper.

Once regulated prices have been set, the industry generally will adjust its stance to accommodate the changes. The prices should therefore be set for a suitable period to provide regulatory certainty and to allow cost recovery for regulated services to occur. The regulatory period cannot be too long, because uncertainty in forecasts and technological change will mean that the assumptions made in setting prices may not continue to apply. Typically, NRAs use 3-5 years as the period for setting prices. The MCMC has determined a period of 3 years from 2018 to 2020 as the appropriate period in this instance.

*5.2.2.2. Promotion of economic efficiency in investments*

NRAs are concerned about promoting economic efficiency of three kinds:

(a) Productive efficiency: achieved when the costs of production are minimized;
(b) Allocative efficiency: achieved when prices are close to cost, so that resources are aligned to production; and

(c) Dynamic efficiency: achieved when companies have the correct incentives to invest and to innovate.

The economic assumption is that these efficiencies will be achieved in a fully competitive market. In response to competition, a firm reduces its production costs as much as possible, sets prices competitively close to its costs, and flourishes through productive investments and innovation. In a fully competitive market, these prices will tend towards marginal cost. In cases where there is no full competition, that is, in areas of market failure, the regulated prices should be set to the levels that would be achieved in a fully competitive market.

Productive efficiency is achieved through setting prices for an efficient service provider. This has the effect of driving all competing service providers over time towards producing outputs (products and services) at minimal cost and pricing to reflect efficiently incurred costs.

Allocative efficiency is achieved by setting prices based on costs. This ensures that investment choices are made in such a way as to favour LTBE. Equally, a service provider with a dominant market position has no incentive to allocate resources to an unfairly profitable service to the detriment of other investments.

Dynamic efficiency is achieved through setting regulated prices that would pertain in a fully competitive market. For mobile termination, for example, setting prices based on Long-Run Incremental costs (see later chapters) encourages operators to compete through innovation (finding better ways of doing things) rather than by exploiting price distortions. For example, lower termination pricing discourages retail pricing designed to discriminate between on-net and off-net calls that result in on-net prices at a level that smaller operators cannot match, so large groups of callers have incentives to stay on the larger network and only make on-net calls. Setting appropriate prices for transmission services also means that network operators are presented with competitively neutral build/buy decisions.

The principal aim of the costing and pricing methods presented in later sections of this PI Paper is to provide prices that are as close as possible to those that would arise from a competitive market, even when competition may not be fully effective.

**Question 2:**

Do you think that the approach to pricing which has been adopted is appropriate? Are there any other criteria that should be considered?

### 5.2.3. Time Horizon

The cost models for this Public Inquiry have been constructed to calculate prices for the period from 2018 to 2020. This period has been chosen because it is long enough to provide regulatory certainty for licensees without being so long that forecasts of demand and unit costs cannot reliably be made.

The MCMC is intending to set regulated prices for appropriate facilities and services in the Access List for the period 2018 to 2020, a period of 3 years. This will provide regulatory certainty for network operators and service providers.

The MCMC will then have an opportunity to refresh its estimates of cost-based prices before the next period of regulatory decision from 2021 onwards.

**Question 3:**

Do you have any comments on the appropriateness of setting regulated prices for the period up to and including 2020?

# 6. Cost Modelling General Issues

## 6.1. Background to the Cost Models

A range of costing methodologies are available. These were first discussed in the Methodology Questionnaire circulated to licensees in February 2017 and that discussion is also presented in the sections below.

## 6.2. Regulatory considerations

In general, the process of competition is considered to be the mechanism of choice for setting prices. This is because the buyers and sellers in any market are best placed to judge the consequences and risks arising from agreeing a price at any given level and they are likely to bear most of those consequences and risks themselves. Aligning the information and risk with those directly involved in the market in this way may be expected to lead to an optimal allocation of resources (neither too much, nor too little consumed) and this approach results in the best possible outcome for consumers and citizens. At the same time, suppliers are able to cover their costs and make a reasonable profit.

However, regulators are expected to intervene in markets where there is evidence that they are insufficiently competitive, or can be expected not to be so. Usually this occurs as a result of sellers in the market amassing an excessive amount of power and misusing that power to raise prices, or to reduce the quality of the goods or services they supply as compared to what would happen in an effectively competitive market. At the same time, sellers with market power may tend to restrict supply in the expectation that this will lead to higher prices, without the fear that other suppliers will step in to fill the gap and drive prices down, or quality up.

In an industry such as telecommunications, furthermore, suppliers must make investments for which they hope to gain a return over a number of years. As a result, they may have to consider not only the potential actions of competitors already active in the market, who will themselves have had to make investments, but also the possibility that others will enter the market with newer technologies that give them the edge on price, quality, or features. Markets that offer the possibility of new competitors entering with better technology like this are said to be "contestable".

Market power can lead to reduced contestability, as well as to reduced competitiveness if sellers use it to create barriers to keep potential entrants out. For example, they might be prepared to price below cost for a limited period, particularly if the new entrant occupies a limited segment of the market. However, other factors such as licensing restrictions, or a shortage of spectrum can have the effect of reducing the contestability of a market.

Where an issue of market power and its actual or potential misuse has been identified, a primary regulatory remedy is to regulate the price that can be charged, for example by setting a maximum. The task of the regulator is to ensure that the price is, as far as possible, within the range that would be expected to prevail under effective competition. Since competition may be expected to drive prices towards costs over time, it is important to find a suitable method of calculating costs.

## 6.3. Fully-Allocated Costs (FAC)

In addition to the concerns about maximising welfare for consumers, regulators often have an obligation to ensure that operators can recover their costs at a reasonable rate of return, so that there is a continued incentive to invest in and maintain their assets. Where this is the primary objective, or where there is little prospect of the market becoming competitive, FAC provides an attractive option. One advantage is that the methodology is closer to that typically used in compiling financial, regulatory and management accounts and so it is easier to reconcile to them, although it is unusual for such accounts to be compiled at the detail required to assess the costs of individual services.

## 6.4. Long-Run Incremental Cost (LRIC)

A key problem with FAC from a regulator's point of view is that it is not a very good representation of the pricing behaviour that economic theory would lead us to expect in competitive and contestable markets. When a firm is evaluating whether to invest to launch a new service, it is reasonable to suppose that they would construct a business case that would compare the additional revenues over time with the additional costs of going ahead with the proposal. Since some costs are likely to be fixed whether or not the project goes ahead, costs calculated on this basis can differ substantially from FAC, in which all costs (including those that are fixed) are distributed amongst the different output services. For example, a hypothetical firm providing only on-net and off-net call origination services might decide to add call termination. They would already have network facilities in place and would only need to add to these to the extent that additional capacity would be needed for the terminating minutes.

Fixed costs may either be shared by a group of two, or more, services (for example voice services, but not data or SMS), or they may arise as a general cost of doing business (for example the CEO's office). Both these types of costs, which are known as fixed shared and fixed common costs, respectively, would need to be recovered by a firm operating in a competitive market, or they would be unable to make normal profits and would go out of business. The question becomes one of how such costs are distributed across services. We discuss some of the options for doing this below.

Before we discuss different forms of LRIC costing, it is important to note a further important difference from FAC, which is that LRIC costing can be forward-looking, as would be the case with the hypothetical business case referred to above, whilst FAC reflects backwards-looking costs (i.e. those cost that have been incurred in the past and are recorded in the accounts). In a contestable market, in which there is a prospect of new competitors entering with better technology, it may be anticipated that firms would reflect this in the way they recover costs over the lifetime of an asset. It might be rational for them to charge a higher price in the early years, so that they can depreciate their assets and remain price-competitive against new entrants with newer technology later on. This can be reflected through LRIC costing by "front-loading" the recovery of the costs of such assets.

## 6.5. LRIC+

The LRIC costing approach that has previously been used in Malaysia and in many other countries, including Europe prior to the introduction of Pure LRIC, is LRIC+. This approach strikes a happy medium between the two limiting cases described above, in that shared and common costs are borne proportionately by all services. The exact proportions may vary, but the usual approach is to distribute shared costs in proportion to the relevant volume measure (for example minutes) and common costs in proportion to the respective incremental cost of each service.

An important advantage of LRIC+ is that it provides greater assurance that the regulated firm can recover all of its efficiently-incurred costs, whereas under Pure LRIC, it is a matter of assumption that they will be able to do so from call origination and other services.

## 6.6. Pure LRIC

Towards one extreme of the spectrum of choices of LRIC costing is an approach that has been advocated by the European Commission (EC), in which no fixed and shared or common costs are recovered from call termination. One effect of this is that none of the costs of providing mobile coverage are covered in mobile call termination charges. It is argued by the EC that subscribers to mobile telephone networks benefit from incoming calls, including those that originate on other networks and so it is reasonable for them to bear a share of the costs of those calls – in this case all of the fixed shared and common costs. It was also a matter of policy for the EC to drive mobile termination rates (MTR) down towards the level of fixed termination rates, which tended to be significantly lower. Pure LRIC is also applicable to modelling fixed telecommunications networks under the EC's framework, but the difference between Pure LRIC and LRIC modelling including fixed shared and common costs (known as LRIC+, see below) tends to be less for fixed. One reason for this is that the cost of providing coverage is not included in Pure LRIC, because coverage is already required for services other than call termination. In a fixed network, coverage is provided by the access network, which is excluded from call costs with either methodology, because its costs are generally recovered from line rental and connection charges.

## 6.7. Stand-Alone Costs (SAC)

At the other extreme, a service might be made to bear all of the fixed shared and common costs. This is considered to be the maximum that a firm might be able to charge in an effectively competitive market. Whilst the MCMC is not aware of SAC being used as a standard for termination rates, it has been applied by Ofcom in the UK as a maximum in the case of certain wholesale data products, where it was considered that the market was close to being fully competitive and so only a "safety" cap might be required.

## 6.8. Step-by-Step

The costing review in 2012 applied a different costing approach in the case of the fixed access network. Instead of modelling each element of the network in detail, considering the different asset lives and costs of numerous categories of equipment and modelling the way in which these are combined together by the operator to provide service, the network is modelled as a single entity with an indefinite lifespan. Each year the value of the network can be expected to depreciate as a result of deterioration of the assets, or of other factors. This is counteracted by capital investment (CAPEX) to renew the assets as required. In a steady state (output remains constant), we would expect depreciation to be roughly equal to CAPEX. Where further investment is made to increase capacity or improve functionality, this can be expected correspondingly to increase the value of the network.

The cost of capital employed in the network and the effects of asset price inflation can be accounted for in the calculations, as they are with alternative methodologies.

The main advantages of the step-by-step approach, sometimes also called the Regulatory Asset Base (RAB) methodology, are its simplicity – the model can be substantially smaller and simpler than for some other approaches – and its direct linkage to the financial accounts.

On the other hand, there can be difficulties in agreeing on the initial valuation and determining whether it represents the efficient economic value of the network. The methodology was developed in the context of the water industry, where the outputs are relatively homogeneous. In telecommunications, this is not generally so. In access networks, we have the phenomenon of fibre being introduced with the effect of improving the usefulness of a line by permitting faster and more reliable services, as well as potentially reducing costs in the long term. However, copper and fibre networks share a number of key facilities, such as trenches, poles and duct networks. Some technological solutions, such as Very-High-Speed Digital Subscriber Line (VDSL) involve a hybrid of copper and fibre.

Whereas LRIC and FAC models allow for the costs of different services to be distinguished by reference to their respective use of different network facilities (using routing factors), this is much less easily done with step-by-step.

The costing review in 2012 modelled copper and fibre networks separately, requiring difficult and necessarily arbitrary division of shared assets. If a single, combined, model is used, however, then there can be a difficulty in distinguishing investment required for maintaining capacity with that required to increase it.

## 6.9. Conclusions

The different economic characteristics of the networks used to produce the facilities and services in the Access List suggest that the appropriate costing methodology may not be the same in each case. The MCMC therefore proposed the appropriate methodologies for the main networks to be modelled as set out in the table below.

**Table 3: Proposed Costing Methodologies**

| Network | 2012 Methodology | Proposed methodology |
|---|---|---|
| Mobile | LRIC+ | The LRIC+ methodology applied in 2012 provides a reasonable balance between ensuring that Access Seekers pay only for the costs incurred by a reasonably efficient operator in providing the service they buy and ensuring that Access Providers can recover their efficient investment in their networks. |
| Fixed access | Step-by-step | The methodology applied in 2012 has two advantages, simplicity and connection to financial accounts. By basing the initial value of the network on the substantially depreciated current cost of the access network it avoids the difficulty that tends to arise with forward-looking LRIC approaches that the replacement cost for the civil engineering elements of the network is so high that it tends to lead to cost estimates that are substantially above current retail and wholesale prices and that would be likely to be unaffordable for Access Seekers and for end users alike.<br><br>On the other hand, the difficulty of distinguishing between the costs of different services is a disadvantage that casts doubt on the usefulness of step-by-step in practice.<br><br>A compromise approach and one that has been applied by regulators in other countries such as the UK, is to use FAC and historic cost accounting of asset values. Whilst a forward-looking LRIC approach is considered to offer a better match to what would happen in a contestable market, this seems less relevant in the case of access, where competitive entry is likely to continue to operate only to a limited degree and in selected areas.<br><br>A potential disadvantage is that FAC/HCA is inherently backward-looking. However, adjustments can be made to take account of asset price inflation, particularly for replacement assets.<br><br>In the Methodology Questionnaire, it was proposed to use FAC to model the fixed access network, based on HCA asset valuations. |

| Network | 2012 Methodology | Proposed methodology |
|---|---|---|
| Fixed core | LRIC + | The LRIC+ methodology applied in 2012 provides a reasonable balance between ensuring that Access Seekers pay only for the costs incurred by a reasonably efficient operator in providing the service they buy and ensuring that Access Providers can recover their efficient investment in their networks. |
| DTT transmission | None | This is a new service that was launched in 2017. Since it is essentially a single-product firm supplying transmission of digital TV channels to broadcasters, there is no issue of separating the cost of one service from another over a shared platform as is the case in the other telecommunications networks. The assets are all recently acquired and so the replacement and historic values are likely to be the same.<br>In the Methodology Questionnaire, it was proposed to use FAC to model DTT transmission, based on HCA asset valuations. |
| Infrastructure Sharing | Step-by-step | There are a number of different ways in which infrastructure may be shared between operators in a way that constitutes a service:<br>(a) In many cases, this is done on a *quid pro quo* basis, for example with operators reaching a mutual agreement to provide each other with access to base station sites.<br>(b) In other cases, specific bottleneck facilities such as fixed network duct and manholes or exchanges may be made available on a shared-cost basis.<br>(c) Finally, the infrastructure to be shared may be provided as a stand-alone business by a third party. The services provided by tower companies would be an instance of this.<br>It is the MCMC's view that these different models require different regulatory treatment.<br>Arrangements of type (a) above have generally not attracted regulatory intervention, on the basis that they are likely to lead to a more efficient use of resources. There is a potential for them to have an exclusionary effect if access of this kind is restricted to incumbent operators, however.<br>Arrangements of type (b) often require regulatory intervention, because there tends to be a significant imbalance of market power between the parties. It is generally considered unlikely that an effectively competitive market for such services would emerge and so an average cost pricing approach, based on historic asset costs is the favoured approach. |

| Network | 2012 Methodology | Proposed methodology |
|---|---|---|
| | | In the case of type (c) arrangements, there is clearly a viable market and to the extent that such services fall within the scope of the Access List, they should be assessed on the same principles as other Access List services. |
| Mobile Virtual Network Operators (MVNO) | None | MVNO Access is a new service included in the Access List. It is the MCMC's preliminary view that *ex ante* price regulation is not warranted for MVNO Access. However, there may be occasions where the MCMC is called upon to act on an *ex post* basis when issues arise.<br><br>In such cases it may be helpful for stakeholders to have a broad expectation of the approach likely to be taken by the MCMC in resolving disputes. The MCMC would consider the following approaches:<br><br>(a) Prices should be broadly cost-oriented;<br>(b) Prices should fall somewhere between the incremental and stand-alone costs of the service; and<br>(c) Prices may be calculated and expressed either in terms of "retail-minus" – a discount on the equivalent retail prices charged by the operator to its retail customers – or "cost-plus" – applying a suitable margin on top of the underlying cost of the service, provided that the resulting prices meet the above two conditions. |

In response to the question in the Methodology Questionnaire about the appropriate costing methodologies to be adopted for the current regulatory pricing review, there was a level of broad agreement from the stakeholders who responded, but various significant variations from it and arguments against the proposals.[4] These included the concept of using Pure LRIC for mobile modelling, historical costs for the fixed access network and current costs for the fixed core network. The argument that no cost regulation of MVNOs should be applied and some comments and suggestions around retail minus price controls were also made. However, the operators differed in their views and were by no means in full agreement with the proposals. A summary of the comments received to this question is presented in the Table below.

[4] The original table in the Methodology Questionnaire has been updated for the Public Inquiry, including the addition of a section dealing with Infrastructure Sharing.

**Table 4: Summary of comments received from respondents on costing methodologies**

| Respondent | Comments |
|---|---|
| **Altel** | Agrees with proposals. However, Altel comments that its own MVNO costs and those paid to the hosting mobile operator should be taken into account. Finally, it warns of risks regarding predatory pricing by mobile operators and the viability of MVNOs. |
| **Celcom** | Argues that the mobile market is competitive and price regulation of MVNOs could distort the market. Infrastructure sharing regulation on uncontestable towers is favoured, strong SMP remedies are still required in fixed markets. Agrees with the proposals generally, with the caveat that further details provided would require further analysis and discussion. |
| **Digi** | Agrees with proposals with the exception of MVNO market, which it considers to be competitive. Price regulation should only be driven by dominance. If the MVNO Access was subject to any regulation, it should only be retail minus. |
| **edotco** | Disagrees for LRIC+ proposal for Infrastructure Sharing, instead, FAC approach is supported. Agrees on the use of LRIC for fixed and mobile models. |
| **Fibrecomm** | Agrees with the proposals. |
| **Fiberail** | Proposes LRIC for fixed access and LRIC+ for fixed core. |
| **Maxis** | Believes the mobile market is competitive and MVNOs should not be regulated but the fixed market still requires monopoly remedies. Agrees on LRIC+ for mobile and fixed, LRIC for DTT, and no price regulation for MVNO. |
| **Merchantrade** | Agrees with the proposals. |
| **PPIT** | Does not agree with incremental costing for the State Backed Companies and recommends step-by-step or full cost recovery of asset base. |
| **REDtone** | Agrees with proposals but states that flexibility for MVNOs is crucial, and there shouldn't be limitation to a single methodology. |
| **TIME** | Agrees with the proposals. However, views that regulation should only apply to dominant operators. |
| **TM** | Proposes pure LRIC for mobile, agrees on fixed core, LRIC+/HCA for fixed access, to exclude DTT from price regulation and cost orientation to be applied for MVNOs. |
| **Webe** | Proposes pure LRIC for mobile, LRIC for fixed access and core, agrees with the proposal for DTT, and to leave it to commercial negotiation for MVNO Access. |

| Respondent | Comments |
|---|---|
| **YTL** | Proposes a LRIC/FAC combination because of investment conditions and economic drivers for mobile, and FAC/HCA for both fixed access and DTT. |
| **Operator A** | The ability to buy access at the right price is agreed, but the solutions discussed are not immediate enough. Hence, benchmarking that passes a retail minus test is suggested as an interim measure. On the cost models, LRIC should not be used for bottleneck services. Where FAC is relied upon, then fully depreciated assets must be excluded from the asset base. Finally, the wholesale charge must be consistent with retail minus methodology. |
| **Operator B** | Recommends controls for MVNO market based on retail minus pricing and various other interventions to promote competition. Pure LRIC should be used for mobile costing. |
| **Operator C** | Generally, agrees with proposals. Access prices should continue to fall, as competition is harsh and circumstances are difficult for new entrants. Infrastructure Sharing should be price regulated and standardised. |

As a result of careful consideration of the comments received and taking into consideration the availability of costing information from the various network operators, the MCMC has decided to adopt the following costing methodologies for the different cost models.

**Table 5: Revised Costing Methodologies**

| Network | Costing methodology |
|---|---|
| Mobile | The MCMC proposes to continue to use LRIC+. |
| Fixed Access | The MCMC proposes to use LRIC+ with asset price adjustment to reflect the presence of fully-depreciated assets. |
| Fixed Core | The MCMC proposes to continue to use LRIC+. |
| DTT Transmission | The MCMC proposes to use a simple, bottom-up model to model DTT transmission, based on current asset costs. |
| Infrastructure Sharing (mobile towers) | The MCMC proposes to model mobile tower services using a simple, bottom-up model, using current asset costs. |

The key change from the approach previously discussed is that it has proven impractical to pursue the proposed approach to modelling the fixed access network. The key challenge in that sector is posed by its dependence on a large proportion of assets that are old and, in many cases, are fully depreciated in TM's financial accounts. There is likely to be a substantial difference between the historic and replacement cost of such assets. Although competing operators can and do enter the market on a niche basis, it is unlikely that an incumbent fixed access operator would fear full-scale entry to the market, because prices will tend to reflect the (lower) historic costs.

As Celcom argued in their response to the earlier informal consultation on the Methodology Questionnaire, this makes the approach favoured earlier in 2012 the theoretically correct solution. However, practical issues intervene to make this "first-best" approach infeasible in the three main options available for the purpose:

(a) The step-by-step approach previously used relies on tracking the value of and expenditure on a homogeneous asset over time. Differentiation is not made for different elements of the network, or for services' using them. This makes it difficult to derive distinct costs for different services on the basis of cost causation and resource usage.
(b) Historic cost data need to be available at the level of detail necessary to create a bottom-up model based on assets valued at historic cost.
(c) A top-down modelling approach would require substantially greater amounts of data and visibility for the MCMC of TM's internal accounting systems, as well as imposing significant costs on TM to support such an exercise. It is for these kinds of reasons that regulators do not usually undertake top-down modelling of regulated firms. This issue is discussed further in Section 7.

In view of these issues, it was decided to use the alternative "second-best" approach of constructing a conventional bottom-up model, using assets priced at their current cost, but with the option of making adjustments to the relevant asset prices to reflect differences in current versus historic costs, particularly where there are fully-depreciated assets. This approach has the following advantages:

(a) The bottom-up approach allows the model to reflect the network of a reasonably efficient notional operator providing the relevant services and with a similar footprint to that of TM;
(b) Current-cost and adjusted prices can be compared;
(c) A reasonable approximation of the efficient pricing signals given the market circumstances can be achieved; and
(d) Distinct prices for the relevant facilities and services in the Access List can be derived.

Three operators, Operator B, TM and Webe argued that Pure PRIC should be adopted for the costing of mobile services. Although the MCMC recognises that such an approach has been adopted in Europe for both fixed and mobile technologies, the MCMC does not wish to adopt different costing methodologies for different technologies in Malaysia and feels that it is still appropriate for network operators to recover a portion of their joint and common costs from their wholesale services. The MCMC therefore does not intend to adopt a Pure LRIC approach at this time.

| |
|---|
| **Question 4:**<br>Do you have any further comments on the proposed costing methodologies? |

# 7. Model structure

## 7.1. Top-down models

One significant type of LRIC methodology is one that starts with the costs expressed in an operator's accounts and makes the necessary adjustments and translations to arrive at costs on a LRIC basis. This is known as the "top-down" approach. Its primary advantage is that it should be possible to reconcile the figures back to the operator's published and audited accounts.

The main disadvantages of the top-down approach are:

(a) Its information requirements can be quite burdensome, in that it may be necessary to delve quite deeply into the underlying information systems to extract the required data;
(b) The data complexity makes it realistic only for an operator to undertake and it is likely to be difficult for a regulator to do so without requiring very extensive and perhaps intrusive access to the operator's information base;
(c) It can be difficult to determine to what extent the observed costs correspond to those of an efficient operator; and
(d) Company accounts are essentially backward-looking records of what has happened and, although assets may be revalued on a current cost basis, it may be difficult to evaluate varying assumptions on such things as future volumes.

## 7.2. Bottom-up models

An alternative to top-down modelling is to build models that simulate the operation of the network under consideration by starting with the expected volume demands on the network (number of subscribers, calls, data volumes, etc.) and applying efficient engineering principles to determine the network equipment and associated activities that will be required to meet that demand. Once the hypothetical network and activities are specified, their costs can be derived. This approach is applied separately to mobile and fixed technologies.

Bottom-up models have several advantages and few disadvantages:

(a) They can be constructed with relatively little input of data on the operator's actual costs;
(b) They can be flexed to accommodate different assumptions and scenarios;
(c) They can more easily reflect efficient provision of services; and
(d) They can be used to calculate forward looking costs for services which help to provide ongoing stability within the sector.

On the other hand, they risk underestimating the costs of an efficient operator, because real-world operators may encounter challenges in practice that are not foreseen in the modelling process and that nevertheless impose costs. This disadvantage can be countered by undertaking some degree of top-down reconciliation, comparing equipment quantities and, to a lesser extent asset values and other financial data with the outputs of the model.

Given the advantages and disadvantages identified above the bottom-up approach is generally considered the most suitable for construction by, or on behalf of a regulator, for identifying appropriate prices for services.

In response to the question on the proposal to use bottom-up models, all respondents, with the exception of edotco who proposed a top-down approach, agreed with this proposal. The MCMC has therefore adopted a bottom-up approach for the cost models.

## 7.3. Depreciation method

Many of the costs involved in operating a network are for capital items such as base stations, duct and trench networks and switching centres that must be paid for up front, and which continue to be useful for many years, perhaps for decades. Since the benefits of the investment continue to be realised during the useful life of the equipment, it is reasonable that the costs should be recovered over that period, or annualised. This is the effect of accounting depreciation policies.

However, since LRIC models need to be forward-looking if they are to reflect efficient investment decisions, assets should be valued at the prevailing rate, year by year. This means taking account of both price trends for the relevant equipment category and of the effects of technology in providing new pieces of equipment to accomplish the same, or a wider range of functions, at a lower cost – the Modern Equivalent Asset (MEA) principle.

Furthermore, since the intensity with which an asset is used and hence the benefit derived from it may vary over time as volumes rise and fall, an optimally efficient annualisation methodology should take this into account also.

Although there are several different annualisation methodologies in use, ranging from straight line, as generally used in statutory and published accounts, through annuities and tilted annuity method and sum of digits, the methodology that is accepted as coming closest to the ideal is Economic Depreciation (ED), which takes proper account of both price trends and changes in volumes over time. Other annualisation methodologies are used as proxies for ED. A potential drawback with this method is that it is computationally more complex than the alternatives.

A further issue with ED is that its proper application requires that the annualisation time series be projected over the full lifetime of the most long-lived assets, although this can be somewhat shorter if a high discount rate (cost of capital) is applied. This period can be quite long – of the order of 20-50 years in some cases – and so the assumptions guiding the later years are necessarily sketchy. After all, looking back in the other direction, 20 years ago, mobile telephony was in its infancy as a technology and 50 years ago it did not exist at all. However, fortunately the detail of what is assumed in those later years has little effect on the results, because of the effect of discounting.

ED provides a way of recovering costs that extends to operational expenses, too. The aim of this costing study is to estimate the service prices in a competitive and contestable market. A player with initially very low volumes could not fully recover its operational expenses at the beginning of its life cycle. If it attempted to do so, it would price itself out of the market. It would rather attempt to recover its costs over the life cycle of the business. Hence, the recovery path of operational expenses must also reflect changes in output and input price levels. ED, in effect, produces a single figure for the cost per unit of output of an asset over the asset's lifecycle, varying year by year only to reflect asset price inflation.

The DTT network presents particular difficulties, because the demand for channels is quite uncertain, beyond the existing free-to air (FTA) services. Capacity is also quite "lumpy", in that the initial capacity of thirty channels required under the terms of MYTV's award to build DTT network is comprised of three multiplex blocks, plus one for emergency cover. Were demand to exceed thirty channels and the necessary spectrum to be made available, it might require a substantial incremental expenditure to make the necessary provision to meet demand.

In view of these factors, we propose to use a simpler annualisation methodology for DTT that does not rely so heavily on forecasting. Tilted annuities may be considered a form of

ED, in that it provides an estimate of the revenue that would be required to produce a net present value for the investment in a capital item over that item's lifetime that is equal to the cost of capital. It can also be "tilted" to allow for changes in asset prices over time. Further, in response to the question on the proposed approach for annualising costs in the DTT transmission model, all respondents were in agreement. The MCMC has therefore used tilted annuities in the DTT model.

In response to the question on whether the Economic Depreciation is the preferred method for the fixed core and access and mobile cost models, most operators were in agreement, although edotco proposed straight line depreciation and Celcom raised concerns about the use of economic depreciation for mobile. Celcom, TM and Webe suggested tilted annuities and edotco suggested straight line depreciation to be more appropriate for the fixed network. Further consideration of the fixed network sector indicated there are significant medium-term uncertainties in the market, including possible further substitution by new mobile technologies such as 5G. This led to the conclusion that the potential for inappropriate assumptions about the longer term growth path of the sector outweighs the theoretical merits of ED over tilted annuities. The MCMC therefore proposes to use tilted annuities for the fixed core and access models.

Maxis and DiGi has proposed to use tilted annuity for mobile models as compared to economic depreciation. Celcom has also commented that in its view a methodology that is consistent in approach from one sector to another is desirable. The MCMC has carefully considered these comments and, given the difficulties of applying ED to the other sectors described above, the MCMC has decided to adopt a consistent approach for the cost models and therefore proposes to adopt the tilted annuity form of annualisation for the mobile model also. The MCMC recognises the level of uncertainty in the future trend for volume of voice and data services and recognises that titled annuities represents a more appropriate reflection of cost recovery under these circumstances.

The mobile towers model does not encounter the same issues of asset utilisation, because the cost is being calculated per site, rather than per tenant. There is therefore no need for the additional complexity of ED. As such, tilted annuities is proposed to be used for consistency with the other sectors.

## 7.4. Allocation of common costs

In Section 6 above, we identified that incremental costs are the best available proxy to prices in a competitive market in the long term. A key problem is that, in the context of a firm with multiple outputs, not all costs would be recovered if each product were priced purely on this basis. The existence of such multi-product firms in a competitive market is an indication that there are economies of scope available from producing the different products within a single firm. It is appropriate, therefore to mark up the incremental costs attributed to each product with a share of these common costs.

The theoretically correct method of doing this is a procedure called Ramsey pricing, which takes account of the range of elasticities and cross-elasticities applicable to the relevant upstream (wholesale) and downstream (retail) products. This procedure is both technically complex and reliant on elasticity data that are unlikely to be available.

A generally accepted substitute is equi-proportional mark-ups (EPMU), under which the proportion of common costs marked up to each increment relates to the respective size of each increment.

In response to the question on whether EPMU is the appropriate methodology for apportioning common costs, most operators were in agreement although TM, Webe and Operator B suggested that no common costs allocation should be included in the mobile model as a Pure LRIC approach should be adopted.

The MCMC has decided to include appropriate common costs in the cost models and to apportion them to services using the EPMU approach to ensure that this cost is not transferred to consumers.

## 7.5. Allocation of costs to services

Once the incremental costs for a large increment, such as with LRIC+, have been assessed, an allocation of costs is made by service. This is done by applying routing factors. These factors reflect the use made of each of the network components distinguished and costed within the model. For example, an on-net mobile call would pass through a BTS and BSC twice, once on the originating leg of the call and once on the terminating leg. By contrast, an incoming call from another network would pass through a BTS and BSC only once. The on-net call would have a routing factor of two for the BTS and BSC components and the incoming call a routing factor of one, meaning the on-net call will receive twice the allocation of these elements of cost.

In this way, services are allocated a share of each of the various network component costs in proportion to their use of them, together with a share of network indirect costs, covering such things as network management systems, motor transport and human resources associated with network activities and a mark-up to cover common costs. Costs within the retail increment (e.g. the retail billing system, marketing) are not included in network costs.

In response to the question on whether the cost causation is the appropriate way in which costs should be allocated within the cost models, all network operators agreed. The MCMC has therefore adopted the principle of cost causation within the models.

## 7.6. Treatment of License and Spectrum fees

License and spectrum fees are chargeable to operators in Malaysia and so form part of the costs of undertaking network activities. As such they should be included in the model of fixed and mobile network costs as appropriate and depreciated over the period for which the corresponding licences are valid.

In response to the question on whether license and spectrum fee costs should be included within the cost models, most network operators agreed with the exception of Webe and TM who presented arguments from Europe to justify excluding them. However, the approach adopted in Europe (Pure LRIC) is somewhat different to that proposed for Malaysia, in that fixed shared costs and fixed common costs are excluded under that approach. On balance, the MCMC decided that license and spectrum fees do represent a cost to network operators and should therefore be included in the cost models.

## 7.7. Defining the Increment

An incremental cost is cost that is incurred in supporting a particular increment of demand, assuming that other increments of demand remain unchanged. The incremental cost can also be calculated as the avoidable costs of not supporting the increment. There is considerable flexibility in the definition of the increment – or increments – to apply in a costing model, and the choice should be suitable for the specific application. The range of choices includes (from narrower to broader):

(a) A marginal unit of demand for a service;
(b) The demand for a service as a whole;
(c) The demand for a group of services; and
(d) The demand for all services or traffic on the network.

A narrow increment coincides more closely with marginal cost and hence with the theoretical ideal. However, the narrower the definition, the greater the proportion of costs that are common and so must be allocated across services. In other words, with a broad increment, more of the economies of scale and scope that arise from providing multiple services will be incorporated in the increment.

On the other hand, if the purpose of the model is to derive costs for a single service and an increment encompassing multiple services is chosen, then it would be necessary to determine the share of costs to be borne by the service in question.

This task is affected by the type of increment that is selected, the main options being average, incremental or marginal. The most usual approach is to use an average increment, which makes for simpler construction of the model, though it requires all traffic to be expressed on an equivalent basis, for example minutes in the case of a predominantly voice network. Having done that, the costs can be apportioned on the basis of usage (all minutes are treated as having an equal cost).

In response to the question on whether respondents agree that a broad increment expressed on an average basis and incorporating all network services is appropriate, most network operators agreed but TM, Webe and Operator B wanted a Pure LRIC approach for the mobile model. As the MCMC has decided not to adopt a Pure LRIC approach to mobile cost modelling, it is appropriate to adopt a broad increment for the cost models.

## 7.8. Network structure: scorched earth versus scorched node

Similar considerations apply in bottom-up fixed and mobile networks with respect to the degree to which the structure of existing networks should be reflected in the models. In the case of fixed networks, a scorched node approach would mean taking the location of main network nodes (sites containing switching centres, concentrators, routers and associated equipment) as a given. However, the modelling process may determine that the use made of each site is sub-optimal and so, for example, a site currently hosting switching equipment should contain only MSAN.

The MSAN acts as the border between access and core networks. To this extent, the scorched node approach provides a starting point for the access network model also. The role of individual sites as 'switch + MSAN', or 'MSAN-only' can, however, be optimised within the model.

In the case of mobile networks, the location of the main core network sites is generally taken as a given when modelling individual mobile networks under scorched node.

In response to the question on whether the scorched node approach is appropriate, all network operators agreed, though TM and Webe proposed scorched earth for the mobile network.

| **Question 5:** |
| --- |
| Do you have any further comments on the elements of cost modelling which the MCMC proposes to adopt? |

## 7.9. Model calibration and reconciliation

Bottom-up models have a potential weakness in not fully taking into account all the costs necessarily incurred in providing services. Because of this, it may be necessary to adjust the model through calibration and reconciliation in order to ensure that all costs are included.

Model calibration involves comparing the modelled network quantities with the deployed network of a real operator in one or more past years, given the known service demands for that operator in those years. A well-formed bottom-up model will give network quantities similar to the deployed network or any significant divergence will be explicable, for example by efficiency factors. The calibration process can be undertaken for significant operators. It ensures that the bottom-up model is driven by the real situation faced by service providers.

Model reconciliation involves comparing the level of costs calculated in the model to the actual costs incurred by a real operator in some past year when the model service demands are set to the actual demands experienced in that year. The comparison has two parts. Firstly, the level of operating expenses and the overall asset values (when adjusted to the same basis, either historic or current costs) should be similar to the observed values (or any divergence should be explicable). This ensures that the bottom-up model is capturing all the relevant service costs.

The second part of model reconciliation is to set an appropriate level of mark-up for common costs. In past years, the service providers' accounts will show some level of common costs and the proportion of these costs compared to total costs can be calculated. If the model is calibrated and reconciled in the first part, then it will produce costs in past years that correspond to the observed values. For future years, the model needs to take account of the fact that costs that are not directly modelled (such as retail costs) will also vary. For example, the retail cost per subscriber may be held constant and the overall level of retail costs will then vary linearly with the number of subscribers. By extrapolating these other costs for a real operator, using the real operator's forecasts, the model can calculate a proportionate mark-up for common costs in future years. A mark-up for the efficient operator model can then be estimated from these calculated values. This ensures that the model can account for common costs.

The LRIC+ bottom-up models presented in Parts D, E, F and G of this PI Paper have been calibrated and reconciled with reported data from the Malaysian operators.

| **Question 6:** |
| --- |
| Do you have any comments on the choice of costing methodology adopted? |

## 7.10. Glide paths

The glide path approach to implement regulated prices provides a means to gradually introduce new prices without causing significant disruption to the existing market players and their finances. However, the approach does mean that an economically inefficient outcome (i.e. rates that are not appropriately set equal to costs) will effectively be tolerated for longer. This creates an additional incentive for operators to innovate, by allowing them to retain the benefits in the form of returns that are slightly above their cost of capital for a limited period. Such an outcome will be at the expense of one or other stakeholder and at the expense of efficient competition and the consumer surplus that results from efficient competition. Glide paths therefore have mixed effects and should not be extended any longer than is required.

In some cases, the MCMC has chosen to use a glide path from the existing regulated prices to new ones, where the prices are sufficiently different. In particular, this has been adopted for the fixed origination and termination services and the mobile origination and termination services. The glide paths start from the last regulated rate and reaches the price calculated from the cost models in 2020, with a linear interpolation between these values for the intervening years. For the fixed services it has been necessary to take account of the circuit switched and IP services when developing the glide path.

| **Question 7:** |
| --- |
| Do you have any comments on the appropriateness of using glide paths and the method by which the glide paths have been calculated? |

## 7.11. Use of Cost Models in Arbitrating Disputes

The cost models presented in this PI Paper have been developed to establish the cost base, and hence cost-based prices, for the facilities and services in the Access List. In some cases, the calculated values will be used to set regulated prices.

In all cases, however, the cost models provide an estimate of average costs of Access List services. The MCMC intends to also use the outputs from the cost models in any dispute that may be notified to it between an access provider and an access seeker where the price of the access services is an issue. The MCMC can seek further information from the access provider in order to estimate its costs and then compare its average price to the cost-based price from the relevant cost model.

**Question 8:**

Do you have any comments on the appropriateness of using the cost model results in arbitrating disputes over access pricing?

## 7.12. Exceptions and adjustments to LRIC-based Prices

### 7.12.1. Co-location, Duct and Manholes and Infrastructure Sharing services

The Access List contains some facilities and services that involve the sharing of existing facilities for the purposes of avoiding competitive bottlenecks and enhancing productive efficiency. For example, an incumbent fixed access operator may have spare space in ducts, manholes and exchanges. At the same time, the cost of installing such facilities can be a formidable barrier to entry for competing operators. Since, by definition, the incremental cost of providing access to such facilities is close to zero, a strict incremental costing approach would tend to yield a very low price. On the other hand, this might be seen as inequitable and it might carry the risk of encouraging inefficient entry. Sharing such facilities also can make it more difficult for the incumbent to rationalise their use of facilities, for example when demand is in decline, or when new technology allows more sparing use to be made of such resources.

In view of issues such as these, the approach that is generally adopted for costing such bottleneck facilities is to calculate the cost based on the average Fully Allocated Cost of the facility in question. Users of the facility can then be charged an equitable share of these costs. This calculation can be based on historic or current costing principles, depending upon the competitive context. For example, in situations where there are substantial proportions of fully-depreciated assets, it may be appropriate to reflect this by basing the calculation on historic costs.

In circumstances where the bottleneck effect is considered to be weak and the market prospectively competitive, best practice would suggest a shift in costing principles towards weaker controls that are more closely aligned to the characteristics of an effectively competitive market. In such cases, a multi-product firm operating in a reasonably competitive market would be expected to price each of its outputs (including infrastructure made available for sharing) at between LRIC and stand-alone cost. The latter is the cost of providing the output on its own, in the absence of other services to share the costs. So a regulator can impose a ceiling based on stand-alone cost and a floor (pure LRIC), rather than proposing a maximum or fixed point price.

A further point to bear in mind about these facilities is that there may be externalities, or wider costs and benefits than those arising directly from production and consumption of the service that is being traded. For example, mobile communications towers are often an unwelcome addition to the landscape, particularly in areas of historic interest or natural beauty. There is thus a wider benefit from keeping the number of towers in an area to a minimum through sharing. It may be appropriate for regulated prices and other measures to take this into account.

Equally, locating towers in remote areas, where the density of population is low may be uneconomic without subsidy and yet the availability of services can contribute to economic development and social inclusion in such areas. Similarly, economic and political objectives may be served by a faster and more widespread roll-out of high-speed fixed broadband services. The solution to these issues may be subsidies to provide incentives to operators to make investments that would otherwise be uneconomic for them. Schemes for both these purposes exist in Malaysia in the shape of the Universal Service Programme (USP) and High-Speed Broadband (HSBB) programmes and care needs to be taken that access pricing is consistent with the aims of these schemes. The proposed treatment of these schemes is discussed in the next section, below.

## 7.13. Treatment of HSBB and USP subsidies

Schemes to encourage more widespread or faster provision of communications services are not uncommon around the world and Malaysia is no exception. The two schemes discussed in this section operate somewhat differently from each other, however and so they will be considered in turn.

The USP, like many universal service programmes, operates by exacting a levy on the revenues of operators, in this case including both retail and wholesale revenues. The proceeds of the levy are distributed to operators who are willing and able to undertake projects that meet the objectives of the fund as subsidies to the investment costs involved. By encouraging such investment, it is hoped that citizens who would not otherwise be able to consume the resulting services are able to do so, with consequent benefits in line with the objectives of the programme. It will be clear that for the hoped-for benefits to be realised, it will be necessary for appropriate downstream investment and consumption choices to be made. For example, the subsidy may pay for the erection of a mobile tower, but users can only consume mobile services if further investment is made in equipping the tower with the necessary electronics and backhaul facilities and if the price they pay is affordable. It will be necessary, therefore, to ensure that access prices deliver the appropriate downstream investment and consumption signals.

The HSBB, by contrast, operates through the investment of public funds in fixed high-speed broadband service provision on a risk-sharing basis. In other words, like a commercial investor, the investment is expected to be remunerated from the returns made on the investment through the recipient operator selling the HSBB services on a retail or wholesale basis. The terms of the scheme provide for a proportionate share of the returns to be remitted to the investing authorities. On the face of it, this is very different to the straightforward subsidy involved in USP payments. However, the scheme would not be necessary to meet its primary aim of promoting HSBB roll-out if commercial returns on such a scheme were expected to be sufficient to justify the allocation of the necessary capital, given the level of risk involved. The degree of subsidy, therefore, to the extent that it exists, arises in the difference in expected returns to the public funds from that that would be expected by the capital market. For the purposes of the notional operator approach, the expected return on capital equates to the WACC.

The proposed approach to reflecting USP and HSBB programmes in access prices is discussed further in the Section 19.3.5 and Section 10.4 respectively of this PI Paper.

## 7.14. Installation charges

Installation charges are often calculated in LRIC models but their costs are not calculated using the true LRIC approach. These are one-off charges associated with initial service provision.

The most straightforward and transparent approach to setting these charges is to match them to the direct operational costs efficiently incurred in putting the service into operation. This is the approach that has been adopted by the MCMC. (In some cases in other jurisdictions, installation charges have been set also to recover some part of the capital cost of the service, but this is much harder to justify.)

**Question 9:**

Do you have any comments on the approach to setting prices for installation charges?

## 8. Mobile Virtual Network Operators

The Malaysian mobile telecommunications market currently supports around forty operational MVNOs, who have around 10% of the total market by subscribers in 2016. It is likely that their share of the market has continued to grow in the intervening period. By international standards, this represents a significant degree of success.

In Malaysia, as in other markets where MVNOs have established a successful presence, this success has been based on the establishment of mutually beneficial relationships between MVNOs and mobile network operators (MNO) seeking to strengthen their position in the market and achieve better levels of utilisation and profit.

On the one hand, from the point of view of an MVNO, the MNO is both a competitor, to some degree, and the supplier of a vital input to their business. This gives the MNO a degree of market power and the possibility of squeezing the margins of its wholesale customer in order to throttle back competition.

On the other hand, MNOs make vital investments in infrastructure that make the business models of both parties possible and that create the possibility of consumers benefitting from the services they provide.

It is open to communications providers, whether MNOs, MVNOs, or prospective MVNOs, to approach the MCMC in cases where they are unable to resolve a dispute. Where such a dispute involves the prices charged to the MVNO for services, it may be helpful for industry participants to have some idea of the approach that the MCMC would be likely to take, were it to make a determination on the rates that should be charged. This would add some degree of certainty for communications providers and their investors.

Equally, if the MCMC became convinced that market failure had occurred, or was in prospect, a case might be made for proactive intervention by the MCMC to correct or prevent such failure. Again, it may reduce uncertainty for market participants if there is some indication of the approach that might be taken under such circumstances.

However, there is a danger that, where the market is operating effectively, signals from the MCMC about prices that it would be likely to impose might distort negotiations unduly.

The MCMC will use the information to be gathered and the cost models generated subsequently to deliberate about the appropriate approach to be adopted for MVNO Access.

The MCMC therefore considered the following potential approaches for MVNO Access. These include the following:

(a) Prices should be broadly cost-oriented;
(b) Prices should fall somewhere between the incremental and stand-alone costs of the service; and
(c) Prices may be calculated and expressed either in terms of "retail-minus" – a discount on the equivalent retail prices charged by the operator to its retail customers – or "cost-plus" – applying a suitable margin on top of the underlying cost of the service, provided that the resulting prices meet the above two conditions.

In response to the question on the MCMC's proposed approach to MVNO service prices, there was a good level of agreement, but significant discussion and argument included in responses. Digi, Webe, Celcom and Maxis argued strongly that the mobile sector is competitive and MVNO Access should not be subject to price regulation. Operator A and Operator B argued for a retail minus approach whereas TM and Altel proposed that prices should be cost-oriented.

The MCMC recognizes that the success of MVNOs results from a combination of a viable business model on the part of an MVNO and a constructive negotiation by an MNO. The overall success of such an arrangement relies on a commercial negotiation which may focus on individual services such as data or voice rather than the full range of services offered by an MNO. Such agreements may also include volume discounts from MNOs as well as minimum volume undertakings by MVNOs. Due to the complexity of these arrangements the MCMC does not propose to regulate for MVNO services but expects the MNOs to act reasonably when negotiating and agreeing commercial arrangements with MVNOs.

Following consideration of the options the MCMC has concluded that the most appropriate approach to the regulation of MVNO Access at this time would be to allow them to be set through commercial negotiations between MVNOs and potential MVNOs and their respective MNOs. The MCMC would however draw on information from the mobile cost model were it asked to intervene in disputes between operators.

**Question 10:**

Do you have any further comments on the proposed approach to regulating MVNO Access?

## PART C: WEIGHTED AVERAGE COST OF CAPITAL (WACC)

One of the costs that firms need to cover in order to remain in business is the cost of raising capital. This is accomplished by the issue of shares and other equities, for which shareholders will expect to be remunerated by some combination of dividend payments and capital appreciation, and also through interest-bearing loans of one kind or another.

The network operators providing facilities and services in the Access List have various different ownership structures and some, including TM, Maxis and Celcom (Axiata) are listed on the Kuala Lumpur stock exchange. The operators may have somewhat different access to capital investment. Nevertheless, the objective is to assess the costs of a reasonably efficient operator in an effectively competitive market, rather than to assess the circumstances of each individual operator.

Following the proposal in the Methodology Questionnaire separate rates of WACC for fixed, mobile, tower companies and DTT transmission are calculated.

The MCMC proposes to adopt the generally accepted methodology for calculating capital costs i.e. the Capital Asset Pricing Model (CAPM), which generates an appropriately weighted estimate of the WACC. Since efficiency considerations apply to capital as well as to other inputs, the optimal balance of debt and equity funding and other parameters may not correspond exactly to that of the actual operators.

The WACC is derived:

(a) in nominal terms, since wholesale prices are fixed in nominal terms; and
(b) pre-tax, since regulatory price-setting normally uses a pre-tax cost of capital to apply to the capital base to calculate annual capital costs before taxes and the prices themselves are expressed net of tax.

The WACC may in principle be different for particular services or types of investment, depending on the level of risk which may vary between them. For example, the WACC for a fibre to the home (FTTH) network may be higher than other parts of the network due to its perceived higher risk. However, if such a network has received direct or indirect government funding then the level of risk may be somewhat mitigated. On the other hand, equity and corporate bond funding, for example, tend to operate at the level of the total enterprise. Technology- or project-related benchmark data are likely to be difficult to obtain. We therefore do not attempt to sub-divide the WACC any further than between fixed and mobile operators, tower companies and the DTT transmission operator.

The cost of equity is the expected rate of return that the market requires in order to attract funds to a particular investment. The cost of debt is the required rate of return for creditors or the rate at which the company can be expected to be able to borrow money.

The WACC for a given company or service is calculated by weighting the average market values of the costs of debt and equity employed by the company.

To determine the WACC, the MCMC has used the following key formula:

$$WACC = [Wd*Kd] + [We*Ke/(1-t)]$$

where

- Wd = Weighted average amount of current cost of debt
- We = Weighted average amount of market value of equity
- Kd = Cost of debt
- Ke = Cost of equity
- t = Corporate income tax rate

The MCMC has used the above recognized formula to calculate appropriate levels of WACC for use in each of the cost models. The calculation has been supported by and derived from appropriate input information gained from stake holders as part of the data request process. Separate calculations of WACC for the fixed (comprising of access and core), mobile, tower companies and the DTT transmission operator cost models have been produced. In each, a high and low rate of WACC have been calculated and subsequently used in the sensitivity analysis for the costs of each of the services.

The parameters used to calculate the WACC can be subject to debate and can be derived in different ways. The MCMC therefore asked the network operators to provide their views of the appropriate values as part of the data request exercise. The MCMC received detailed responses from two operators in relation to the Mobile WACC and from TM in relation to the Fixed WACC. In addition, the MCMC made initial WACC calculations based on international benchmarks and standard published data sources. The different values were then compared with each other and with those derived in 2012 for the previous review.

This enabled ranges for the different parameters to be established and proposed values lying within those ranges to be chosen. In compiling the ranges, values proposed by the operators that appeared to be methodologically incorrect were excluded, for example, being based solely on one operator's financial circumstances. In the initial calculation, a method for deriving the risk-free rate was used that starts with an international standard for a minimally risky investment, in this case, the Central Bank of Malaysia's current 10-year bond rate.

The individual calculations for the upper and lower rates of WACC which the MCMC subsequently uses to determine its recommended wholesale prices for facilities and services in the Access List are shown in the following sections.

| **Question 11:** |
| --- |
| Do you have any comments on the approach to calculating the appropriate levels of WACC? |

## 9. Common Parameters

Certain parameters of the calculation are common to all of the modelled sectors, because they relate to the broader characteristics of the capital market in Malaysia and not to individual sectors. These are:

(a) The risk-free rate;
(b) The Equity Risk Premium (ERP); and
(c) The marginal corporate tax rate.

The estimation of these parameters is dealt with in this section and the parameters that are specific to the respective sectors (Fixed, Mobile, Towers and DTT) are discussed in the succeeding sections.

### 9.1. Risk-free rate (RF)

The risk-free rate represents the return that would be expected on an investment in Malaysia with no, or minimal, risk. Usually yields from Government bonds are used as a measure of this, taking a government maturity period that is reasonably close to the average life of the assets under consideration. Generally, this is taken to be 10 years.

Seven operators provided an estimate of this parameter, ranging between 4% and 4.66%. As one might expect, bond yields fluctuate over time and this may account for the variation in estimates. Subsequently the price at the time of writing has fallen slightly to 3.98%[5].

[5] This is as at 11th July 2017 (https://www.investing.com/rates-bonds/malaysia-10-year-bond-yield).

An alternative method is to start with a bond rate from a large and stable central bank, or group of central banks and adjust the risk to account for local conditions, in particular the difference in the inflation rate. An example of this approach is shown in the table below.

**Table 6: Risk-free rate calculation based on Eurozone rates**

| Parameter | Rate | Source |
|---|---|---|
| Risk-Free Rate (RFR) EU nominal | 0.50% | https://markets.ft.com/data/bonds?mhq5j=e2 21st July 2017 |
| CPI EU | 1.30% | https://tradingeconomic 21st July 2017s.com/euro-area/inflation-cpi |
| RFR EU real | -0.79% | |
| Inflation rate Malaysia | 3.60% | https://tradingeconomics.com/malaysia/inflation-cpi 21st July 2017 |
| Adjusted rate for Malaysia | **2.78%** | |

The value of 2.78% obtained in the table above is significantly lower than that obtained directly from the Malaysian market. This may reflect economic factors in the Eurozone that could distort the rate and this might also be the case if, say, US rates were chosen instead. Provided the market for bonds locally is reasonably liquid (where sufficient quantity is traded to enable the market to set the price accurately), then it is the MCMC's view that an estimate based on the local bond market is preferable.

The proposed range and point value are shown in the table below:

**Table 7: Proposed range and point value for the risk-free rate**

| | Min | Max |
|---|---|---|
| **Proposed range** | 3.98% | 4.66% |
| **Proposed point value** | **4.00%** | |

## 9.2. Equity Risk Premium (ERP)

The Equity Risk Premium represents the additional return expected by investors in the stock market over and above a risk-free investment. This can be measured by analysing yield spreads in the market and comparing them with bond yields over time.

Eight operators provided estimates of this parameter, ranging between 2.89% and 10.94%. The MCMC proposes to exclude the lower extreme of this range, because of technical issues[6] in its derivation, leaving a still broad range from 4.30% to 10.94%.

[6] It appears to be a point estimate, whereas the long-term average according to the source quoted - http://www.market-risk-premia.com/my.html - is somewhat higher.

A published source[7] for this parameter that is specific to the Malaysian market, though it takes the US market as a starting point, is published by Professor Damodaran of Stern Business School. He gives a value of 7.61%, which is slightly above the midpoint of the range suggested by the operators. Professor Damodaran's value is derived by first calculating a value for the US market and then adapting it to Malaysia by comparing the respective equities market price spreads.

**Table 8: Equity Risk Premium proposed range and point value**

| | Min | Max |
|---|---|---|
| **Proposed range** | 4.30% | 10.94% |
| **Proposed point value** | **7.61%** | |

### 9.3. Tax rate (t)

The standard corporate tax rate for all large companies in Malaysia is 24%. No adjustment has been made for domestic versus international investors and this parameter is not subject to a range of uncertainty.

**Question 12:**

Do you have any comments on the proposed common parameters to be included in the WACC calculations?

## 10. Fixed Network

### 10.1. Gearing

Gearing is defined as the proportion of debt in the total value (debt plus equity) of the enterprise, where equity should be expressed in market terms. For calculating the pre-tax WACC value, forward-looking gearing is required: that is, what the gearing is expected to be over the regulatory period.

TM provided MCMC with an estimate of their gearing of 25.19%.

**Table 9: Regional comparison data (source: FT.com, July, 2017)**

| | Unlevered beta | Levered beta | Gearing |
|---|---|---|---|
| HKT Trust | 0.21 | 0.26 | 33% |
| NTT | 0.42 | 0.53 | 27% |
| PLDT | 1.00 | 1.25 | 34% |

[7] http://pages.stern.nyu.edu/~adamodar/

| | Unlevered beta | Levered beta | Gearing |
|---|---|---|---|
| Singtel | 0.96 | 1.21 | 15% |
| Spark | 0.77 | 0.96 | 11% |
| Telstra | 0.68 | 0.85 | 26% |
| | | | |
| **Average** | **0.67** | **0.84** | **24%** |
| Min | 0.21 | 0.26 | 11% |
| Max | 1.00 | 1.25 | 34% |

The average market-focused gearing of a sample of regional fixed and fixed/mobile operators is 24%. On the other hand, Belgium (2010), France (2013), Norway (2013), UK (2013) and Ireland (2014) have all implemented notional gearing of 40% for fixed operator WACCs. However, macroeconomic factors may tend to lead to a different gearing to be efficient and so, since the operator's reported gearing is in line with regional comparators, the MCMC proposes to use this.

## 10.2. Cost of Debt

The estimated cost of debt for a fixed operator is estimated to be 4.83%, based on a risk-free (10-year bond) rate of 4.0% and a debt risk premium of 0.83%. The risk-free rate was discussed in Section 9.1 above. The debt risk premium arises from the difference in spreads for corporate bonds in the sector as compared to government bonds. The MCMC has used the figure provided by TM. An alternative method would be to use a "synthetic" approach, building up the estimated value from those in other markets and making an adjustment to reflect differing conditions in Malaysia. For example, the Irish Regulator, ComReg in 2014[8] estimated the debt premium for larger European operators at 1.5% and added a further 0.25% to this to reflect the higher costs of borrowing for Irish utility companies, compared to their counterparts in the rest of Europe. Clearly this would tend to lead to a higher estimate, if similar comparison data were available for Malaysia. Similarly, Professor Damodaran suggests a figure of 2.93%, derived by adding a sector-specific premium of 1.05% to a global default spread of 1.88%. However, such approaches rely on assumptions about the comparability of the different comparator companies and the financial markets in which they are embedded.

## 10.3. Cost of Equity

The cost of equity is calculated by adding to the risk-free rate a premium that reflects the greater perceived risk of investing in the stock market, as compared to government bonds (the ERP) and modifying this by a factor (the beta) that reflects the relative volatility of

[8] Cost of Capital: Mobile Telecommunications, Fixed Line telecommunications, Broadcasting (Market A and Market B) Response to Consultation and Decision Reference: ComReg Document 14/136 & D15/14, 18/12/2014.

stocks in the sector (fixed telecommunications), as compared to the market as a whole. On average, the value of the beta will, by definition, be one. Values of less than one reflect stocks that tend to move up or down less than the market as a whole and vice versa.

The risk-free rate and the ERP were discussed above. For estimating the asset beta, an analysis of a sample of other fixed operators in the region was carried out. This is presented in Table 9, above. Although the range was quite large (0.26 to 1.25), the average of 0.84 was a little above the figure provided by TM (0.78).

The cost of equity data for a notional efficient fixed operator is given in the following table.

**Table 10: Calculation of the cost of equity for fixed operators**

| Cost of Equity = RF + β*ERP | Operator inputs | Value used |
|---|---|---|
| Risk-free rate (RF) | 4.23% | 4.0% |
| Beta (β) | 0.78 – 0.84 | 0.78 |
| Equity Risk Premium (ERP) | 4.30% - 10.94% | 7.61% |
| Cost of Equity (CE) | 8.01% - 11.46% | 9.94% |

## 10.4. Impact of HSBB funding

TM has benefited from funding for its HSBB programme and this has been applied to capital expenditure in all the main segments of the network, access, core and international. As a result, it is difficult to disentangle its effects on different services. Although the aim of the funding is to encourage the roll-out of high-speed broadband services, the facilities required to do this are shared by most, if not all, other services. The funding is provided on the basis that a commercial return on the investment is expected to be paid to the funding agency. However, there is no specified rate of return specified after the first few years, so it is not possible to gauge the cost to TM of this investment.

If it turns out that a full commercial return is made over the course of the project, then this should equate to the firm's WACC and therefore no adjustment would need to be made. However, it is unlikely that a Government agency would consider funding a private sector firm unless the projects to be funded were expected not to earn the firm an adequate return such that the firm could fund them from the capital markets. Equally, it is unlikely that TM would consent to any such arrangement unless the overall returns, including any element of subsidy, met their cost of capital. It may therefore be assumed that there is at least some small element of subsidy, despite the general intention to operate the scheme on a commercial basis.

Although some further funding is envisaged in forthcoming years, the scale of this funding is uncertain. The MCMC has therefore looked at the period up to the base year for modelling purposes, which covers the bulk of currently planned funding. The total funding for the project over this period amounts to RM12.2bn, of which RM2.7bn was contributed by the Government of Malaysia. Some RM2.7bn of this was used for network CAPEX, equating to 26.54% of the net book value of TM's network assets at the end of 2016. Whilst the funding flows in later years might alter this balance slightly, the additional monies would have to be set against dilution of the HSBB share through replacement of capital assets.

It is proposed, therefore, to apply a small discount of 5% to the implied capital costs for the 26.54% of the network assets accounted for by external HSBB funding.

### 10.5. Estimated WACC Values

For a Malaysian fixed network operator, the cost of debt is estimated to be 4.83%, the cost of equity is 9.94%, the forward-looking gearing is 25.19%, and the tax rate is 24%. These figures provide a pre-tax WACC value of 11.00%.

The formula for calculating the discounted WACC due to the HSBB government funding is as follows:

| |
|---|
| WACC * (1 – proportion of the network assets accounted for by external HSBB funding * HSBB funding discount) |

Applying the 5% discount for HSBB discussed in the previous section reduces the WACC figure to 10.85%. If government funding was a pure subsidy with zero return, which would mean that the HSBB funding discount is 100% (zero return means discount on return of 100%), the resulting WACC figure would be 8.08%.

| |
|---|
| **Question 13:**<br>Do you have any comments on the WACC values proposed for the Fixed Network Services? |

## 11. Mobile Network

### 11.1. Gearing

Two operators – Operator D and Operator F – reported recent gearings in the range of 16-19%, and Operator E reported a much lower level of debt. A sample of other mobile operators in the region (see Table 11, below) suggests an average of 22%, though the range in the sample is very large (<1% to 59%). After removing some of the more extreme values results, the average remains at 22%.

**Table 11: Regional comparison data (source: FT.com, July, 2017)**

| | Unlevered beta | Levered beta | Gearing | Gearing (excl. outliers) |
|---|---|---|---|---|
| Docomo (Japan) | 0.60 | 0.69 | 2% | |
| Starhub (Singapore) | 0.50 | 0.57 | 17% | 17% |
| China Mobile (HK) | 0.69 | 0.79 | 0% | |
| Hutchison Telecom (HK) | 0.33 | 0.38 | 24% | 24% |
| Softbank (Japan) | 0.99 | 1.13 | 59% | |
| SK Telecom (South Korea) | na | na | 27% | 27% |
| FarEastTone (Taiwan) | na | na | 14% | 14% |
| Taiwan Mobile (Taiwan) | na | na | 13% | 13% |
| Trikomsel (Indonesia) | 0.842 | 0.97 | 22% | 22% |
| TrueMove (Thailand) | na | na | 39% | 39% |
| | | | | |
| **Average** | **0.66** | **0.75** | **22%** | **22%** |
| Min | 0.33 | 0.38 | 0% | 13% |
| Max | 0.99 | 1.13 | 59% | 39% |

In the earlier cited 2014 report, ComReg found that European mobile operators typically have a gearing of around 20%. As well as the individual circumstances of operators, for example their position in technology investment cycles, macroeconomic conditions in a particular country can have a significant bearing on the most efficient mixture of debt and equity capital. The recent figures provided by the Malaysian mobile operators in 2016 when compared with the earlier years, suggest an upward trend for gearing. It was therefore concluded that a gearing of 16.2%, based on an average of the gearing for the three leading operators would be an appropriate forward-looking value.

## 11.2. Cost of Debt

The period over which debt should be financed is the average life of the assets in each economic model. Long-term debt with 10-year maturity has been used. The cost of debt for a mobile operator is estimated to be 4.9%, based on a risk-free (10-year bond) rate of 4.0% and a debt risk premium of 0.9%. The risk-free rate was discussed above. The debt risk premium arises from the difference in spreads for corporate bonds in the sector as compared to government bonds. The MCMC has used an average of the figures provided by the mobile operators, which ranged from 0.23% to 1.89%.

## 11.3. Cost of Equity

The cost of equity is calculated by adding to the risk-free rate a premium that reflects the greater perceived risk of investing in the stock market, as compared to government bonds (the ERP) and modifying this by a factor (the beta) that reflects the relative volatility of stocks in the sector (mobile telecommunications), as compared to the market as a whole. On average, the value of the beta will, by definition, be one. Values of less than one reflect stocks that tend to move up or down less than the market as a whole and vice versa.

The risk-free rate and the ERP were discussed above. For estimating the asset beta, an analysis of a sample of other mobile operators in the region was carried out. This is presented in Table 11, above and, although the range was again quite large (0.38 to 1.13), the average of 0.75 was quite close to the average of the figures provided by the operators of 0.85 (ranging between 0.67 – 0.99).

The cost of equity data for a typical mobile operator is given in the following table.

**Table 12: Calculation of the cost of equity for mobile operators**

| Cost of Equity = RF + β*ERP | Operator inputs | Value used |
|---|---|---|
| Risk-free rate (RF) | 4.10% - 4.35% | 4.0% |
| Beta (β) | 0.67 - 0.99 | 0.85 |
| Equity Risk Premium (ERP) | 4.30% - 10.94% | 7.61% |
| Cost of Equity (CE) | 8.01% - 11.46% | 10.45% |

## 11.4. Estimated WACC Values

For a Malaysian mobile operator, the cost of debt is estimated to be 4.9%, the cost of equity is 10.45%, the forward-looking gearing is 16.2%, and the tax rate is 24%. These figures provide a pre-tax WACC value of 12.32%.

**Question 14:**

Do you have any comments on the WACC values proposed for the Mobile Network Services?

# 12. Infrastructure Sharing

## 12.1. Gearing

Seven operators provided estimates of gearing in the range of 12.9% - 65.6%, with an average value of 26.15%. Since there are no other quoted towers companies in the region, the MCMC looked at two US comparators and one European (see Table 13, below). Whilst other analyses have used figures from companies such as Maquarie and National Grid, these companies combine a range of different activities and so it is difficult to disentangle their mobile telecommunications towers activities from the rest. This sample has an average gearing of 20%, (though the range in the sample is 14% to 24%).

**Table 13: Comparison data (source: FT.com, July 2017)**

| | Unlevered beta | Levered beta | Gearing |
|---|---|---|---|
| Crown Castle | 0.60 | 0.77 | 23% |
| American Tower | 0.73 | 0.93 | 24% |
| IE Towers | 0.80 | 1.01 | 14% |
| | | | |
| **Average** | | **0.90** | **20%** |
| Min | | 0.77 | 14% |
| Max | | 1.01 | 24% |

As well as the individual circumstances of operators, for example their position in technology investment cycles, macroeconomic conditions in a particular country can have a significant bearing on the most efficient mixture of debt and equity capital. However, the sample mean is reasonably close to the average for the operators who provided estimates, so the MCMC has used the latter figure (26.15%).

## 12.2. Cost of Debt

The cost of debt for a tower operator is estimated to be 6.0%, based on a risk-free (10-year bond) rate of 4.0% and a debt risk premium of 2.0%. The risk-free rate was discussed above. The debt risk premium arises from the difference in spreads for corporate bonds in the sector as compared to government bonds. The MCMC has used an average of the figures provided by the tower operators, which ranged from 1.50% to 2.50% (The MCMC excluded an outlier value of 11%).

## 12.3. Cost of Equity

The cost of equity is calculated by adding to the risk-free rate a premium that reflects the greater perceived risk of investing in the stock market, as compared to government bonds (the ERP) and modifying this by a factor (the beta) that reflects the relative volatility of stocks in the sector (mobile telecommunications towers), as compared to the market as a whole. On average, the value of the beta will, by definition, be one. Values of less than one reflect stocks that tend to move up or down less than the market as a whole and vice versa.

The risk-free rate and the ERP were discussed above. For estimating the equity beta, an analysis of a sample of operators in the US and Europe was undertaken. This is presented in Table 13, above and, although the range of asset betas was again quite large (0.6 to 0.8), the average levered beta of 0.90 obtained from them was the same as the average of the figures provided by the operators of 0.9 (ranging between 0.64 – 1.05, based on three operators who provided data).

The cost of equity data for a typical tower operator is given in the following table.

**Table 14: Calculation of the cost of equity for tower operators**

| Cost of Equity = RF + β*ERP | Operator inputs | Value used |
|---|---|---|
| Risk-free rate (RF) | 4.10% - 4.35% | 4.0% |
| Beta (β) | 0.64 – 1.05 | 0.9 |
| Equity Risk Premium (ERP) | 4.30% - 10.94% | 7.61% |
| Cost of Equity (CE) | 4.00% - 11.48% | 10.85% |

### 12.4. Estimated WACC values

For a Malaysian tower operator, the cost of debt is estimated to be 6.0%, the cost of equity is 10.85%, the forward-looking gearing is 26.15%, and the tax rate is 24%. These figures provide a pre-tax WACC value of 12.11%.

**Question 15:**

Do you have any comments on the WACC values proposed for the Towers Services?

## 13. DTT Transmission

### 13.1. Introduction

The key issue with estimating a WACC for the DTT sector is that there are no close comparator companies that have stock exchange listings. Whilst other analyses have used figures from companies such as Maquarie and National Grid, as well as mobile towers companies (see Section 12, above), these companies combine a range of different activities and so it is difficult to disentangle their DTT activities from the rest. Nevertheless, analyses done in Ireland (2014)[9] and Sweden (2007)[10] provide some useful parallels.

As well as the individual circumstances of operators, for example their position in technology investment cycles, macroeconomic conditions in a particular country can have a significant bearing on the most efficient mixture of debt and equity capital. Any assessment of the appropriate WACC for a DTT operator in Malaysia therefore needs to take into account the local capital market context, as well as the specific characteristics of the sector.

The DTT sector has similarities to the other sectors under consideration in this analysis, in that it is a capital-intensive network business that is dependent on similar, though not identical, technology to the other sectors.

## 13.2. Gearing

The Swedish study cited above estimated target gearing to be in the range 20-40% for the broadcasting sector. Bearing this in mind and further comparators, ComReg in Ireland selected a notional value of 25%. The MCMC has adopted this figure, as it is also within the range applied in the other three sectors.

## 13.3. Cost of Debt

The cost of debt for a DTT operator is estimated to be 5.24%, based on a risk-free (10-year bond) rate of 4.0% and a debt risk premium of 1.24%, which is a simple average of the debt premium used in the other three sectors. The risk-free rate was discussed above. The debt risk premium arises from the difference in spreads for corporate bonds in the sector as compared to government bonds. The Swedish study used a value of 1.2%, based on European comparators and the Irish study took this and added a premium to reflect the difference between the cost of borrowing for Irish utility companies, compared to those in larger European countries. It is not possible to replicate this approach using available data for Malaysia and there may be difficulties in translating such figures across regions. However, the figure of 1.24% does not look unreasonable in this light.

[9] ComReg Document 14/136 & D15/14, 18th December 2004.
[10] Copenhagen Economics, "WACC FOR BROADCASTING – TERACOM", report prepared for the Swedish regulator (Post och Telestyrelsen), 21st February 2007.

## 13.4. Cost of Equity

The cost of equity is calculated by adding to the risk-free rate a premium that reflects the greater perceived risk of investing in the stock market, as compared to government bonds (the ERP) and modifying this by a factor (the beta) that reflects the relative volatility of stocks in the sector, as compared to the market as a whole. On average, the value of the beta will, by definition, be one. Values of less than one reflect stocks that tend to move up or down less than the market as a whole and vice versa.

The risk-free rate and the ERP were discussed above. For estimating asset beta, the MCMC again used an average of the values used in the other three sectors, giving a value of 0.84 and a value for the cost of equity of 10.39%.

The Irish and Swedish studies estimated the beta at 0.72 and 0.73, respectively.

## 13.5. Estimated WACC values

For a Malaysian DTT operator, the cost of debt is estimated to be 5.24%, the cost of equity 10.39%, the forward-looking gearing 25%, and the tax rate 24%. These figures provide a pre-tax WACC value of 11.57%.

**Question 16:**

Do you have any comments on the WACC values proposed for the DTT Transmission Services?

# 14. Summary and sensitivities

The central estimates of the WACC and its supporting parameters for the four sectors, mobile, fixed, towers and DTT are set out in the table below.

**Table 15: Point estimates of WACC and associated parameters**

| | Towers | Mobile | Fixed | DTT |
|---|---|---|---|---|
| **Weighted average cost of capital (WACC)** | | | | |
| Nominal pre-tax WACC | **12.11%** | **12.32%** | **11.00%** | **11.57%** |
| After 5% discount | | | **10.85%** | |
| | | | | |
| **Cost of Debt = RF + DP** | | | | |
| Risk-free rate (RF) | 4.00% | 4.00% | 4.00% | 4.00% |
| Debt Premium (DP) | 2.00% | 0.90% | 0.83% | 1.24% |

| | Towers | Mobile | Fixed | DTT |
|---|---|---|---|---|
| Cost of Debt (CD) | **6.00%** | **4.90%** | **4.83%** | **5.24%** |
| | | | | |
| **Cost of Equity = RF + β*ERP** | | | | |
| Risk-free rate (RF) | 4.00% | 4.00% | 4.00% | 4.00% |
| Beta (β) | 0.90 | 0.85 | 0.78 | 0.84 |
| Equity Risk Premium (ERP) | 7.61% | 7.61% | 7.61% | 7.61% |
| Cost of Equity (CE) | **10.85%** | **10.45%** | **9.94%** | **10.39%** |
| | | | | |
| **Other parameters** | | | | |
| Tax rate (t) | 24.00% | 24.00% | 24.00% | 24.00% |
| Gearing (G) | 26.15% | 16.20% | 25.19% | 25.00% |

The discussion in the preceding sections identified a number of alternative values for the various parameters underlying the WACC calculations. Some of these are interlinked and others are common across the different sectors. This creates a large number of possible combinations with different outcomes for the respective WACC values. In view of this, a Monte Carlo simulation was carried out. This involves randomly varying the value of the different parameters between the minimum and maximum values identified and recalculating the WACC results. This is done a large number of times (2,000 in this case), so that the range of potential outcomes can be explored.

The parameter ranges are set out in Table 16, below.

**Table 16: Parameter ranges for the WACC sensitivity analysis**

| | Towers | | Mobile | | Fixed | | DTT | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** | **Min** | **Max** |
| Risk-free rate (RF) | 3.98% | 4.66% | 3.98% | 4.66% | 3.98% | 4.66% | 3.98% | 4.66% |
| Debt Premium (DP) | 1.50% | 2.50% | 0.23% | 1.89% | 0.83% | 2.93% | 0.85% | 2.44% |
| | | | | | | | | |
| Beta (β) | 0.77 | 0.90 | 0.67 | 0.99 | 0.78 | 0.84 | 0.72 | 0.88 |
| Equity Risk Premium (ERP) | 4.30% | 10.94% | 4.30% | 10.94% | 4.30% | 10.94% | 4.30% | 10.94% |
| | | | | | | | | |
| Tax rate (t) | | | | | | | | |
| Gearing (G) | 20.00% | 26.15% | 16.20% | 22.00% | 25.19% | 40.00% | 20.00% | 40.00% |

The results of the analysis are set out in the table below:

**Table 17: WACC Monte Carlo sensitivity analysis results**

| | Towers | Mobile | Fixed | DTT |
|---|---|---|---|---|
| Point estimate | **12.11%** | **12.32%** | **10.85%** | **11.57%** |
| Average | 11.77% | 12.16% | 10.75% | 10.82% |
| Min | 9.25% | 9.57% | 8.32% | 8.04% |
| Max | 14.88% | 15.05% | 13.54% | 14.67% |

In the table above, the Point estimates of the WACC in each sector are presented, together with average, minimum and maximum values taken from the 2,000 Monte Carlo simulations. The average values differ slightly from the Point estimates, because the ranges of values above and below the Point estimate are not always symmetrical.

## 15. Recommendation

The MCMC proposes to use the upper and lower rates of WACC set out in Table 17, above, in calculating the costs of the regulated wholesale facilities and services in the Access List, with the Point estimate being the preferred value in each case. However, as explained in Part D of this PI Paper, for fixed services, 8.08% would be used for sensitivity analysis.

**Question 17:**

Do you have any comments on the range of WACC values proposed?

# PART D: FIXED SERVICE

## 16. Introduction to Fixed Services

### 16.1. Fixed Services

The category of Fixed Services encompasses those facilities and services in the Access List that are provided on a fixed telecommunications network.

There are following fixed services in the Access List.

(a) Fixed termination and origination services
- Fixed Network Origination Service
- Fixed Network Termination Service

(b) Transmission-related services
- Interconnect Link Service
- Wholesale Local Leased Circuit Service
- Domestic Connectivity to International Services – Connection services to the submarine cable system
- Trunk Transmission Service
- End-to-End Transmission Service

(c) Fixed Access services
- Full Access Service

(d) Line Sharing Service
- Sub-loop Service
- Digital Subscriber Line Resale Service
- Wholesale Line Rental Service

(e) HSBB Services
- Layer 2 HSBB Network Service with QoS
- Layer 3 HSBB Network Service with Network Service
- Layer 3 HSBB Network Service without Network Service

(f) Bitstream Services
- Bitstream with Network Service
- Bitstream without Network Service

(g) Other services
- Network Co-Location Service
- Duct and Manhole Access

## 16.2. Fixed Services Cost Model

In order to provide a full set of costs for the Fixed Services in the Access List, the MCMC has developed a cost model which is based on the bottom up LRIC+ methodology. The principal supplier of fixed services is TM. Even if there are other alternative fixed operators, their size is relatively small and therefore in line with international best practice, the model of fixed network in Malaysia is based on the network of the incumbent operator.

## 16.3. Features of the Fixed network model

The fixed network model is a bottom-up LRIC+ model. The basic steps of such a model are demand calculation, network dimensioning, network costing and splitting network cost to services.

## 16.4. Service demand and traffic

In order to calculate the costs of the regulated services, the model has to calculate the total demand in the network including non-regulated services, because the network elements are shared and used by all service. The model works by dimensioning a network that will meet these service demands each year at an appropriate quality of service. There are two basic groups of services - line rental services and traffic services. Line rental services use the access network equipment, while traffic services use the core network equipment. Traffic services are further split between data traffic, voice traffic and SMS traffic. Data monthly rental services (broadband lines, leased lines) combine the line rental of access line with the data traffic in core network.

The past, current and forecasted future volumes of all services were provided by TM. In cases where the data was not complete for all years, the trend from available years of the same service was extended or the trend of similar service was used in order to have complete values of service volumes in all years. For regulated services where there is no take up (the service volume is zero) a minimum service volume of 1 was used in order to be able to calculate the cost of the regulated service.

The input data show the following trends in the service volumes. The number of minutes of voice services is expected to decrease by 7% annually between 2016 and 2021. Data traffic is expected to increase by 14% annually between 2016 and 2021. The number of copper access lines is expected to decrease by 7% annually between 2016 and 2021. The number of fibre access lines is expected to increase by 16% annually between 2016 and 2021.

The demand for access lines in the access network is given simply by the number of access lines.

The traffic demand in the core network was calculated in the form of busy hour traffic required to provide the collected volumes of traffic services.

For data traffic services, the busy hour traffic which is used for dimensioning the required capacity in the core network was calculated as the nominal data speed multiplied by the contention ratio of the service.

For voice traffic, first the number of busy hour erlangs was calculated by using the following formula:

| |
|---|
| Busy hour erlangs = {voice minutes + voice minutes / average call duration * (1 - % of unsuccessful calls from total call attempts) * average ringing time} / 365 * % of traffic in busy hour / 60 |

Busy hour erlangs were then converted into busy hour channels needed to carry the busy hour erlangs with the selected blocking probability.

The busy hour channels were then multiplied by the channel size to derive the busy hour traffic from voice services.

The number of SMS was converted into busy hour traffic using the following formula:

| |
|---|
| Busy hour Mbit/s from SMS = number of SMS * SMS size in bytes * 8 / 1024 / 1024 / 365 * % of traffic in busy hour / 3600 |

The busy hour Mbit/s from all services (data traffic, voice traffic, SMS traffic) were then multiplied by routing factors for each of the services and summarized across all services to get the total traffic going through each of the core network elements.

All traffic parameters used in the above mentioned calculations were provided by TM.

## 16.5. Network dimensioning

Network dimensioning is the method used to calculate the number of network elements which are needed to handle the service demand calculated in the previous step.

The access network was dimensioned based on the number of access lines and the average usage of individual access network elements per access line in TM's network.

The core network cables were dimensioned based on the number of nodes and the distances between these nodes in the TM network. This is in line with the scorched node approach to bottom-up modelling where the existing locations of nodes are kept in the model.

The core network transmission and switching equipment was dimensioned based on the traffic going through the network elements and based on other drivers including number of subscribers. The unit capacities and utilization of the equipment were provided by TM.

## 16.6. Network costing

The next step is to calculate the annual costs of the network elements. This is done by multiplying the quantities of the network elements by their unit prices, annualizing the capital expenditure and adding annual operational costs.

In line with the bottom-up LRIC+ methodology, the model uses replacement costs for network equipment which reflect their replacement value at today's prices. TM was asked to provide the latest unit prices for their network equipment of the same capacities which were used in the network dimensioning step. In cases where TM uses some outdated equipment which is no longer purchased, they are replaced by the modern equivalent assets. This is the case for DSLAMs and local exchanges which were fully replaced in the model by MSANs.

In addition to equipment prices, annual operational costs (OPEX) were also collected from TM.

Price trends were obtained to adjust equipment prices and operational costs for future years. There are generally different price trends for equipment prices and for operational costs associated with equipment.

To annualize the capital expenditure, the economic lives of the network equipment were needed. TM was asked for the economic lives of their equipment. In case of fibre drop cables, the data has been adjusted to give economic lifetimes that are consistent with actual usage.

The model uses tilted annuity formula to calculate annualized capital expenditure. This is the preferred approach because this provides the closest approximation to ED (which is the theoretical depreciation to be used in an economic cost model).

## 16.7. Service costing

The last step is the calculation of service costs. The access network elements are allocated to services based on the number of lines and usage of different access network elements by individual line types. The core network elements are allocated to services based on the service traffic multiplied by routing factors.

The above described costs are the direct network costs (cost of network elements). In additional there are indirect network costs, retail costs and general overheads associated with providing services. The ratio of indirect network costs, retail costs and general overheads to the direct network costs was calculated based on the actual values from TM in 2015 and 2016 and the average ratio between these two years was used as a mark-up to calculate the indirect network costs, retail costs and general overheads for each service. Retail costs were applied only to retail services and not to wholesale services.

## 16.8. Treatment of HSBB subsidies

The amounts received by TM for HSBB from the government were not proposed as a subsidy, but as a Public Private Partnership, because the government is expected to receive a return in the form of a revenue share. Therefore, these payments have not been excluded from the cost of the services. Nevertheless, it is likely that such an arrangement would only be necessary if the necessary funding were not forthcoming from the capital markets. This matter is discussed in more detail in Section 10.4 dealing with calculation of the WACC.

## 16.9. Model reconciliation

The Fixed network model has been subject to model calibration and reconciliation. Wherever possible, the original data provided by TM has been used, but in some cases the values have been changed to reflect efficient price levels achievable by operators in Malaysia and efficient operation. The following changes to the original TM data were done:

(a) The voice channel size was reduced to 87.2 kbit/s;
(b) The average SMS size was estimated to be 105 bytes;
(c) The lifetime of drop cables and drop points was increased to 10 years;
(d) The lifetime of BTU was increased to 5 years; and
(e) The unit price of fibre cabinet was reduced to RM25,000.

The costs calculated by the bottom-up model must also be reconciled with the top-down book values and general ledger costs provided by TM. The initial cost data provided by TM had to be changed in the following areas in order to produce realistic results:

(a) The fully depreciated assets were removed from the calculation of annualized CAPEX, (but their OPEX is included in the modelled costs). The categories of assets affected were access network civil works, access network copper cables, MSANs and DSLAMs, transport network cables and buildings; and

(b) The OPEX levels were reduced to match the real OPEX provided by TM.

## 16.10. Comments Received from Network Operators

Based on the initial model viewing the following comments were received from the operators.

Celcom, Digi, Maxis, TM and Operator C commented that the model was published with only dummy data and therefore it is very difficult to review the model. However, the model is based on the incumbent's data and due to the confidentiality requirements, the data cannot be shared with other operators. Celcom and Maxis further argued that TM will be able to input their own data into the model which will then help them to review the model and give TM an advantage over other operators. The MCMC is of the view that all operators may input realistic data (equipment capacities, unit costs, routing factors etc.) and review the model calculations. They just cannot review the data submitted by TM, but they can review the model calculations.

Celcom, Maxis and Operator C argued that the model should take into account the subsidies received by TM for HSBB and exclude them from the cost of the services. However, the government investment into HSBB is not a subsidy, but Public Private Partnership, because the government receives a revenue share. The manner that this is dealt with is discussed in Section 10.4.

Celcom asked why the MCMC changed the approach for modelling the fixed access network from top-down FAC and HCA to bottom-up LRIC. Celcom added, that 2013 EC Recommendation (C(2013) 5761) says that "the recommended costing methodology the Regulatory Asset Base (RAB) corresponding to the reusable legacy civil engineering assets … taking account of the assets' elapsed economic life and thus of the costs already recovered by the regulated SMP operator." According to the EC recommendation, "…the initial RAB corresponding to the reusable legacy civil engineering assets would be set at the regulatory accounting value, net of the accumulated depreciation at the time of calculation…". Celcom is concerned that the new approach adopted by the MCMC (BU LRIC with tilted annuity) will allow the incumbent operator to over-recover its investment cost for the access network, so in turn leading to inflated prices for HSBB and other fixed services. This is because assets in the access network are likely to be heavily depreciated and in many cases fully depreciated. Switching from a HCA and FAC approach to the new method will cause significant over-recovery of costs.

The MCMC decided to use the bottom-up LRIC approach for the simple reason that top-down models based on FAC and HCA are usually created by the operators and not by the regulators, because regulators do not have access to the necessary data.

This approach represents the best practice. The EU Recommendation of 11.9.2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment mentioned by Celcom also says that:

> *"(29) The bottom-up long-run incremental costs plus (BU LRIC+) costing methodology best meets these objectives for setting prices of the regulated wholesale access services. This methodology models the incremental capital (including sunk) and operating costs borne by a hypothetically efficient operator in providing all access services and adds a mark-up for strict recovery of common costs. Therefore, the BU LRIC+ methodology allows for recovery of the total efficiently incurred costs.*
>
> *(30) The BU LRIC+ methodology calculates the current costs on a forward-looking basis (i.e. based on up-to-date technologies, expected demand, etc.) that an efficient network operator would incur to build a modern network today, one able to provide all required services. Therefore, BU LRIC+ provides correct and efficient signals for entry.*
>
> *(31) Where cable, fibre (FttX) and, to a lesser extent, mobile networks (in particular Long Term Evolution or LTE mobile networks) are competing against copper networks, SMP operators react by upgrading their copper networks and progressively replace them with NGA to address this competitive threat. Therefore, since no operator would today build a pure copper network, the BU LRIC+ methodology calculates the current costs of deploying a modern efficient NGA network.*
>
> *(32) Such an efficient NGA network would consist wholly or partly of optical elements, depending on national circumstances, and should be capable of delivering the targets of the Digital Agenda for Europe set out in terms of bandwidth, coverage and take-up.*
>
> *(33) Valuation of the assets of such an NGA network at current costs best reflects the underlying competitive process and, in particular, the replicability of the assets.*
>
> *(34) Unlike assets such as the technical equipment and the transmission medium (for example fibre), civil engineering assets (for example ducts, trenches and poles)*

*are assets that are unlikely to be replicated. Technological change and the level of competition and retail demand are not expected to allow alternative operators to deploy a parallel civil engineering infrastructure, at least where the legacy civil engineering infrastructure assets can be reused for deploying an NGA network.*

*(35) In the recommended costing methodology the Regulatory Asset Base (RAB) corresponding to the reusable legacy civil engineering assets is valued at current costs, taking account of the assets' elapsed economic life and thus of the costs already recovered by the regulated SMP operator. This approach sends efficient market entry signals for build or buy decisions and avoids the risk of a cost over-recovery for reusable legacy civil infrastructure. An over-recovery of costs would not be justified to ensure efficient entry and preserve the incentives to invest because the build option is not economically feasible for this asset category."*

The MCMC has used exactly the approach as described in the mentioned EU Recommendation. In addition, the MCMC does not agree with the statement made by Celcom that a bottom-up LRIC approach leads to over recovery of investment cost. Over recovery of costs would happen only in the case when fully depreciated assets are included in the calculation. If the current costs of the network are adjusted by the value of the fully depreciated assets, then no over-recovery happens. The MCMC cost model excludes the fully depreciated assets from the calculation.

Celcom further argued that using tilted annuity to calculate the annualised CAPEX compared to straight line depreciation plus the cost of capital (NBV*WACC) increases the costs. However even Celcom admitted that in early years of the asset life the titled annuity leads to lower annualised CAPEX and in later years tilted annuity leads to higher annualised CAPEX than straight line depreciation plus the cost of capital (NBV*WACC). The obvious reason is that NBV is decreasing over time so the cost of capital is very high in early years and very low in later years when using the straight line depreciation plus the cost of capital (NBV*WACC). This variability of results is exactly the reason why straight line depreciation plus the cost of capital (NBV*WACC) is not usually used in bottom-up models and titled annuity is the preferred approach. Tilted annuity leads to the same cost recovery over the full lifetime of the asset as straight line depreciation plus the cost of capital (NBV*WACC), but the advantage of tilted annuity is, that the cost of capital is distributed evenly between the years. This enables the calculation of stable regulated prices which do not change every year.

Celcom argued that the model operating manual is not sufficient because it describes only the calculations in the model but not the input data. The MCMC is of the view that the model operating manual should only describe the model calculations because these are part of the model and should not describe the input data because input data are not part of the model and can be changed any time. Celcom further asked how the data for trenches, ducts and cables were derived and how the leased line numbers were converted to bandwidth. All these data were collected directly from TM and verified using benchmarks. The MCMC cannot publish the input data and start a discussion about these data because of the confidentiality.

Celcom argued that the depreciation methodology in the fixed model should be economic depreciation because it is used also in the mobile model. This comment is noted and all models will apply the same depreciation methodology for consistency as discussed in Section 7.3.

Celcom asked why all types of calls have been included separately in the model. The MCMC is of the view that the increased granularity can be used by the MCMC in taking decision on possible disputes between operators.

Celcom wanted to know how average bandwidth of leased lines in each category was estimated. In reality, the bandwidth was not estimated at all, both the number of leased lines and their real bandwidth was collected from TM.

Celcom argued that using contention ratios in calculating broadband services demand should be replaced by calculation of average busy hour data usage. Celcom said that contention ratios are not used by most operators. According to Celcom, this approach leads to the situation that a 16 Mbit/s line costs twice as much as an 8 Mbit/s line even if peak traffic usage may differ little on the two types of lines. The MCMC is of the view that even if contention ratios are not used to block traffic from individual subscribers, it is proper to use them for network dimensioning – the operator has to dimension the network in such a way that theoretically all customers may obtain the capacity given by the line speed multiplied by the contention ratio in order to satisfy the contractual obligations towards the customers. From this point of view, it is correct that 16 Mbit/s line costs twice as much as the 8 Mbit/s line (even if the customer does not use it), because he has the guaranteed option to use 16 Mbit/s multiplied by the contention ratio and not only 8 Mbit/s multiplied by the contention ratio. Broadband services are not priced based on actual data usage but based on the option to use the purchased speed. If broadband services would be priced based on actual data usage as Celcom suggests then two customers, both using an 8 Mbit/s line should pay different prices if one of them uses the full speed available to them but the other uses only a small proportion of the speed. The MCMC does not think that this approach is viable.

Celcom pointed out that in NGN core networks the voice channel size is more than 64 kbit/s because of protocols and overheads used. The voice channel size in the model was changed to 87.2 kbit/s to include also the headers.

Celcom pointed out that 140 bytes is very high for the average SMS size. The 140 bytes is the size of SMS which uses all 160 characters. The average SMS size was changed to 105 bytes based on the assumption that average SMS uses 75% of the characters.

Celcom asked how the top-down building costs were used. The top-down building costs were not used in the model. Building costs were modelled bottom-up based on the space needed by the number of pieces of each equipment type as calculated by the model.

Celcom asked why retail costs were included. The MCMC decided to include retail costs in order to be able to review the costs of retail services, if needed.

Celcom pointed out that leased lines growth should be independent from broadband services. New data about expected leased lines growth has been obtained from TM.

Celcom argued that the access network should have 2 levels of distribution points. This is the case in the model. Primary distribution happens at cabinets and secondary at drop points.

Celcom argued that MSANs should be split into several categories based on sizes. The MCMC agrees that using several categories based on sizes could increase the precision of calculation. However, TM was not able to provide such data. In addition, the size of the MSAN matters only in relation to the MSAN chassis because the same cards are used in all sizes of MSANs. The total MSAN costs calculated using the average MSAN size were reconciled with the real costs of TM and the use of the average MSAN size did not increase the costs.

Celcom argued that DWDM should not be used in all local nodes. However, the modelled network uses local fibre rings to connect local nodes. DWDM is needed to send the signal from the MSAN to the local ring fibre. For connections between nodes in the same location, DWDM is not used.

Celcom argued that the network management system should be allocated to parts of network which use it most. It is not clear which network parts Celcom meant and what allocation drivers should be used. However, the MCMC has allocated the network management system to all network equipment which is monitored by the network management system based on the total annual cost of the equipment.

Celcom argued that the MSAN and OLT chassis should not be split to cards based on the number of the cards and should be allocated to the cards based on their costs. However, the capacity of the MSAN and OLT chassis is based on slots where cards can be placed. If a card occupies the slot, it occupies the same proportion of the MSAN or OLT chassis regardless of the cost of the card. Therefore, the number of cards is the correct causal driver. The MCMC is of the view that to split the chassis to individual card types based on the number of the cards is the correct way.

Maxis argued that stranded assets should not be included in the cost model. The MCMC fully agrees with this statement and confirms that no stranded assets are included in the fixed model. Because the model is bottom-up, it calculates the number of network assets needed to handle the demand and therefore there are no stranded assets which would not be used to provide the services. Stranded assets can occur only in top-down models because they use the asset values from an operator's fixed asset register and it is possible that the fixed asset register includes some stranded assets.

Maxis argued that services should not be priced based on the costs of using legacy assets for provision of the services because the services can be provisioned at lower costs using an NGN network. The MCMC agrees with this statement and confirms that the model does not use any legacy assets and models a fully NGN fixed network.

Maxis argued that the HSBB costs and FTR could be overestimated based on slow migration time from DEL and Streamyx services to Unifi. This argument is not clear to the MCMC because there is no parameter concerning the migration time in the model. The migration should be reflected only by changing the number of different lines as input volumes to the model and the costs per line are then calculated based on these volumes. There is no danger of overestimating the costs of the HSBB due to slow migration time. The FTR cannot be influenced in any way because TM uses and the model calculates a fully NGN core network so the FTR terminating on all types of lines are based on NGN costs.

Maxis argued that based on data from BEREC: the lifetime of civil infrastructure should be between 30 and 44 years, the percentage of civil infrastructure considered reusable should be between 35% and 100% and the percentage of already depreciated reusable civil infrastructures should be between 20.5% and 33%. The MCMC confirms that the lifetime of civil infrastructure assets in the model is 30 years (low end of the recommended interval) and the percentage of civil infrastructure considered reusable in the model is 100% (high end of the recommended interval). As for the percentage of already depreciated reusable civil infrastructure, this is not relevant and is not used in the model. As the model uses tilted annuity to calculate the cost of capital, the cost of capital is split equally between the years and it does not matter if any asset is in the early or later years of its lifetime.

Maxis and TM asked how Layer 2 and Layer 3 HSBB services will be calculated if there are no volumes collected from TM. As both these services have no take up, High Speed Broadband Access Service is used instead. This service is also included in the model to reflect the demand for this type of service and to include the traffic in the overall traffic in the model. For the sole purpose of calculating the unit price of the Layer 2 and Layer 3 HSBB services, the MCMC assumed a volume of 1 line with speed of 1 Mbit/s. The costs of all other speeds needed for the Access List were calculated based on the cost of access elements which are not traffic sensitive per one line plus the cost of the core network elements which are traffic sensitive calculated for the speed 1 Mbit/s multiplied by the number of Mbit/s of each individual speed.

Maxis asked if IPTV is considered as an OTT service. The model is based on the services in the Access List and the Access List defines only FTTH services and not IPTV services. Therefore, IPTV was not considered in the model and is treated as an OTT service.

Maxis argued that the High Speed Broadband Access Service should be regulated for a mix of different speeds and not for a single bandwidth. Maxis further asked why the service cost in the models is not split between port and bandwidth charges. The MCMC would like to point out that this service is not included in the Access List and is therefore not regulated. It is included in the model only because the model includes all traffic in the network. Therefore, no additional granularity is needed. In addition, the model calculates the cost of a mix of all speeds as proposed by Maxis (the service volume is the total traffic for this service which is not split into individual bandwidths).

Maxis suggested the split between IP and circuit switched calls is missing in the model. The MCMC would like to point out that TM's core network is already fully NGN which is reflected in the model. All calls are therefore IP and there are no circuit switched calls.

Maxis asked for a network topology diagram of the access network to be able to assess how much fibre and copper is used in TM network. According to Maxis, this would enable it to analyse the allocation between legacy and fibre networks and remove any stranded assets for the asset base. Maxis added an example of such a diagram of Telenor that has been made public by the Norwegian regulator. The MCMC has reviewed the diagram and it is unclear how the diagram could assist in assessing the proportion of fibre and copper in the access network. The MCMC's model calculates copper lines and FTTH lines in the access network. The proportion of copper and fibre in the access network is therefore based on the proportion of these two types of lines and the average usage of copper and fibre cables per one copper and fibre line. The model is bottom-up and therefore calculates only such a number of assets of each type which is used by the services. There are no stranded assets in the model. Stranded assets can be included only in a top-down model, which takes asset values from the fixed asset register of the modelled operator and the fixed asset register may also include stranded assets.

Maxis argued that the MCMC removed contention ratios as part of the service definition of HSBB in the Access List which means that contention ratios should not be included in access pricing and in the model. The MCMC is of the view that no access seeker would be willing to pay for a HSBB service without a contention ratio (which would effectively mean contention ratio 1:1). This would bring the HSBB service to the cost level of a leased line. Therefore, the contention ratio was used for HSBB services.

Maxis provided estimates for several input data in the model and the MCMC confirms that these estimates have been used in validating the model inputs.

Maxis asked how the MCMC segregated the voice traffic terminated over Unifi, which should have lower costs. The MCMC does not agree that voice traffic terminated to Unifi lines should have lower costs. All voice traffic shares the same core network, which is fully NGN. The cost of termination services does not include the cost of the access line, but only the cost of the core network. Therefore, the cost of termination in all types of lines is the same and there is no need to separate traffic terminated in Unifi lines.

Maxis argued that Layer 2 and Layer 3 HSBB services should have regulated prices for different speeds. The MCMC confirms that prices for different speeds were calculated. These services have no take-up, therefore it was not necessary to include different speeds in the data collection. But the unit prices for each speed were calculated as the cost of access elements which are not traffic sensitive per one line plus the cost of the core network elements which are traffic sensitive calculated for the speed 1 Mbit/s multiplied by the number of Mbit/s of each individual speed.

Maxis argued that passive infrastructure such as trenches and manholes should be shared between copper and fibre lines. The MCMC confirms that this is exactly the case. The model models one access network including both copper and fibre lines and they share the passive infrastructure. The model does not calculate a copper network only and a fibre only network and does not add these two networks together. This would lead to the duplication of the passive infrastructure as Maxis fears.

**Question 18:**

Do you have any comments on the approach adopted for the fixed model?

# 17. Proposed Regulated Prices

## 17.1. Fixed Network Origination Service

This service covers the cost in the originating network of a call outgoing from fixed network to other national fixed and mobile networks for freephone 1800 number services and toll free 1300 number services.

The cost is based on usage of network elements by the outgoing call, which is reflected in routing factors, and on call characteristics (average call duration, % of unanswered calls, % of traffic in busy hour). The resulting unit costs (Sen/min) of origination service are shown in the table below.

**Table 18: Fixed Network Origination Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Outgoing national calls (Sen/min) | 1.53 | 1.60 | 1.66 |

The costs are increasing over time due to the decreasing voice traffic which results in a higher portion of voice-related network costs (softswitch, interconnection gateway) per call minute.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 19: Fixed Network Origination Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Outgoing national calls (Sen/min) | 1.43 | 1.50 | 1.55 |

**Table 20: Fixed Network Origination Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Outgoing national calls (Sen/min) | 1.42 | 1.48 | 1.54 |

The last regulated prices for origination are as follows:

(a) PSTN network origination local 1.82 Sen/minute;
(b) PSTN network origination single tandem 4.54 Sen/minute;
(c) PSTN network origination double tandem 6.53 Sen/minute;

(d) PSTN network origination double tandem with submarine cable 17.68 Sen/minute; and

(e) IP network origination national 1.28 Sen/minute.

The MCMC is of the view that this tariff structure is no longer relevant because the fixed core network is now fully NGN. Therefore, the distinction between PSTN and IP calls is no longer appropriate as all calls are IP calls. The distinction between local, single tandem and double tandem, which is related to PSTN network, is also no longer appropriate. Calls are also not separated to those that use and those that do not use the submarine cable. This is because the cost of the submarine component used for voice traffic is not significant; there is sharing of capacity in the submarine cable with data traffic which consumes most of the capacity. The costs calculated by the model are significantly lower than the previously regulated price for PSTN single tandem origination which was the most relevant service. Therefore, the new regulated price can be implemented using a glide path.

The MCMC proposes the following new regulated prices for the fixed network origination service:

**Table 21: Fixed Network Origination Service Prices**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Outgoing national calls (Sen/min) | 3.58 | 2.62 | 1.66 |

## 17.2. Fixed Network Termination Service

This service covers the cost in the terminating network of a call incoming to fixed network from other national fixed and mobile networks.

The cost is based on usage of network elements by the incoming call, which is reflected in routing factors, and on call characteristics (average call duration, % of unanswered calls, % of traffic in busy hour). The resulting unit costs (Sen/min) of termination service are shown in the table below.

**Table 22: Fixed Network Termination Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Incoming national calls (Sen/min) | 1.42 | 1.49 | 1.54 |

The costs are increasing over time due to the decreasing voice traffic which results in a higher portion of voice-related network costs (softswitch, interconnection gateway) per call minute.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 23: Fixed Network Termination Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Incoming national calls (Sen/min) | 1.33 | 1.39 | 1.44 |

**Table 24: Fixed Network Termination Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Incoming national calls (Sen/min) | 1.32 | 1.38 | 1.43 |

The last regulated prices for termination are as follows:

(a) PSTN network termination local 1.65 Sen/minute;
(b) PSTN network termination single tandem 4.10 Sen/minute;
(c) PSTN network termination double tandem 4.83 Sen/minute;
(d) PSTN network termination double tandem with submarine cable 17.44 Sen/minute; and
(e) IP network termination national 1.53 Sen/minute.

The MCMC is of the view that this tariff structure is no longer relevant because the fixed core network is now fully NGN. Therefore, as discussed above, the distinction between PSTN and IP calls and the distinction between local, single tandem and double tandem are no longer appropriate. Calls are also not separated to those that use and those that do not use the submarine cable. This is because the cost of the submarine component used for voice traffic is not significant; there is sharing of capacity in the submarine cable with data traffic which consumes most of the capacity. The costs calculated by the model are significantly lower than the previously regulated price for PSTN single tandem termination which was the most relevant service. Therefore, the new regulated price can be implemented using a glide path.

The MCMC proposes the following new regulated prices for the fixed network termination service:

**Table 25: Fixed Network Termination Service Prices**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Incoming national calls (Sen/min) | 3.25 | 2.39 | 1.54 |

## 17.3. Interconnect Link Service

The Interconnect Link Service cost covers cost for 1 km of the interconnect link cable. The resulting costs in are shown below.

**Table 26: Interconnect Link Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Interconnect Link Service monthly rental (RM/km/month) | 1,207 | 1,267 | 1,331 |
| Interconnect Link Service installation (RM/installation) | 19,757 | 20,745 | 21,782 |

The costs are increasing over time due to the increasing cost of cables and related civil infrastructure.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 27: Interconnect Link Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Interconnect Link Service monthly rental (RM/km/month) | 1,289 | 1,353 | 1,421 |

**Table 28: Interconnect Link Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Interconnect Link Service monthly rental (RM/km/month) | 1,166 | 1,224 | 1,285 |

The MCMC proposes to regulate the prices for Interconnect Link Service based on Table 26 above.

## 17.4. Wholesale Local Leased Circuit Service

The Wholesale Local Leased Circuit Service covers the access part of a leased line. Circuits up to 1 Mbps use a copper access line, from 1 Mbps up to 1 Gbps use a fibre access line with UPE, from 1 Gbps up to 10 Gbps use fibre access lines with 10G UPE and from 1 Gbps and above use fibre access lines with DWDM terminal. The resulting costs in RM/month are shown below. The costs include also the cost of the port.

**Table 29: Wholesale Local Leased Circuit Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Wholesale Local Leased Circuit Service up to 1 Mbps (RM/month) | 51 | 52 | 53 |
| Wholesale Local Leased Circuit Service from 1 Mbps up to 1 Gbps (RM/month) | 1,782 | 1,728 | 1,677 |
| Wholesale Local Leased Circuit Service from 1 Gbps up to 10 Gbps (RM/month) | 16,056 | 15,537 | 15,049 |
| Wholesale Local Leased Circuit Service from 1 Gbps using DWDM (RM/month) | 4,279 | 4,150 | 4,030 |

The costs for circuits up to 1 Mbps are increasing over time due to the increasing cost of cables and related civil infrastructure whereas the prices for higher speed circuits are decreasing over time due to the decreasing costs of the transmission equipment.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 30: Wholesale Local Leased Circuit Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Wholesale Local Leased Circuit Service up to 1 Mbps (RM/month) | 52 | 53 | 55 |
| Wholesale Local Leased Circuit Service from 1 Mbps up to 1 Gbps (RM/month) | 1,711 | 1,660 | 1,613 |
| Wholesale Local Leased Circuit Service from 1 Gbps up to 10 Gbps (RM/month) | 15,285 | 14,794 | 14,333 |
| Wholesale Local Leased Circuit Service from 1 Gbps using DWDM (RM/month) | 3,894 | 3,780 | 3,674 |

**Table 31: Wholesale Local Leased Circuit Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Wholesale Local Leased Circuit Service up to 1 Mbps (RM/month) | 48 | 49 | 50 |
| Wholesale Local Leased Circuit Service from 1 Mbps up to 1 Gbps (RM/month) | 1,665 | 1,614 | 1,566 |
| Wholesale Local Leased Circuit Service from 1 Gbps up to 10 Gbps (RM/month) | 15,032 | 14,548 | 14,094 |
| Wholesale Local Leased Circuit Service from 1 Gbps using DWDM (RM/month) | 3,849 | 3,735 | 3,629 |

Costs for installation of wholesale local leased circuit service are shown in RM/installation.

**Table 32: Wholesale Local Leased Circuit Service Installation Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Wholesale Local Leased Circuit Service installation (RM/installation) | 9,879 | 10,373 | 10,891 |

The costs for installation are increasing over time due to the increasing labour costs.

The MCMC proposes to regulate the prices for Wholesale Local Leased Circuit Service based on Table 29 and Table 32 above.

## 17.5. Domestic Connectivity to International Services

The Domestic Connectivity to International Services is used together with the Network Co-Location Service and the transmission service.

It includes the tie cable between TM's and Access Seeker's equipment. The resulting costs are shown below.

**Table 33: Domestic Connectivity to International Services Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Domestic Connectivity to International Services monthly rental (RM/month) | 3.40 | 3.57 | 3.74 |
| Domestic Connectivity to International Services installation (RM/installation) | 85 | 89 | 94 |

The costs are increasing over time due to the increasing cable and labour cost.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 34: Domestic Connectivity to International Services Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Domestic Connectivity to International Services monthly rental (RM/month) | 3.71 | 3.90 | 4.10 |

**Table 35: Domestic Connectivity to International Services Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Domestic Connectivity to International Services monthly rental (RM/month) | 3.15 | 3.31 | 3.48 |

The MCMC proposes to regulate prices for Domestic Connectivity to International Services based on Table 33 above.

## 17.6. Trunk Transmission Service

The Trunk Transmission Service covers the transmission in the core network. Because of the significant cost of the submarine cable, the Trunk Transmission Service is separated between transmission within Peninsular Malaysia and within Sabah and Sarawak and transmission between Peninsular Malaysia and Sabah and Sarawak. The resulting costs in RM/month are shown below.

**Table 36: Trunk Transmission Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Trunk Transmission Service within Peninsular Malaysia and within Sabah and Sarawak for 1 Mbps (RM/month) | 24 | 21 | 18 |
| Trunk Transmission Service between Peninsular Malaysia and Sabah Sarawak for 1 Mbps (RM/month) | 52 | 47 | 42 |
| Trunk Transmission Service within Peninsular Malaysia and within Sabah and Sarawak for 1 Gbps (RM/month) | 25,028 | 21,577 | 18,709 |
| Trunk Transmission Service between Peninsular Malaysia and Sabah and Sarawak for 1 Gbps (RM/month) | 53,623 | 47,926 | 43,128 |

The costs for Trunk Transmission Service are decreasing over time due to the decreasing costs of the transmission equipment and increasing traffic in core network.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 37: Trunk Transmission Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Trunk Transmission Service within Peninsular Malaysia and within Sabah and Sarawak for 1 Mbps (RM/month) | 23 | 20 | 18 |
| Trunk Transmission Service between Peninsular Malaysia and Sabah and Sarawak for 1 Mbps (RM/month) | 53 | 48 | 43 |

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Trunk Transmission Service within Peninsular Malaysia and within Sabah and Sarawak for 1 Gbps (RM/month) | 23,901 | 20,642 | 17,929 |
| Trunk Transmission Service between Peninsular Malaysia and Sabah and Sarawak for 1 Gbps (RM/month) | 54,331 | 48,666 | 43,884 |

**Table 38: Trunk Transmission Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Trunk Transmission Service within Peninsular Malaysia and within Sabah and Sarawak for 1 Mbps (RM/month) | 23 | 20 | 17 |
| Trunk Transmission Service between Peninsular Malaysia and Sabah and Sarawak for 1 Mbps (RM/month) | 49 | 44 | 39 |
| Trunk Transmission Service within Peninsular Malaysia and within Sabah and Sarawak for 1 Gbps (RM/month) | 23,179 | 20,022 | 17,394 |
| Trunk Transmission Service between Peninsular Malaysia and Sabah and Sarawak for 1 Gbps (RM/month) | 49,985 | 44,742 | 40,321 |

The costs for installation of Trunk Transmission Service are shown in RM/installation.

**Table 39: Trunk Transmission Service Installation Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Trunk Transmission Service installation (RM/installation) | 19,757 | 20,745 | 21,782 |

The costs for installation are increasing over time due to the increasing labour cost.

The MCMC proposes to regulate prices for Trunk Transmission Service based on Table 36 and Table 39 above.

## 17.7. End-to-End Transmission Service

The End-to-End Transmission Service covers two Wholesale Local Leased Circuit Services and the transmission in the core network. Because of the significant cost of the submarine cable, the transmission service is separated between transmission within Peninsular Malaysia and within Sabah and Sarawak and transmission between Peninsular Malaysia and Sabah and Sarawak. The resulting costs in RM/month are shown below.

**Table 40: End-to-End Transmission Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| End-to-End Transmission Service within Peninsular Malaysia and within Sabah and Sarawak for 1 Mbps (RM/month) | 126 | 125 | 125 |
| End-to-End Transmission Service between Peninsular Malaysia and Sabah and Sarawak for 1 Mbps (RM/month) | 154 | 151 | 149 |
| End-to-End Transmission Service within Peninsular Malaysia and within Sabah and Sarawak for 1 Gbps (RM/month) | 28,592 | 25,032 | 22,063 |
| End-to-End Transmission Service between Peninsular Malaysia and Sabah and Sarawak for 1 Gbps (RM/month) | 57,187 | 51,382 | 46,482 |

The costs for the End-to-End Transmission Service are decreasing over time due to the decreasing costs of the transmission equipment and increasing traffic in core network.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 41: End-to-End Transmission Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| End-to-End Transmission Service within Peninsular Malaysia and within Sabah and Sarawak for 1 Mbps (RM/month) | 127 | 127 | 127 |
| End-to-End Transmission Service between Peninsular Malaysia and Sabah and Sarawak for 1 Mbps (RM/month) | 157 | 154 | 153 |
| End-to-End Transmission Service within Peninsular Malaysia and within Sabah and Sarawak for 1 Gbps (RM/month) | 27,322 | 23,962 | 21,154 |
| End-to-End Transmission Service between Peninsular Malaysia and Sarawak for 1 Gbps (RM/month) | 57,753 | 51,986 | 47,110 |

**Table 42: End-to-End Transmission Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| End-to-End Transmission Service within Peninsular Malaysia and within Sabah and Sarawak for 1 Mbps (RM/month) | 118 | 117 | 117 |
| End-to-End Transmission Service between Peninsular Malaysia and Sabah and Sarawak for 1 Mbps (RM/month) | 144 | 141 | 140 |

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| End-to-End Transmission Service within Peninsular Malaysia and within Sabah and Sarawak for 1 Gbps (RM/month) | 26,508 | 23,249 | 20,526 |
| End-to-End Transmission Service between Peninsular Malaysia and Sabah and Sarawak for 1 Gbps (RM/month) | 53,314 | 47,970 | 43,453 |

The costs for installation of the End-to-End Transmission Service are shown in RM/installation.

**Table 43: End-to-End Transmission Service Installation Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| End-to-End Transmission Service installation (RM/installation) | 19,757 | 20,745 | 21,782 |

The costs for installation are increasing over time due to the increasing labour cost.

The MCMC proposes to regulate prices for End-to-End Transmission Service based on Table 40 and Table 43 above.

## 17.8. Full Access Service

The Full Access Service includes the copper access line including MDF but without line card. The resulting costs are shown below.

**Table 44: Full Access Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Full Access Service monthly rental (RM/month) | 22 | 23 | 24 |
| Full Access Service installation (RM/installation) | 214 | 224 | 235 |

The costs are increasing over time due to the increasing cost of cables and related civil infrastructure and labour cost.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 45: Full Access Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Full Access Service monthly rental (RM/month) | 25 | 26 | 27 |

**Table 46: Full Access Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Full Access Service monthly rental (RM/month) | 21 | 22 | 22 |

The MCMC proposes not to regulate the prices for Full Access Service.

## 17.9. Line Sharing Service

The Line Sharing Service costs are equal to 50% of the costs of the Full Access Service. The resulting costs are shown below.

**Table 47: Line Sharing Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Line Sharing Service monthly rental (RM/month) | 11 | 12 | 12 |
| Line Sharing Service installation (RM/installation) | 107 | 112 | 118 |

The costs are increasing over time due to the increasing cost of cables and related civil infrastructure and labour cost.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 48: Line Sharing Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Line Sharing Service monthly rental (RM/month) | 12 | 13 | 14 |

**Table 49: Line Sharing Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Line Sharing Service monthly rental (RM/month) | 10 | 11 | 11 |

The MCMC proposes not to regulate the prices for Line Sharing Service.

## 17.10. Sub-loop Service

The Sub-loop Service includes the copper access line from the customer premises to the cabinet. The resulting costs are shown below.

**Table 50: Sub-loop Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Sub-loop Service monthly rental (RM/month) | 12 | 12 | 13 |
| Sub-loop Service installation (RM/installation) | 107 | 112 | 118 |

The costs are increasing over time due to the increasing cost of cables and related civil infrastructure and labour cost.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 51: Sub-loop Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Sub-loop Service monthly rental (RM/month) | 13 | 14 | 14 |

**Table 52: Sub-loop Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Sub-loop Service monthly rental (RM/month) | 11 | 11 | 12 |

The MCMC proposes not to regulate the prices for Sub-loop Service.

## 17.11. Digital Subscriber Line Resale Service

The Digital Subscriber Line Resale Service covers the copper access line, MDF, line card and transmission in the core network to the Internet. It does not include the international out payments for Internet connectivity. The resulting costs in RM/month are shown below.

**Table 53: Digital Subscriber Line Resale Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Digital Subscriber Line Resale Service 1 Mbps (RM/month) | 28 | 29 | 29 |
| Digital Subscriber Line Resale Service 2 Mbps (RM/month) | 30 | 31 | 31 |
| Digital Subscriber Line Resale Service 4 Mbps (RM/month) | 35 | 34 | 34 |
| Digital Subscriber Line Resale Service 8 Mbps (RM/month) | 43 | 42 | 41 |

The costs for the Digital Subscriber Line Resale Service with low speeds are increasing over time due to the increasing cost of cables and related civil infrastructure in the access network. The costs for high speed services are decreasing over time due to the decreasing costs of the transmission equipment and increasing traffic in core network.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return.  The results of these two scenarios are shown below.

**Table 54: Digital Subscriber Line Resale Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Digital Subscriber Line Resale Service 1 Mbps (RM/month) | 30 | 31 | 32 |
| Digital Subscriber Line Resale Service 2 Mbps (RM/month) | 32 | 33 | 34 |
| Digital Subscriber Line Resale Service 4 Mbps (RM/month) | 37 | 37 | 37 |
| Digital Subscriber Line Resale Service 8 Mbps (RM/month) | 45 | 44 | 43 |

**Table 55: Digital Subscriber Line Resale Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Digital Subscriber Line Resale Service 1 Mbps (RM/month) | 26 | 27 | 27 |
| Digital Subscriber Line Resale Service 2 Mbps (RM/month) | 28 | 28 | 29 |
| Digital Subscriber Line Resale Service 4 Mbps (RM/month) | 32 | 32 | 32 |
| Digital Subscriber Line Resale Service 8 Mbps (RM/month) | 40 | 39 | 38 |

The costs for installation of the Digital Subscriber Line Resale Service are shown in RM/installation.

**Table 56: Digital Subscriber Line Resale Service Installation Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Digital Subscriber Line Resale Service installation (RM/installation) | 334 | 351 | 368 |

The costs for installation are increasing over time due to the increasing labour cost.

The MCMC proposes not to regulate the prices for Digital Subscriber Line Resale Service.

## 17.12. Wholesale Line Rental Service

The Wholesale Line Rental Service includes the copper access line, MDF and line card.  The resulting costs are shown below.

**Table 57: Wholesale Line Rental Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Wholesale Line Rental Service monthly rental (RM/month) | 26 | 27 | 28 |
| Wholesale Line Rental Service installation (RM/installation) | 237 | 249 | 262 |

The costs are increasing over time due to the increasing cost of cables and related civil infrastructure and labour cost.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 58: Wholesale Line Rental Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Wholesale Line Rental Service monthly rental (RM/month) | 28 | 29 | 30 |

**Table 59: Wholesale Line Rental Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Wholesale Line Rental Service monthly rental (RM/month) | 24 | 25 | 26 |

The MCMC proposes not to regulate the prices for Wholesale Line Rental Service.

## 17.13. Layer 2 HSBB Network Service with QoS

The Layer 2 HSBB Network Service with QoS covers the BTU, fibre access line, ODF, OLT GPON card and transmission in the core network to the POI with the Access Seeker. The costs include also the cost of the port. The resulting costs in RM/month are shown below.

**Table 60: Layer 2 HSBB Network Service with QoS Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Layer 2 HSBB Network Service 5 Mbps (RM/month) | 84 | 84 | 84 |
| Layer 2 HSBB Network Service 10 Mbps (RM/month) | 89 | 88 | 88 |
| Layer 2 HSBB Network Service 20 Mbps (RM/month) | 100 | 97 | 96 |
| Layer 2 HSBB Network Service 30 Mbps (RM/month) | 110 | 106 | 103 |
| Layer 2 HSBB Network Service 50 Mbps (RM/month) | 132 | 124 | 119 |
| Layer 2 HSBB Network Service 100 Mbps (RM/month) | 184 | 169 | 157 |
| Layer 2 HSBB Network Service 200 Mbps (RM/month) | 289 | 258 | 233 |
| Layer 2 HSBB Network Service 300 Mbps (RM/month) | 395 | 347 | 309 |

| | | | |
|---|---|---|---|
| Layer 2 HSBB Network Service 400 Mbps (RM/month) | 500 | 436 | 386 |
| Layer 2 HSBB Network Service 500 Mbps (RM/month) | 605 | 526 | 462 |

The costs for Layer 2 HSBB Network Service with QoS are decreasing over time due to the decreasing costs of the transmission equipment and increasing traffic in core network.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 61: Layer 2 HSBB Network Service with QoS Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Layer 2 HSBB Network Service 5 Mbps (RM/month) | 96 | 96 | 97 |
| Layer 2 HSBB Network Service 10 Mbps (RM/month) | 101 | 101 | 101 |
| Layer 2 HSBB Network Service 20 Mbps (RM/month) | 111 | 109 | 108 |
| Layer 2 HSBB Network Service 30 Mbps (RM/month) | 121 | 118 | 116 |
| Layer 2 HSBB Network Service 50 Mbps (RM/month) | 140 | 134 | 130 |
| Layer 2 HSBB Network Service 100 Mbps (RM/month) | 190 | 177 | 166 |
| Layer 2 HSBB Network Service 200 Mbps (RM/month) | 290 | 261 | 239 |
| Layer 2 HSBB Network Service 300 Mbps (RM/month) | 389 | 346 | 311 |
| Layer 2 HSBB Network Service 400 Mbps (RM/month) | 489 | 430 | 384 |
| Layer 2 HSBB Network Service 500 Mbps (RM/month) | 588 | 515 | 456 |

**Table 62: Layer 2 HSBB Network Service with QoS Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Layer 2 HSBB Network Service 5 Mbps (RM/month) | 74 | 74 | 74 |
| Layer 2 HSBB Network Service 10 Mbps (RM/month) | 79 | 78 | 78 |
| Layer 2 HSBB Network Service 20 Mbps (RM/month) | 89 | 86 | 85 |
| Layer 2 HSBB Network Service 30 Mbps (RM/month) | 99 | 95 | 92 |
| Layer 2 HSBB Network Service 50 Mbps (RM/month) | 118 | 111 | 106 |
| Layer 2 HSBB Network Service 100 Mbps (RM/month) | 167 | 152 | 141 |
| Layer 2 HSBB Network Service 200 Mbps (RM/month) | 263 | 235 | 212 |
| Layer 2 HSBB Network Service 300 Mbps (RM/month) | 360 | 317 | 282 |
| Layer 2 HSBB Network Service 400 Mbps (RM/month) | 457 | 399 | 353 |
| Layer 2 HSBB Network Service 500 Mbps (RM/month) | 554 | 482 | 424 |

The costs for installation of Layer 2 HSBB Network Service with QoS are shown in RM/installation.

**Table 63: Layer 2 HSBB Network Service with QoS Installation Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Layer 2 HSBB Network Service installation (RM/installation) | 946 | 993 | 1,043 |

The costs for installation are increasing over time due to the increasing labour cost.

The MCMC proposes to regulate the prices for Layer 2 HSBB Network Service with QoS based on Table 60 and Table 63 above.

## 17.14. Layer 3 HSBB Network Service with Network Service

The Layer 3 HSBB Network Service with network service covers the BTU, fibre access line, ODF, OLT GPON card and transmission in core network to the POI with the Access Seeker. The costs include also the cost of the port. The resulting costs in RM/month are shown below.

**Table 64: Layer 3 HSBB Network Service with Network Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Layer 3 HSBB Network Service with Network Service 5 Mbps (RM/month) | 87 | 86 | 86 |
| Layer 3 HSBB Network Service with Network Service 10 Mbps (RM/month) | 94 | 93 | 92 |
| Layer 3 HSBB Network Service with Network Service 20 Mbps (RM/month) | 110 | 107 | 104 |
| Layer 3 HSBB Network Service with Network Service 30 Mbps (RM/month) | 125 | 120 | 116 |
| Layer 3 HSBB Network Service with Network Service 50 Mbps (RM/month) | 156 | 147 | 140 |
| Layer 3 HSBB Network Service with Network Service 100 Mbps (RM/month) | 233 | 215 | 199 |
| Layer 3 HSBB Network Service with Network Service 200 Mbps (RM/month) | 388 | 350 | 317 |
| Layer 3 HSBB Network Service with Network Service 300 Mbps (RM/month) | 542 | 485 | 436 |
| Layer 3 HSBB Network Service with Network Service 400 Mbps (RM/month) | 696 | 621 | 555 |
| Layer 3 HSBB Network Service with Network Service 500 Mbps (RM/month) | 851 | 756 | 673 |

The costs for Layer 3 HSBB Network Service with network service are decreasing over time due to the decreasing costs of the transmission equipment and increasing traffic in core network.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 65: Layer 3 HSBB Network Service with Network Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Layer 3 HSBB Network Service with Network Service 5 Mbps (RM/month) | 98 | 99 | 100 |
| Layer 3 HSBB Network Service with Network Service 10 Mbps (RM/month) | 105 | 105 | 105 |
| Layer 3 HSBB Network Service with Network Service 20 Mbps (RM/month) | 120 | 118 | 117 |
| Layer 3 HSBB Network Service with Network Service 30 Mbps (RM/month) | 135 | 131 | 128 |
| Layer 3 HSBB Network Service with Network Service 50 Mbps (RM/month) | 165 | 157 | 151 |
| Layer 3 HSBB Network Service with Network Service 100 Mbps (RM/month) | 239 | 222 | 208 |
| Layer 3 HSBB Network Service with Network Service 200 Mbps (RM/month) | 386 | 352 | 321 |
| Layer 3 HSBB Network Service with Network Service 300 Mbps (RM/month) | 534 | 481 | 435 |
| Layer 3 HSBB Network Service with Network Service 400 Mbps (RM/month) | 682 | 611 | 549 |
| Layer 3 HSBB Network Service with Network Service 500 Mbps (RM/month) | 830 | 741 | 663 |

**Table 66: Layer 3 HSBB Network Service with Network Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Layer 3 HSBB Network Service with Network Service 5 Mbps (RM/month) | 77 | 76 | 76 |
| Layer 3 HSBB Network Service with Network Service 10 Mbps (RM/month) | 84 | 83 | 82 |
| Layer 3 HSBB Network Service with Network Service 20 Mbps (RM/month) | 98 | 95 | 93 |
| Layer 3 HSBB Network Service with Network Service 30 Mbps (RM/month) | 113 | 108 | 104 |
| Layer 3 HSBB Network Service with Network Service 50 Mbps (RM/month) | 141 | 133 | 126 |
| Layer 3 HSBB Network Service with Network Service 100 Mbps (RM/month) | 213 | 196 | 181 |
| Layer 3 HSBB Network Service with Network Service 200 Mbps (RM/month) | 356 | 322 | 291 |

| | | | |
|---|---|---|---|
| Layer 3 HSBB Network Service with Network Service 300 Mbps (RM/month) | 500 | 447 | 402 |
| Layer 3 HSBB Network Service with Network Service 400 Mbps (RM/month) | 643 | 573 | 512 |
| Layer 3 HSBB Network Service with Network Service 500 Mbps (RM/month) | 786 | 699 | 623 |

Costs for installation of Layer 3 HSBB Network Service with network service are shown in RM/installation.

**Table 67: Layer 3 HSBB Network Service with Network Service Installation Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Layer 3 HSBB Network Service with Network Service installation (RM/installation) | 946 | 993 | 1,043 |

The costs for installation are increasing over time due to the increasing labour cost.

The MCMC proposes to regulate the prices for Layer 3 HSBB Network Service (with Network Service) based on Table 64 and Table 67 above.

## 17.15. Layer 3 HSBB Network Service without Network Service

The Layer 3 HSBB Network Service without network service covers the BTU, fibre access line, ODF and OLT GPON card. Transmission in core network is not included because the POI with Access Seeker is in the same location as the line card. The resulting costs are shown below.

**Table 68: Layer 3 HSBB Network Service without Network Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Layer 3 HSBB Network Service without Network Service (RM/month) | 79 | 80 | 80 |
| Layer 3 HSBB Network Service without Network Service installation (RM/installation) | 946 | 993 | 1,043 |

The costs for the Layer 3 HSBB Network Service without network service are increasing over time due to the increasing cost of cables and related civil infrastructure in the access network and labour cost.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 69: Layer 3 HSBB Network Service without Network Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Layer 3 HSBB Network Service without Network Service (RM/month) | 91 | 92 | 94 |

**Table 70: Layer 3 HSBB Network Service without Network Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Layer 3 HSBB Network Service without Network Service (RM/month) | 70 | 70 | 71 |

The MCMC proposes to regulate Layer 3 HSBB Network Service (without Network Service) based on Table 68 above.

## 17.16. Bitstream with Network Service

The Bitstream with Network Service cover the copper access line, MDF, line card and transmission in the core network to the POI with the Access Seeker. The resulting costs in RM/month are shown below.

**Table 71: Bitstream with Network Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Bitstream with Network Service 1 Mbps (RM/month) | 28 | 28 | 29 |
| Bitstream with Network Service 2 Mbps (RM/month) | 30 | 30 | 31 |
| Bitstream with Network Service 4 Mbps (RM/month) | 34 | 34 | 34 |
| Bitstream with Network Service 8 Mbps (RM/month) | 42 | 41 | 40 |

The costs for bitstream services with low speeds are increasing over time due to the increasing cost of cables and related civil infrastructure in access network. The prices for higher speed bitstream services are decreasing over time due to the decreasing costs of the transmission equipment and increasing traffic in core network.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 72: Bitstream with Network Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Bitstream with Network Service 1 Mbps (RM/month) | 30 | 31 | 32 |
| Bitstream with Network Service 2 Mbps (RM/month) | 32 | 33 | 33 |
| Bitstream with Network Service 4 Mbps (RM/month) | 36 | 36 | 36 |
| Bitstream with Network Service 8 Mbps (RM/month) | 44 | 43 | 42 |

**Table 73: Bitstream with Network Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Bitstream with Network Service 1 Mbps (RM/month) | 26 | 26 | 27 |
| Bitstream with Network Service 2 Mbps (RM/month) | 28 | 28 | 29 |
| Bitstream with Network Service 4 Mbps (RM/month) | 32 | 32 | 32 |
| Bitstream with Network Service 8 Mbps (RM/month) | 39 | 38 | 37 |

Costs for installation of bitstream services are shown in RM/installation.

**Table 74: Bitstream with Network Service Installation Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Bitstream with Network Service installation (RM/installation) | 334 | 351 | 368 |

The costs for installation are increasing over time due to the increasing labour cost.

The MCMC proposes not to regulate the prices for Bitstream with Network Service.

## 17.17. Bitstream without Network Service

The Bitstream without Network Service cover the copper access line, MDF and line card. Transmission in the core network is not included because the POI with the Access Seeker is in the same location as the line card. The resulting costs are shown below.

**Table 75: Bitstream without Network Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Bitstream without Network Service (RM/month) | 26 | 27 | 28 |
| Bitstream without Network Service installation (RM/installation) | 334 | 351 | 368 |

The costs for Bitstream without Network Service are increasing over time due to the increasing cost of cables and related civil infrastructure in the access network and labour cost.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 76: Bitstream without Network Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Bitstream without Network Service (RM/month) | 28 | 29 | 30 |

**Table 77: Bitstream without Network Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Bitstream without Network Service (RM/month) | 24 | 25 | 26 |

The MCMC proposes not to regulate the prices for Bitstream without Network Service.

## 17.18. Network Co-Location Service

The Network Co-Location Service includes physical co-location in Access Provider's premises. Co-location of one square metre in buildings includes the cost of two square metres of building space to account for the additional space needed for the access to the space directly occupied by the co-located equipment. The resulting costs in RM/month are shown below (except for electricity consumption which is shown in RM/kWh).

**Table 78: Network Co-Location Service Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Co-location of half of copper cabinet (RM/month) | 85 | 86 | 87 |
| Co-location of half of fibre cabinet (RM/month) | 346 | 336 | 327 |
| Co-location of one square metre in technical building (RM/month) | 75 | 78 | 81 |
| Co-location of one square metre in domestic submarine cable landing station (RM/month) | 780 | 818 | 857 |
| Co-location of one square metre in international submarine cable landing station (RM/month) | 329 | 345 | 362 |
| Co-location of one square metre in earth station (RM/month) | 342 | 358 | 375 |
| kWh of electricity consumed by co-located equipment (RM/kWh) | 0.8583 | 0.9013 | 0.9463 |

The costs are increasing over time due to the increasing cost of civil infrastructure.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 79: Network Co-Location Service Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Co-location of half of copper cabinet (RM/month) | 81 | 82 | 84 |
| Co-location of half of fibre cabinet (RM/month) | 307 | 299 | 292 |
| Co-location of one square metre in technical building (RM/month) | 75 | 78 | 81 |
| Co-location of one square metre in domestic submarine cable landing station (RM/month) | 780 | 818 | 857 |
| Co-location of one square metre in international submarine cable landing station (RM/month) | 329 | 345 | 362 |
| Co-location of one square metre in earth station (RM/month) | 342 | 358 | 375 |
| kWh of electricity consumed by co-located equipment (RM/kWh) | 0.8583 | 0.9013 | 0.9463 |

**Table 80: Network Co-Location Service Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Co-location of half of copper cabinet (RM/month) | 82 | 83 | 85 |
| Co-location of half of fibre cabinet (RM/month) | 315 | 307 | 299 |
| Co-location of one square metre in technical building (RM/month) | 72 | 75 | 79 |
| Co-location of one square metre in domestic submarine cable landing station (RM/month) | 775 | 813 | 852 |
| Co-location of one square metre in international submarine cable landing station (RM/month) | 327 | 343 | 360 |
| Co-location of one square metre in earth station (RM/month) | 339 | 355 | 372 |
| kWh of electricity consumed by co-located equipment (RM/kWh) | 0.8583 | 0.9013 | 0.9463 |

The MCMC proposes not to regulate the prices for Network Co-Location Service.

## 17.19. Duct and Manhole Access

The costs for Duct and Manhole Access are calculated based on the share of duct and manhole costs representing usage of 25% of the ducts and manholes. The resulting costs in RM/month are shown below.

**Table 81: Duct and Manhole Access Costs**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Duct access of 25% of duct per km (RM/month) | 20 | 21 | 22 |
| Manhole access of 25% of manhole 850mm x 850mm x 650mm (RM/month) | 13 | 14 | 15 |
| Manhole access of 25% of manhole 3740mm x 1640mm x 2000mm (RM/month) | 25 | 26 | 27 |

The costs are increasing over time due to the increasing cost of civil infrastructure.

As a sensitivity analysis we have run two alternative scenarios: using simple annuity instead of tilted annuity and using WACC of 8.08% instead of 10.85%. The WACC would be 8.08% if the HSBB government contribution were provided at zero return. The results of these two scenarios are shown below.

**Table 82: Duct and Manhole Access Costs using simple annuity**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Duct access of 25% of duct per km (RM/month) | 23 | 24 | 25 |
| Manhole access of 25% of manhole 850mm x 850mm x 650mm (RM/month) | 15 | 16 | 17 |
| Manhole access of 25% of manhole 3740mm x 1640mm x 2000mm (RM/month) | 28 | 30 | 31 |

**Table 83: Duct and Manhole Access Costs using WACC of 8.08%**

| | 2018 | 2019 | 2020 |
|---|---|---|---|
| Duct access of 25% of duct per km (RM/month) | 18 | 19 | 20 |
| Manhole access of 25% of manhole 850mm x 850mm x 650mm (RM/month) | 12 | 13 | 13 |
| Manhole access of 25% of manhole 3740mm x 1640mm x 2000mm (RM/month) | 23 | 24 | 25 |

The MCMC proposes to regulate the prices for Duct and Manhole Access based on Table 81 above.

**Question 19:**

Do you have any comments on the proposed prices for the fixed services in the Access List?

# PART E: MOBILE SERVICES

## 18. Mobile Services

### 18.1. Services

There are three mobile services in the Access List:

(a) Mobile Network Origination Service;
(b) Mobile Network Termination Service; and
(c) MVNO Access.

The proposed regulatory approach for MVNO Access was discussed in Section 8 of this PI Paper.

The mobile model is based on a Total Service LRIC methodology and so it includes a full range of retail and wholesale services offered by the mobile operators. The individual service costs and prices include voice origination and termination, SMS and MMS origination and termination, video origination and termination, as well as mobile data.

In the current state of the market, the most critical price is for the Mobile voice termination service. This price (Mobile Termination Rate or "MTR") is the amount a mobile network operator can charge another mobile network operator or a fixed network operator to terminate a voice call on its mobile network. Each mobile network operator has a monopoly on terminating calls to customers on its own network.

Due to the high level of termination traffic, small changes in the value of the MTR can have a large effect on the income and expenses of a mobile network operator. The MCMC has therefore developed a detailed model of mobile network operations based on extensive data from operators.

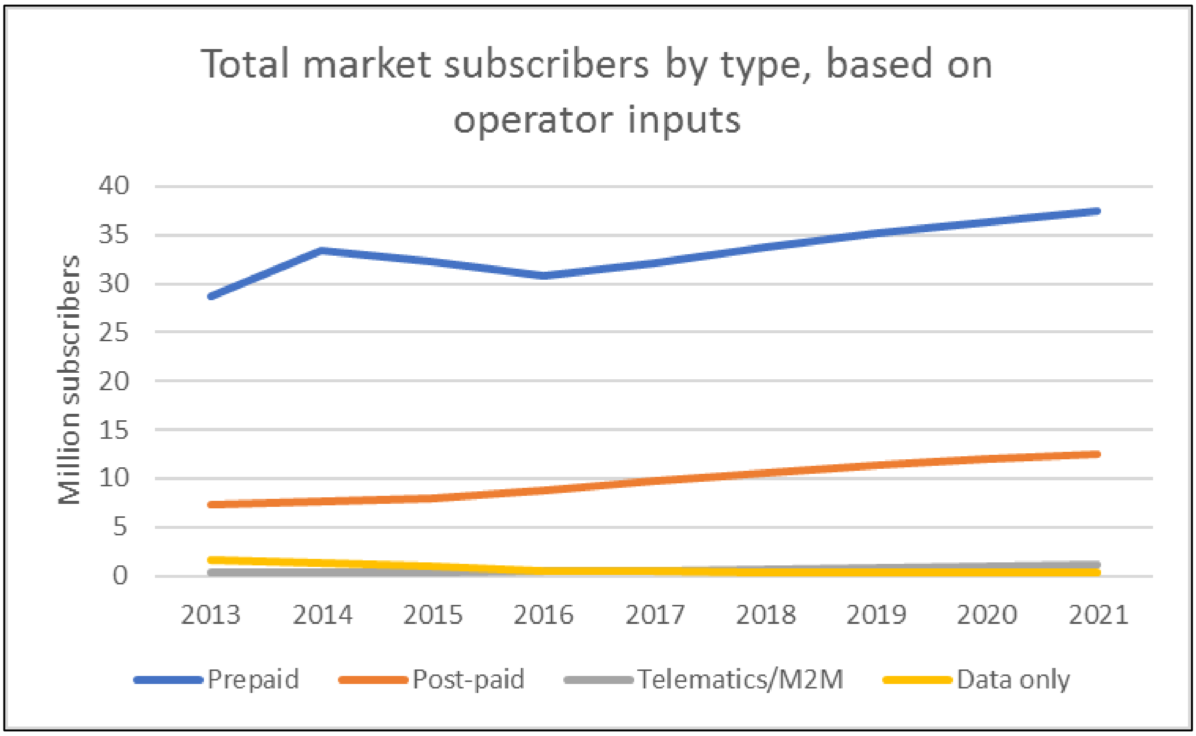
### 18.2. Service demands and traffic

The Mobile model uses the number of active subscribers (customers) as the basic demand unit. Due to the high number of pre-paid subscribers in the mobile market, this number may be substantially less than the total number of SIMs in circulation, because subscribers often retain pre-paid SIMs after they have stopped using them. According to the MCMC Pocket Book of Statistics, the mobile penetration rate is 134% in the first quarter of 2017 and the number of active subscriptions is approximately 42.8 million, of which 9.4 million are post-paid [11].

Four mobile network operators – Celcom, DiGi, Maxis and U Mobile – provided data for the mobile cost model. The data included forecasts of active subscribers to 2021. Taken together, these forecasts provide a view of the evolution of the mobile market in Malaysia. An averaged version of this aggregate forecast for the total market was used. The model is mainly concerned with a "notional mobile operator", which has 25% market share. This represents an efficient level of demand in a market with three major operators and one smaller operator in the process of penetrating the market. In the overall market, the growth of subscribers declines in later years but still maintains a healthy growth of 4-5%.

Figure 1, below, shows that prepaid contracts are expected by the operators to remain the most popular type of service subscription. Modest growth in post-paid contracts is also expected, together with substantial annual growth in machine-to-machine (M2M) contracts that started from a very low base. Other data-only contracts (associated with dongles, tablets, laptops and similar devices) are expected to decline in numbers.

**Figure 1: Total market subscribers, based on operator inputs**




TM and Webe have pointed out that the subscribers of the four main networks do not represent the whole market, as there are smaller operators operating as MVNOs, or with their own spectrum allocations. The MCMC estimates that these smaller operators

[11] https://www.mcmc.gov.my/skmmgovmy/media/General/pdf/1Q17-facts-figures.pdf

accounted for some 3.3 million subscriptions in addition to the total reported by the four MNOs in 2016. Maxis also cited evidence from the GSMA that the "other" category accounted for 6% of the market in 2017 and this was forecasted by the GSMA to reach 7% by 2018. Although the operator in question suggested that the proportion would continue to grow beyond that, this was not borne out in the data provided by them. Nevertheless, the figure of 6-7% is broadly consistent with the data provided to the MCMC.

Equally, it does not appear that this additional segment of the market would justify a change to the proposed 25% market share of the Notional Operator to 20%, as Maxis has argued. Nevertheless, a full 25% of the market would imply a number slightly greater than 25% of total MNO subscribers. One difficulty with this is not knowing which category of subscribers should be scaled up. It has generally been the case that MVNOs concentrate on prepaid subscribers. This is because they often have a "value" proposition that appeals to the segments of the market that prefer the control offered by prepaid and also because adding post-paid billing capability significantly adds to the complexity and cost of their systems. On the other hand, niche MNOs might have a different profile and some MVNOs target segments such as businesses and M2M where post-paid contracts are the norm. Increasing the number of subscribers of the Notional Operator is assumed to have to scale to 25% of the total market rather than 25% of MNO subscribers, and this reduces the calculated cost of voice call termination by around 0.05 sen per minute.

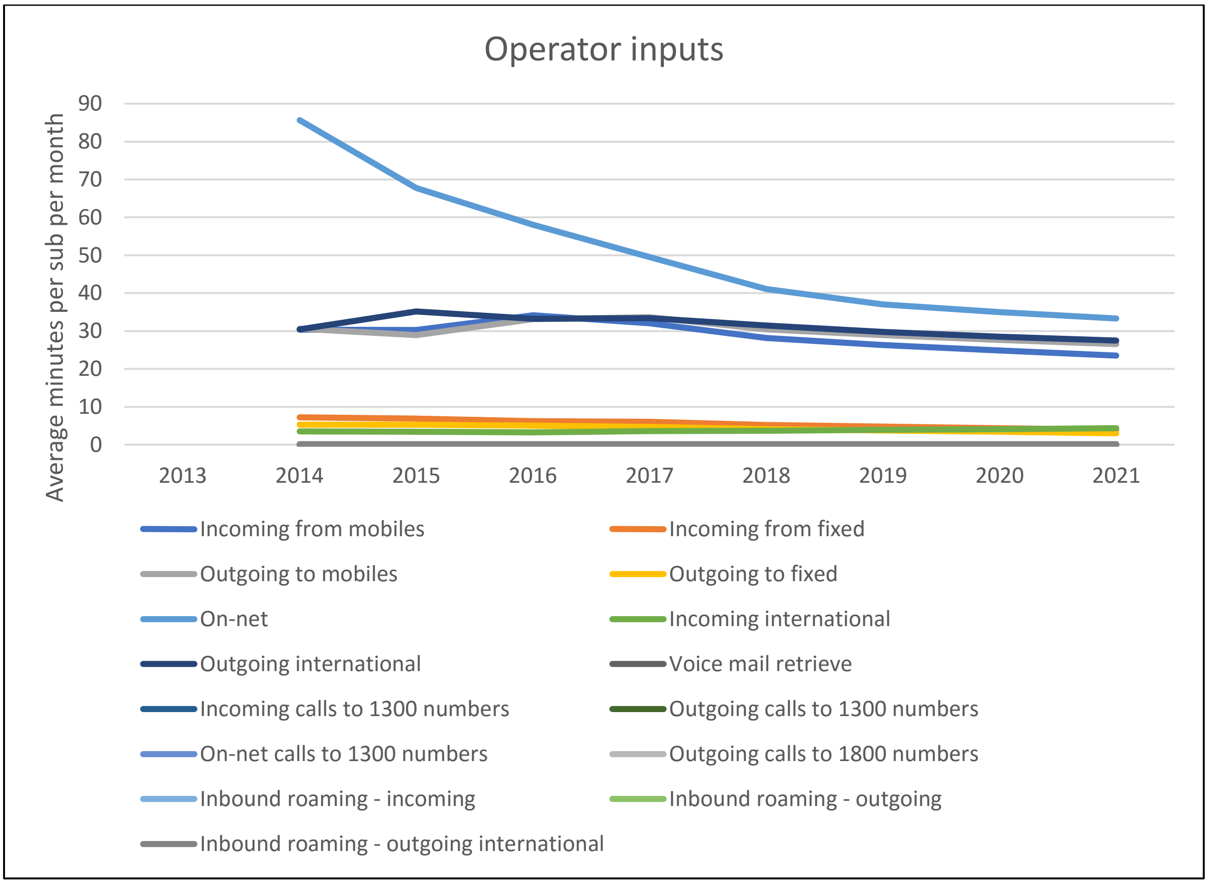
Maxis also cited that the restrictions laid down by the MCMC to limit the number of SIMs that could be registered by a single individual would mean that operators' projections of prepaid subscribers might be too high. Indeed, no effect of this is discernible in that operator's, or the others' data. However, although the MCMC agrees that this might have a one-off effect on the number of SIMs in circulation, it would not be appropriate to make adjustments for it in the absence of any data to indicate the possible size of the effect. Furthermore, it is doubtful if such a reduction in SIM numbers would have a significant effect on total traffic, as individuals would be likely to concentrate their usage on a smaller number of SIMs[12]. Since the number of SIMs in circulation does not in itself have an appreciable effect on costs, it is reasonable to ignore this change in market conditions for the purposes of calculating network service costs.

The operators also provided data on network demand – minutes of voice calls, numbers of messages for SMS and MMS, and megabytes of data for data services – generated by the mobile customers. These data were cross-checked with figures provided to the MCMC in past years and data provided by operators for traffic carried between them.

[12] Based on Hand Phone User Survey 2014, 62.3% of users use only one active SIM. Of those who use more than one SIM, 70% users have a preference towards a different operator. 31.1% use 2 active SIMs, 5.1%$ use 3 active SIMS, 0.8% use 4 active SIMS, 0.5% use 5 active SIMS and 0.2% use more than 5 active SIMS.

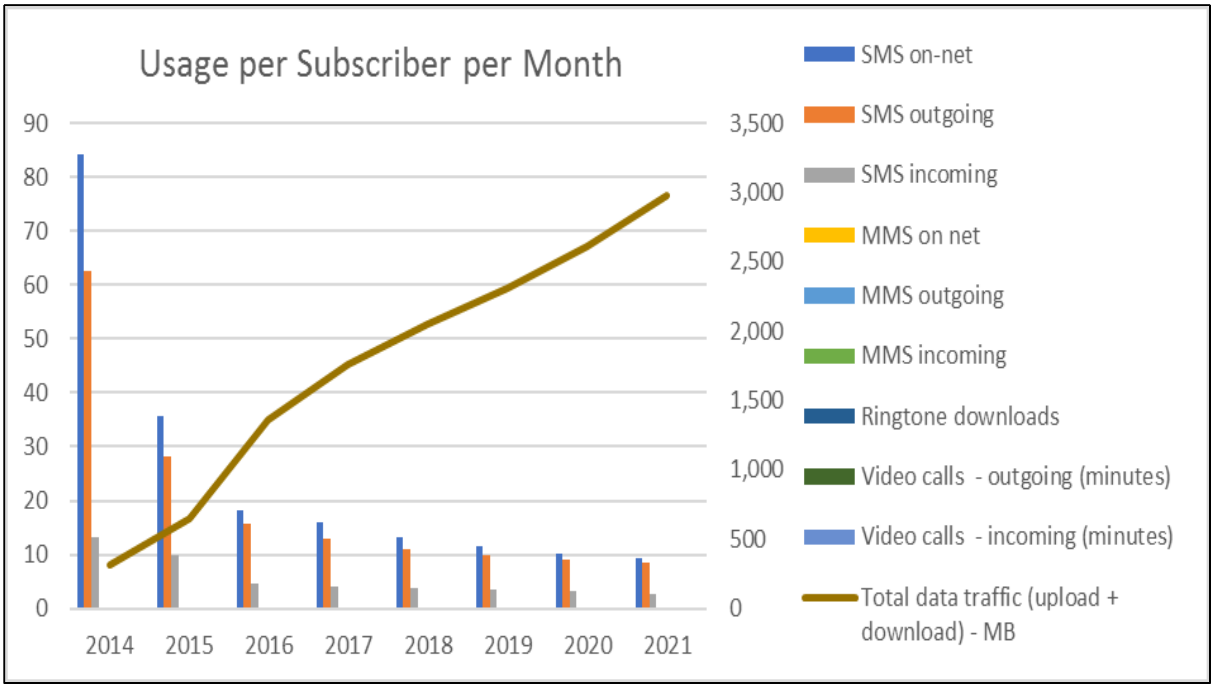
The model uses averaged calling rates per subscriber for a view of the demands likely to be faced by the Notional Operator. Voice traffic overall continues to decline but at rates of only 1-2% *per annum* in later years, compared to 4-7% in the early years. The decline in overall voice traffic is moderated by the growth in subscribers discussed above. Usage per subscriber is generally anticipated to decline (see Figure 2, below). Data traffic, however, exhibits strong growth with rates above 15% *per annum* in all years.

**Figure 2: Average minutes per subscriber, per month, based on operator inputs**




For the Notional Operator, the MCMC has calculated the average usage per subscriber for each service. These figures are inputs to the model and multiplied by the average number of subscribers in each year to derive the total service volume.

**Figure 3: Average usage of non-voice services per subscriber, per month, based on operator inputs**




The non-voice services (see Figure 3, above) have shown a contrasting pattern, with declines in the usage of SMS, MMS and video calls, but the strong growth in mobile data usage is expected to continue. The average data usage per subscriber in the data provided by the operators is 1.3GB per month, rising to 1.7GB in 2017 and 2.9GB in 2021. This rate of usage appears to vary quite widely across the operators. TM and Webe noted in their comments on the preliminary version of the model that Maxis, for example, announced in their 2016 Annual Report[13] that their subscribers were using 4GB per month, up from 1.5GB last year. It is not clear, however, that the average level of data usage across the whole market should be adjusted on this basis.

According to the data provided by the operators, mobile data usage per subscriber grew at an average of 108% per year between 2014 and 2016. They expect it to grow at an average rate of 17% per year between 2016 and 2021. The reasons for the rapid recent growth are likely to include the rapid growth of smartphones, the deployment of widespread 3G and 4G networks offering faster data rates and the capability to support data-heavy traffic such as streaming video and the increasing emphasis of popular social networking applications on video (Facebook, Whatsapp, YouTube, Facetime and popular online games, for example). Whilst these trends might be expected to continue to some extent, it has been estimated that smartphone penetration has now reached 80%[14] and 4G is now widespread in urban and suburban areas. It is therefore not unlikely that growth

[13] Please see http://maxis.listedcompany.com/misc/ar_segment/2016_amend/media/MaxisAR2016.pdf.
[14] Malaysian Digital Association / Nielsen - http://www.malaysiandigitalassociation.org.my/wp-content/uploads/2016/08/Malaysia-Digital-Landscape-August-2016.pdf

will moderate to some degree over the next few years. The effect of varying the assumptions about the rate of growth in data usage are examined in Section 18.20.

Since the network model (see next section) calculates the number of base stations needed based on the average area covered by a base station using each of the different technologies (2G, 3G and 4G), the land area of the country is divided into Dense Urban, Urban, Suburban and Rural geotypes. The MCMC has used average values for the total land area represented by each geotype and for the cell radii applicable to each.

**Question 20:**

Do you have any comments on the proposed assumptions for the Notional Operator's services and volumes?

## 18.3. Spectrum allocations and coverage

The availability of radio spectrum to each operator plays a key role in determining the costs of network rollout. Lower frequencies have better propagation characteristics, leading to lower costs for providing coverage.

The current allocations of radio spectrum to the mobile operators are shown in Table 84, below. It will be seen that the Notional Operator in the model has a spectrum allocation similar to that for the three larger operators: 10 MHz of paired spectrum in the 900 MHz band, 20 MHz of paired spectrum in the 1800 MHz band, 15 MHz of paired spectrum in the 2.1 GHz range and 10 MHz in the 2.6 GHz range. Most mobile network operators have similar spectrum allocations in the 1800 MHz band and/or higher frequencies, but one operator, Digi has only 5 MHz of paired spectrum in the 900 MHz band. The MCMC has therefore examined the effect of this restricted 900 MHz spectrum allocation on the costs of origination and termination and findings show the cost differences are minimal.

**Table 84: Current spectrum assignments for the four mobile operators, plus the Notional Operator**

| From 1 July 2017 onwards | 900 MHz | 1800 MHz | 2100 MHz[15] | 2600 MHz |
|---|---|---|---|---|
| **Permitted use:** | **2G/3G/4G** | **2G/3G/4G** | **3G** | **4G** |
| Celcom | 2x10MHz | 2x20MHz | 2x15MHz + 5MHz | 2x10MHz |
| Digi | 2x5MHz | 2x20MHz | 2x15MHz + 5MHz | 2x10MHz |
| Maxis | 2x10MHz | 2x20MHz | 2x15MHz + 5MHz | 2x10MHz |

[15] The 2.1MHz allocations are due for renewal in April 2018.

| From 1 July 2017 onwards | 900 MHz | 1800 MHz | 2100 MHz[15] | 2600 MHz |
|---|---|---|---|---|
| U Mobile | 2x5MHz | 2x15MHz | 2x15MHz + 5MHz | 2x10MHz |
| **Notional Operator** | **2x10MHz** | **2x20MHz** | **2x15MHz** | **2x10MHz** |

Maxis commented that the coverage rates assumed in the model were different from their own. However, the Notional Operator assumptions are designed to reflect a typical operator and not any particular operator. For the Notional Operator, the geographic coverage of the 2G network by 2016 is assumed to extend over all Dense Urban and 97% and 94% of Urban and Suburban areas respectively, and 40% of Rural areas. Similar levels of coverage are assumed for 3G and for 4G (LTE) in Dense Urban, Urban and Suburban areas, but with Rural coverage of 18% in 2016, rising to 40% in 2021. Although the four main operators have somewhat varying coverage, the Notional Operator assumptions reflect the coverage requirements of the majority of mobile network operators.

Maxis also highlighted that the geotype definitions used in the model, in particular the proportion of the population assumed to be living in urban areas, which is smaller in the model assumptions than Government Census figures would suggest is the case. Again, these were based on the inputs provided by operators and the reconciliation process, taking into account the cell radii reported by the operators, suggests that the number of coverage base stations resulting from the definitions provided by the operators matches the numbers they reported reasonably well. This step was not possible in the case of Maxis, because of the difference in the geotype definition used.

The cell radii referred to in the previous paragraph relate to 900 MHz equipment, based on an assumption that the Notional Operator would be likely to use this spectrum band for providing coverage, because it tends to have better propagation characteristics than 1800 MHz spectrum. Digi commented that 1800 MHz spectrum should also be applied within the model, since for historical reasons their network is largely implemented using this frequency band. It is indeed the case that 1800 MHz spectrum is applied in the model, but it is assumed to be used for adding traffic-carrying capacity to the 2G RAN, rather than for coverage. This is consistent with the generally adopted approach for cost modelling in 2G networks.

TM commented that the costs of coverage should be excluded from a LRIC model, because they are not traffic-related. However, this is only applicable with a pure LRIC methodology and not with the LRIC+ methodology.

**Question 21:**

Do you have any comments on the proposed approach to the radio spectrum and coverage assumptions?

## 18.4. Mobile network model

The coverage assumptions described in the previous section drive the calculation of the number of base stations required to provide coverage. A further set of calculations is concerned with the network quantities required to carry the estimated traffic. In Dense Urban, Urban and Suburban areas, one would expect the network size to be driven by peak traffic requirements as well as coverage. Here, the calculations begin with the number of transmit-receive antenna elements ("TRXs" in a 2G context) required to provide satisfactory service in the busy hour and work into the network determining the quantity of equipment required to support the demand. About 8% of demand is generally assumed to occur in the busy hour[16]. In line with comments from Operator E[17] on the preliminary model, the MCMC refined this to 9.3% of voice traffic in the voice busy hour and 7% of data traffic in the data busy hour to reflect more closely the pattern of traffic from subscribers in Malaysia. This increased the calculated cost of voice call termination by around 0.11 Sen per minute.

The most significant portion of the cost is associated with the radio network and hence it is important to model the cost elements in some detail. There is technology change occurring in mobile radio networks – from GSM (or 2G), through 3G to LTE. Each of these technologies uses different radio network elements and so the dimensioning of the network for each of these technologies is performed separately in the model. The transition from one technology to another is modelled through demand profiles that distribute traffic among the three technologies over the regulatory period. These profiles are based on the respective population coverage of the three technologies, their respective data rates (more data may be assumed from technologies that offer faster rates). The capacity of the 2G radio access network (RAN) is dimensioned according to voice demands, whereas that of 3G and 4G RANs are dimensioned by the aggregate of voice and data traffic demand. VoLTE is assumed to be activated on the 4G network, allowing it to carry billable voice and SMS services.

The model therefore represents a compromise between true efficiency, which might drive to the lowest cost technology immediately, and the current situation of the mobile

[16] The model calculates traffic demands in the voice and data busy hours, including the respective contributions of voice to the data busy hour and vice versa.
[17] Based on Operator E's busy days' trend, voice and data traffic have been historically peak at the same time i.e. between 10pm and 11pm. Operator E experiences significantly higher proportions of traffic in the busy hour (9.3% of voice and 7% of data) than what is suggested by current model output."

operators, which is determined largely by customer preferences and the rate at which handsets are updated.

Digi commented that the bit rates at which voice service were assumed in the model to be carried over the RAN were in general too low[18]. The MCMC has therefore reverted to the bit rates assumed in the 2012 model, as set out in the table below. This had the effect of increasing modelled voice call termination costs by around 0.28 sen per minute.

**Table 85: Voice bit rates assumed in the model**

| Network sector | Voice bit rate (kbps) |
|---|---|
| 2G RAN | 10 |
| 3G RAN | 40 |
| 4G RAN | 62 |
| Core network | 64 |

Celcom commented that the assumed value for the spectrum reuse factor in the 2G RAN calculations was over-optimistic, in the sense that it would imply a very efficient set of measures to avoid interference between one cell and another. The MCMC therefore changed this factor from 4 to 12, which it understands reflects more usual practice. This made a very small difference of around 0.01 sen per minute to the modelled voice termination cost.

The same operator also commented that MMS and video call traffic would not be carried over the 2G network, but that some of this traffic was assumed to do so in the model calculations. Although one operator did represent this situation in the data they submitted, the MCMC agrees that such services generally became available with the advent of 3G and so the model has been altered to reflect this. Celcom hypothesised that this might be driving an excessive number of 2G base stations calculated by the model to be required for capacity. However, this was not the case, as 2G RAN calculations in the model are primarily driven by voice traffic demands and redirecting MMS and video call traffic away from the 2G RAN made no measurable difference to cost, as the volumes of these services are in any case very small. The excessive number of 2G capacity base stations in the preliminary model was found to stem from a formula error that had crept in following the initial calibration of the model. Correcting this error reduced the calculated call termination cost by 0.64 sen per minute.

Celcom also commented that the model appeared to be achieving implied levels of spectral efficiency (the amount of data transmitted over the RAN per Hz of radio frequency

[18] Digi believes the model underestimate the data rate per voice channel in the air interface, in particular for 3G.

bandwidth) that were in breach of Shannon's Law[19]. They claimed that the model produced implied efficiencies of up to 5bps per Hz, as compared to a theoretical maximum of 1. The MCMC has investigated this and was only able to reproduce something like this figure if a cell (i.e. a single transmit – receive path) was taken to be a base station. In reality, however, it is usual practice to sectorise base stations, or in other words to use directional antennae that allow several (typically three) cells to be mounted on each base station. Furthermore, modern RAN technologies such as HSPA and LTE use techniques like QAM (quadrature amplitude modulation) and MIMO (multiple input, multiple output - spatially separating the antenna elements at both the base station and the mobile device, in effect creating multiple paths, each of which is limited by Shannon's Law). By using these and other techniques, LTE Advanced (LTE-A) can, under ideal conditions, achieve a system spectral efficiency as great as 30 bps per Hz. However, the model does not produce implied spectral efficiencies anything like this high, averaging 0.19, 0.53 and 0.52 for 2G, 3G and 4G in the base year.

## 18.5. Radio network costs

In addition to the costs of network elements, mobile providers have costs associated with their radio access networks. The most important of these are annual licence and spectrum fees. Maxis and Altel noted that not all of the relevant spectrum costs had been included in the model. This has now been corrected.

On the other hand, TM and Webe argued that spectrum costs should not be included in the model, because they are not traffic-sensitive. This would not, in the MCMC's view be consistent with the general approach adopted for the model of using a whole-network increment, since spectrum costs are clearly a part of the total costs of operating the network.

**Table 86: Spectrum costs used in the model**

| | **900MHz (2G/3G/4G)** | **1800MHz (2G/3G/4G)** | **2100MHz (3G)** | **2600MHz (4G)** | **Microwave** | **Total** |
|---|---|---|---|---|---|---|
| **Total charge over 15 years** | 999.44 | 871.08 | | | | **1,870.52** |
| **Up-front (%)** | 43.7% | 43.7% | | | | |
| **Up-front (RM million)** | 436.40 | 380.35 | 50.00 | 180.00 | | **1,046.75** |
| **Annual** | 37.54 | 32.72 | 45.62 | 9.14 | 15.75 | **140.76** |

[19] Please see https://en.wikipedia.org/wiki/Shannon%E2%80%93Hartley_theorem.

The spectrum costs adopted for use in the model are shown in the table above. The figures for 900MHz and 1800MHz are based on the recent spectrum allocation round. The others are based on averages for the operators in 2016.

## 18.6. Other cost inputs

Several operators provided comments on the cost inputs to the model. In some cases, this was to reiterate the figures that had already been submitted. For example, Maxis commented that the asset lives assumed in the model were too short and Maxis and Celcom commented on this basis that the asset prices were too low. In general, the input costs used were derived by taking an average of the inputs provided by the operators, though in some cases inputs were excluded from the average, for example because it was clear that the cost provided covered a range of network elements that are considered separately in the model. For example, 3G Node B base stations are bundled by suppliers with the RNC.

TM commented that the capacity assumptions should be similarly based on those of Malaysian operators, in view of the fact that a number of these inputs were marked in the model as being consultant inputs. In fact, the input capacity values were equally based on operator inputs, but marked as consultant inputs where it was necessary to adjust the figure to match up with the unit cost inputs.

TM also commented that the passive base station costs included in the model, when aggregated together is higher than TM’s own capital costs for such passive infrastructure. It is open to TM and others to provide further evidence in response to this Public Inquiry if they believe that the costs included in the model are unrepresentative.

TM also commented that the model does not include rental received for the use of base station sites and that the model therefore risks double-counting these costs. It is not, in the MCMC’s view, appropriate to include service revenues in a cost model. However, the relevant costs per base station are adjusted in the model to take account of base station sharing.

TM identified an input error in the price trend for the capital cost of an interconnection billing system. This has been corrected.

## 18.7. USP

The mobile operators have also received USP compensations in recent years. These compensations cover elements of the mobile operators’ capital expenditures. Maxis pointed out that a USP levy of 6% is paid on MTRs. This is not included in the calculations, as it is not a network cost, but something akin to a tax levied on termination revenues. USP levies on retail services are excluded for the same reason.

## 18.8. Cost mark-ups

The model includes a mark-up on network element costs to account for fixed and common costs. In keeping with the principle of cost reconciliation, this mark-up is calculated by comparing the direct network costs calculated bottom-up with the total network costs determined top-down. For the Notional Operator, the top-down costs are averaged as a percentage from the cost data provided by the mobile operators.

**Table 87: Common cost mark-up calculation**

| | Operator C | Operator D | Operator E | Operator F | Average |
|---|---|---|---|---|---|
| **Network** | 35% | 36% | 39% | 33% | 36% |
| **Retail** | 52% | 37% | 34% | 58% | 45% |
| **Other** | 14% | 26% | 27% | 9% | 19% |
| **Network share of other costs** | 5% | 13% | 14% | 3% | 9% |
| **EPMU mark-up** | 16% | 36% | 36% | 10% | 25% |

The cost percentages derived from the top-down data provided by the operators is shown in the table above. The fixed and common costs are represented by the other category, which is shared proportionately between retail and network.[20]

**Question 22:**

Do you have any comments on the design assumptions for the mobile model?

## 18.9. Access List service costs

The model produces estimate of the cost of a range of services, including, but not limited to those in the Access List. The inclusion of services not currently in the Access List does not imply any intention on the MCMC's part to add them to the Access List. Rather, it is necessary to account for all the traffic carried by the Notional Operator and so the range of services is necessarily broad. The costs calculated by the model are set out in the table below. These costs are based on the base case assumptions, including a WACC of 12.32%. The figures are given for both ED and tilted annuities, in view of the initial proposal to use ED and the view expressed by Celcom, for example, that ED is the correct approach. They

[20] The figure 9% was incorrectly used in the preliminary model. This has now been changed.

are overall averages, including the use of the submarine link between East and West Malaysia in the small proportion of cases.

**Table 88: Service costs calculated using ED**

| Service | Unit | 2018 | 2019 | 2020 |
|---|---|---|---|---|
| **Voice origination** | sen per Minute | 1.56 | 1.46 | 1.49 |
| **Voice origination (with submarine cable)** | sen per Minute | 23.37 | 23.41 | 23.61 |
| **Voice termination** | sen per Minute | 1.57 | 1.47 | 1.50 |
| **Voice termination (with submarine cable)** | sen per Minute | 23.37 | 23.41 | 23.61 |
| **SMS** | sen per Message | 0.04 | 0.04 | 0.04 |
| **MMS** | RM per Message | 1.03 | 1.03 | 1.02 |
| **Data** | sen per MB | 6.84 | 5.96 | 5.34 |

**Table 89: Service costs calculated using tilted annuities**

| Service | Unit | 2018 | 2019 | 2020 |
|---|---|---|---|---|
| **Voice origination** | sen per Minute | 1.95 | 1.73 | 1.57 |
| **Voice origination (with submarine cable)** | sen per Minute | 24.09 | 24.26 | 24.19 |
| **Voice termination** | sen per Minute | 1.97 | 1.74 | 1.59 |
| **Voice termination (with submarine cable)** | sen per Minute | 24.09 | 24.26 | 24.19 |
| **SMS** | sen per Message | 0.05 | 0.05 | 0.05 |
| **MMS** | RM per Message | 1.63 | 1.49 | 1.38 |
| **Data** | sen per MB | 5.06 | 5.03 | 4.99 |

These numbers provide the "base case" for the consideration of regulated mobile prices. Following the initial informal consultation and subsequent experience with modelling the other sectors, it was decided to use tilted annuities as the means of annualising capital costs over time.

Although voice traffic is expected by the operators to decline over the next few years, continued growth in demand for data services will tend to lead to more intensive utilisation of relatively fixed assets. While demand is increasing, there are still significant investments to be made for 4G expansion over the regulatory period, but these are off-set by better utilisation of the network as a whole, leading to lower unit costs.

**Question 23:**

Do you have any comments on the service costs calculated by the mobile model?

## 18.10. Inclusion of 2G, 3G and 4G in the model

The major mobile operators in Malaysia, however, are still in the transition from 2G to 3G and 4G services and there is a significant legacy of 2G and 3G handsets among end users. TM and Webe commented in relation to the preliminary model that 2G should be excluded from the model, as it is not a modern technology. A notional new entrant operator would therefore be expected to build a network using some combination of 3G and 4G technologies. However, in view of the legacy base of 2G handsets, the planned switch-off date for 2G yet to be decided in Malaysia and also the general principle of allowing for a reasonable transition period for newer generations of technology, the MCMC proposes to reflect in the model a transition to newer generations of technology over time.

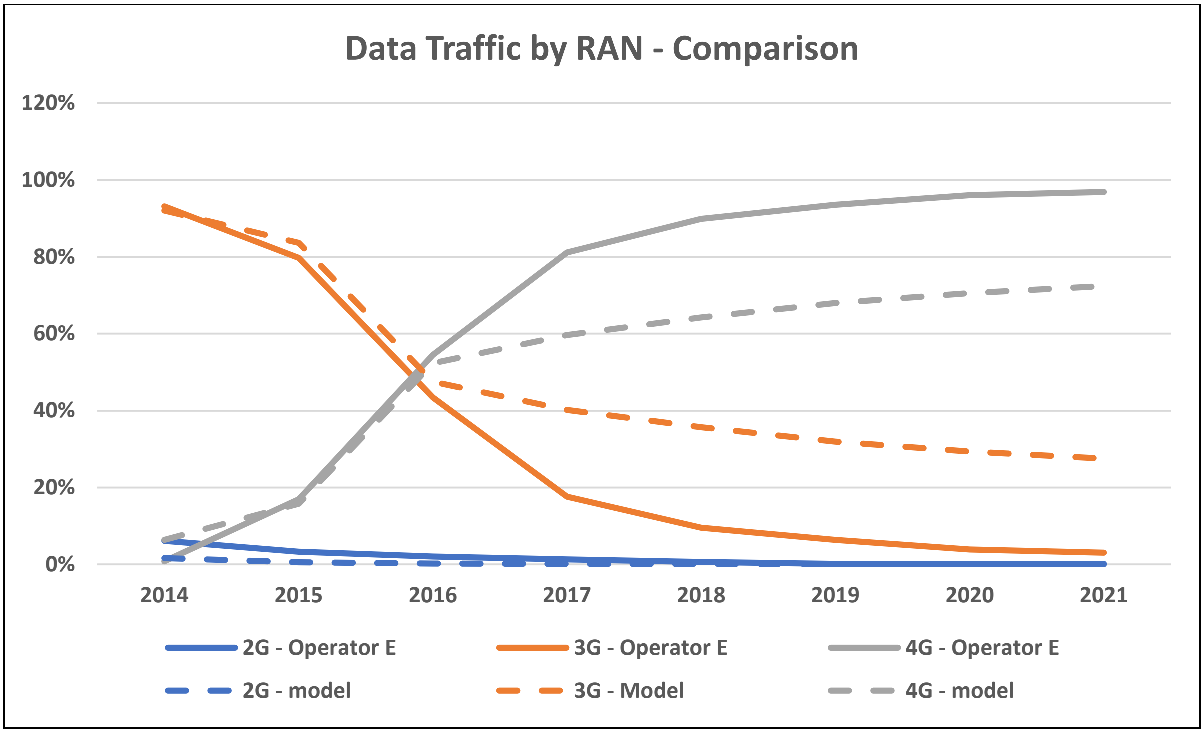
Altel commented that 5G should be included. However, it is not feasible to do this in MCMC's view, because there is not yet sufficient information about how such networks will be deployed in Malaysia or elsewhere, or what their costs will be. Hence, the prices for this study only covers a period of 3 years i.e. from 2018-2020.

In the Notional Operator model, 2G voice traffic is estimated to be 33% in 2016, declining to about 19% by 2016. By contrast, only 10% of data traffic is assumed to be carried over 2G in 2016, declining to around 2% by 2021.

Operator E commented that the model's use of coverage (and data rate, in the case of data traffic) is not a true reflection of technology split in our network as it is largely dependent on customers' device usage and traffic consumption. The effect is that the model assumes a very different distribution of traffic between technologies (both voice and data) than what is the case in its actual network, and they strongly suspect, in the networks of the other mobile operators too.

The operator provided some numbers with their comments and also in response to the data request to show the proportions of different types of traffic carried by the respective RANs. In effect, these suggest that the transition of both voice and data traffic to 4G will be more rapid in the years following 2016 than the factors taken into account in the model would lead one to expect (see Figure 4, below). This might reflect a preference on the part of multi-RAN devices for connecting to the fastest available service for mobile data, but the inclusion of the factor for relative network data rate in the model was intended to capture this kind of effect. It is less easy to understand why such a preference would apply in the case of voice traffic, however.

**Figure 4: Proportion of mobile data traffic carried by 2G, 3G and 4G RANs, comparing Operator E's estimates with those of the model**




The comparison of projections for voice traffic is shown in Figure 5, below. It may be seen that a very similar divergence occurs between the model's projections post 2016 based on coverage and those of Operator E. Prior to 2016, however, Operator E's figures map less closely to the model's projections, than is the case for mobile data. This may be that voice calling over 4G is limited by the availability of VoLTE capability in mobile devices and in the network. The initial version of the model contained the assumption that voice capability was available for 100% of 4G coverage in each year. If this is modified so that there is no 4G voice capability before 2016, 10% in 2016 and 70% thereafter, the model tracks Operator E's numbers reasonably up until 2017 (see Figure 6, below).

**Figure 5: Proportion of mobile voice traffic carried by 2G, 3G and 4G RANs, comparing Operator E's estimates with those of the model**

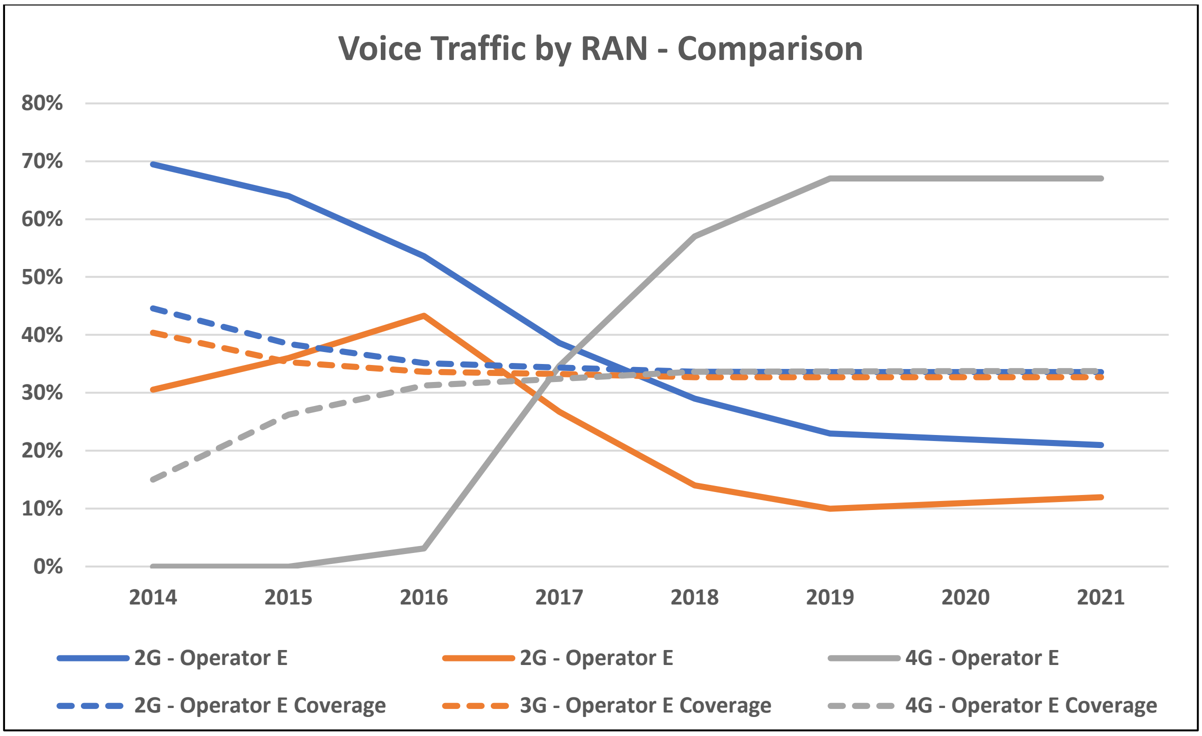
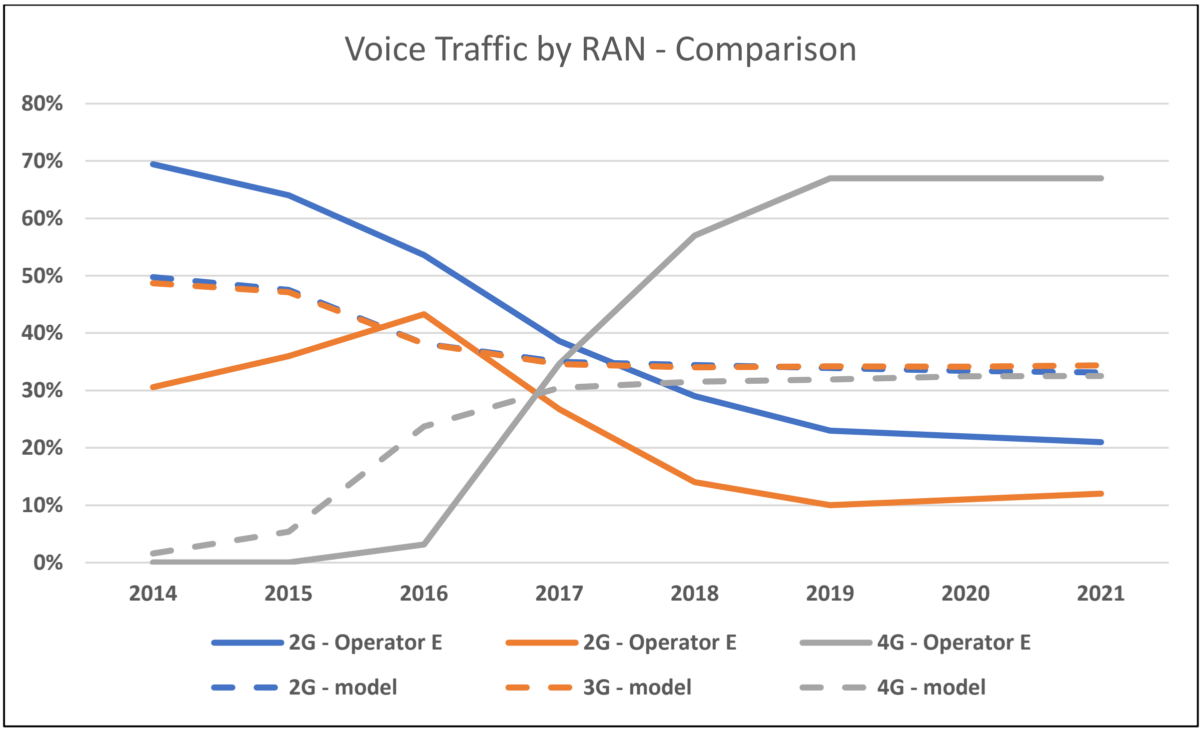



**Figure 6: Proportion of mobile voice traffic carried by 2G, 3G and 4G RANs, comparing Operator E's estimates with those of the model – with modified roll-out of VoLTE**



Nevertheless, it remains unclear why Operator E's figures show a greater proportion of voice calls being carried over 2G than coverage considerations would lead one to expect, unless some policy intervention by the operator has led to preferential routing of voice traffic over 2G where both types of coverage are available.

On balance, since none of the other operators were able to provide traffic split in this way and unless further light can be shone on this matter by the operators, the MCMC is minded to retain the current assumptions and methodology for dividing traffic across the three RANs.

Whilst operators and regulators in some other countries in the region have announced projected dates for 2G switch-off, this has not yet occurred in Malaysia. This suggests that there will be a continuing substantial legacy of 2G technology for the current regulatory period. The MCMC is therefore minded to take into account the continuing transition from 2G and to reflect this transition during the regulatory period in the costing of mobile origination and termination.

## 18.11. Local and National Rates

The regulated prices for Mobile Network Origination Service and Mobile Network Termination Service differentiate between Local and National rates. The MCMC understands that this relates to a historical pricing structure and to geographically-specific numbering blocks as the means of identifying which rate to charge. Such a structure is unusual for the mobile sector, for the obvious reason that mobile subscribers can travel with their device and so the end point in the network (base station) serving them can only be determined at the time of the call being connected. Furthermore, mobile networks are evolving towards a flat structure, with a set of core fibre rings and calls routed by servers operating in response to shared demands, rather than on a geographical basis. Against such a background, it is increasingly difficult to distinguish the costs of terminating calls to nearby, versus distant called parties. Furthermore, it is also understood that the operators, as far as possible, have a policy of far-end handover (delivering the call in a locality and through a point of interconnection that will attract the lower rate). This is potentially inefficient, in that it will tend to proliferate points of interconnection beyond the most economically efficient number.

Although some operators were able to provide the MCMC with routing factors that indicated slightly lower resource use for Local rate calls, others were not able to do so. In other words, for some operators at least, the local and national distinction has no counterpart in network terms and so no real basis for a cost distinction. For others, it was difficult to discern a consistent pattern.

At the same time, the existence of the distinction in regulatory prices appears to be driving network investment in far-end handover to take advantage of what amounts to a regulatory arbitrage opportunity.

In conclusion, the MCMC has formed the view that the Local and National differentiation has outlived its usefulness.

## 18.12. Submarine cable

There is some uncertainty in the modelled cost of the less than 1% of calls using the submarine cable as part of the interconnection service, resulting from widely varying cost inputs from the operators. As things stand, the model is showing an increase in this element of cost on a unit basis, to 24.1 sen per minute, for voice origination and termination with submarine cable, as compared to the last regulated rates of 15.76 and 15.73 sen per minute for Call Origination and Call Termination services, respectively. Whilst this might result from a decline in volumes not matched by a corresponding reduction in capacity, the MCMC is not convinced that this is the case. Indeed, a new domestic submarine cable that has already been completed would be expected to increase capacity substantially, whilst reducing unit costs.

The MCMC has considered setting averaged rates, including submarine cable costs in a national averaged rate, but this might have the effect of distorting investment incentives by removing the pricing signals driving build/buy decisions on the part of operators when they decide where to hand over traffic. It is proposed, therefore, to retain the current rates for Mobile Call Origination with submarine cable and Mobile Call Termination with submarine cable.

**Question 24:**

Do you have any comments on the 3G/4G only operator, local/national call rates and submarine cable issues?

## 18.13. Sensitivity analysis

This section provides some additional results from the model to demonstrate how the final calculated prices change with modifications to key parameters.

## 18.14. WACC value

The WACC value is a key parameter in that it determines the return on capital required for a suitable return to investors. The following tables show the effect on mobile interconnection rates for the standard Notional Operator inputs of a range of WACC values above and below the proposed value. For purposes of illustration, the cost in 2020 calculated by the model using tilted annuities is shown. The voice call costs are averaged between origination and termination.

**Table 90: The effect of a range of WACC values on voice, SMS and MMS costs in 2020**

| | WACC | | | | |
|---|---|---|---|---|---|
| | **9.57%** | **10.01%** | **12.32%** | **13.85%** | **15.05%** |
| **Mobile call origination/termination** (Sen/min) | 1.520 | 1.529 | **1.579** | 1.613 | 1.640 |
| **SMS** (Sen/message) | 0.046 | 0.046 | **0.048** | 0.048 | 0.049 |
| **MMS** (RM/message) | 1.329 | 1.337 | **1.380** | 1.409 | 1.432 |

## 18.15. Annualisation Method

**Table 91: Effect of different annualisation methods on the calculated voice, SMS and MMS cost in 2020 across a range of WACC values**

| | WACC | | | | |
|---|---|---|---|---|---|
| | **9.57%** | **10.01%** | **12.32%** | **13.85%** | **15.05%** |
| **Call Origination/Termination** (Sen/min) | | | | | |
| ED | 1.434 | 1.444 | 1.498 | 1.534 | 1.563 |
| Tilted annuities | 1.520 | 1.529 | **1.579** | 1.613 | 1.640 |
| **SMS** (Sen/message) | | | | | |
| ED | 0.042 | 0.042 | 0.043 | 0.043 | 0.044 |
| Tilted annuities | 0.046 | 0.046 | **0.048** | 0.048 | 0.049 |
| **MMS** (RM/message) | | | | | |
| ED | 0.984 | 0.989 | 1.020 | 1.041 | 1.057 |
| Tilted annuities | 1.329 | 1.337 | **1.380** | 1.409 | 1.432 |

## 18.16. USP expenditure

It is appropriate to consider whether to exclude expenditure on USP projects: that is, reduce capital expenditure in the model in the early years to reflect the USP receipts from the MCMC. This would have a very small effect on the overall costs, as USP receipts by mobile operators (some RM 46 million in 2016) in aggregate represent less than 1% of annual CAPEX in the model. The MCMC has therefore not included a sensitivity calculation for this.

## 18.17. Subscribers

The operators' projections for the next five years offer a range of different expectations about the development of the market. In the case of subscriber numbers, these range from a modest 1% per annum to 14% per annum. The effects of this are shown in the table below, with voice call, SMS and MMS costs in 2020 shown in the cells.

**Table 92: Effects of different assumptions about subscriber numbers on voice, SMS and MMS costs in 2020 (WACC = 12.32%, tilted annuities)**

| | | Voice | SMS | MMS |
|---|---|---|---|---|
| Base case | | 1.58 | 0.05 | 1.38 |
| Slower subscriber growth | 1% | 1.64 | 0.05 | 1.46 |
| Faster subscriber growth | 14% | 1.48 | 0.04 | 1.26 |

The results show that, as might be expected, higher subscriber numbers lead to lower termination costs, because the assets in the network are better utilised over time. This greater utilisation most likely stems from the additional network traffic generated by the additional subscribers. For voice calls, the most optimistic scenario (fastest subscriber growth) leads to a decrease in cost of 0.10 sen per minute, whilst the most pessimistic leads to an increase of 0.06 sen per minute.

## 18.18. Voice calls

The operators' projections for the next five years offer a range of different expectations about the development of the market. In the case of calling rates per subscriber, these range from a modest 2% per annum increase to a fairly precipitous reduction of -23% per annum, with an average projection of -0.4% per annum growth.

**Table 93: Effects of different rates of change in calling rates on voice, SMS and MMS costs in 2020 (WACC = 12.32%, tilted annuities)**

| | Growth rate | Voice | SMS | MMS |
|---|---|---|---|---|
| Base case | -0.4% | 1.58 | 0.05 | 1.38 |
| Slower calls growth | -23% | 1.34 | 0.05 | 1.38 |
| Faster calls growth | +2% | 1.93 | 0.05 | 1.54 |

In this case, the more pessimistic projection led to a 0.24 sen per minute decrease in costs, whilst the most optimistic projection also led to an increase in costs of 0.35 sen per minute. The higher rate of growth in calling results in higher levels of equipment deployment in the model and this outstrips the increase in volumes over the range examined in the sensitivities, resulting in higher measured unit costs in the model.

## 18.19. SMS

The operators' expectations about SMS usage rates per subscriber range from a steady +0.5% per annum reduction to a brisker reduction of -19% per annum, with an average projection of -11.8% per annum growth.

None of the permutations of these rates of change in SMS usage had an appreciable effect on voice call, or MMS cost in 2020, however.

**Table 94: Effects of varying growth rates in SMS usage on voice, SMS and MMS costs in 2020 (WACC = 12.32%, tilted annuities)**

| | Growth rate | Voice | SMS | MMS |
|---|---|---|---|---|
| Base case | -11.8% | 1.58 | 0.05 | 1.38 |
| Slower SMS growth | -19% | 1.58 | 0.05 | 1.38 |
| Faster SMS growth | +0.5% | 1.58 | 0.05 | 1.38 |

## 18.20. Mobile data

The operators' expectations about mobile data usage rates per subscriber, by contrast range from 1.3% per annum growth to a brisker increase of 33.7% per annum, with an average projection of 17% per annum growth. In the high growth case, average data usage reaches 5.7GB per subscriber in 2020. The results are shown in the table below.

**Table 95: Effects of varying growth rates in mobile data usage on voice, SMS and MMS in 2020 (WACC = 12.32%, tilted annuities)**

| | Growth rate | Voice | SMS | MMS |
|---|---|---|---|---|
| Base case | +17% | 1.58 | 0.05 | 1.38 |
| Slower data growth | +1.3% | 2.39 | 0.06 | 1.95 |
| Faster data growth | +33.7% | 1.17 | 0.04 | 1.09 |

It can be seen from the table that faster growth in mobile data usage has quite a marked effect on calculated termination costs, as well as those of MMS and SMS. For voice calls, the most pessimistic assumption, in which there is very little further growth leads to an increase in calculated cost of 0.81 sen per minute over the base case, whilst the most optimistic, in which growth continues at a fairly rapid pace, leads to a reduction in cost of 0.41 sen per minute. There are significant effects on calculated costs for SMS and MMS services also. In general, greater volumes of data usage reduce overall average costs, as it tends to result in better utilisation of assets such as base station infrastructure and core sites.

In their comments on the preliminary model, some operators commented that the existing rates were in line with international norms, or lower and that the rates suggested by the model were unduly low. Celcom compared them with current termination rates in Europe and found that they were low even on that comparison. However, it will be seen that consumption of mobile data is a major factor that has changed in the intervening period between this and the previous access pricing review, together with investment by the operators in infrastructure that supports that service (3G and 4G networks, in particular). This has led to a situation where voice traffic on Malaysian mobile networks accounts for only a small percentage of the total. Furthermore, data published by Ofcom last year[21] showed that the current consumption of mobile data by Malaysians was ahead of major countries in Europe, such as the UK, France and Germany at that time.

**Table 96: Mobile data usage by country 2015/2016**

| Country | Average mobile data usage per subscriber, per month (GB) |
|---|---|
| **Malaysia** | **1.3**[22] |
| UK | 1.2 |
| Italy | 1.1 |
| France | 0.8 |
| Spain | 0.7 |
| Germany | 0.6 |
| Netherlands | 0.6 |

Finally, a somewhat more extreme sensitivity was run, in which mobile data usage was held at the 2014 level of 312 MB per subscriber per month. In this case, the calculated termination cost was just over 5 sen per minute. This is, of course, higher than the existing rate, which was based on quite modest data usage, but this may perhaps be accounted for by the additional investment in 4G coverage assumed in the current model.

**Question 25:**

Do you have any comments on the sensitivity analysis?

[21] Please see https://www.ofcom.org.uk/__data/assets/pdf_file/0026/95660/ICMR-2016-3.pdf.
[22] The figure for Malaysia is for 2016, the others are for 2015.

## 18.21. Proposed regulated prices

The considerations of the previous sections suggest that regulated prices for mobile origination and termination should be set using the inputs for an operator with 25% market share. Prices at this level provide the right incentives for market competition, investment in new technologies and service innovation to greater usage of new technologies.

While the MCMC has powers to set regulated prices for messaging and video services, there is no clear need to do so. For SMS and MMS messaging services, the operators enter into agreements that may assume symmetry of traffic and involve no settlements; or may charge for interconnection at a low rate per message. Video services are developing in a number of ways but most video on mobiles is today to and from internet sites, rather than between users. There is likely to be significant service innovation in video and messaging services over the next few years, driven by new handset capabilities and new service concepts. Setting regulated prices for messaging and video services for the period to 2020 therefore risks creating regulatory distortions in the evolving market.

The MCMC proposes to set regulated prices only for voice interconnection for Mobile Network Origination and Mobile Network Termination Services. The proposed prices are based on those calculated for the Notional Operator inputs to the Mobile model. It is necessary, however, to avoid abrupt changes that may prove disruptive to the industry. The MCMC has therefore used a glide path from the last regulated rates to the calculated LRIC rates in 2020. For the submarine cable option, the prices are based on the last regulated rates.

The proposed regulated prices are shown in the following tables.

**Table 97: Mobile Network Origination Service Proposed Prices**

<table>
<tr><th>Voice call origination</th><th>Units</th><th>2018</th><th>2019</th><th>2020</th></tr>
<tr><td>Local</td><td>Sen/min</td><td rowspan="2">3.13</td><td rowspan="2">2.33</td><td rowspan="2">1.58</td></tr>
<tr><td>National</td><td>Sen/min</td></tr>
<tr><td>National with Submarine Cable</td><td>Sen/min</td><td>15.70</td><td>15.70</td><td>15.70</td></tr>
</table>

**Table 98: Mobile Network Termination Proposed Prices**

<table>
<tr><th>Voice call termination</th><th>Units</th><th>2018</th><th>2019</th><th>2020</th></tr>
<tr><td>Local</td><td>Sen/min</td><td rowspan="2">3.03</td><td rowspan="2">2.33</td><td rowspan="2">1.58</td></tr>
<tr><td>National</td><td>Sen/min</td></tr>
<tr><td>National with Submarine Cable</td><td>Sen/min</td><td>15.70</td><td>15.70</td><td>15.70</td></tr>
</table>

It will be seen that, as well as merging Local and National rates, the respective rates for Mobile Network Origination Service and Mobile Network Termination Service converge. The current rates are slightly higher for origination than for termination, whereas the model suggests that the costs are very close, with termination slightly more expensive. Again, the differences depend on the average routing factors provided by operators. Termination involves a query to the HLR to find the current location of the called subscriber, which would add a very small amount to the unit cost. However, the pattern of routing factors provided by different operators was not sufficiently consistent in other respects to substantiate a continued price difference. It is therefore proposed that the rates should converge over the period of the glide path.

**Question 26:**

Do you have any comments on the proposed regulated prices?

# PART F: INFRASTRUCTURE SHARING

## 19. Mobile Infrastructure Sharing Service (Towers)

### 19.1. Background and Purpose

Infrastructure Sharing in the Access List comprise of:

(a) Provision of space at specific network facilities to enable access seekers to install and maintain its own equipment; and
(b) Provision of access to in-building common antenna systems and physical access to the central equipment room.

To date, this service has not been subject to price regulation, with operators free to agree prices by negotiation. However, as this is a regulated service in the Access List, the MCMC has a duty to ensure that the price terms and conditions are reasonable.

In the previous dominance study that was conducted, MCMC have declared the following licensees' dominant in their respective state tower markets due to a combination of market share and restrictions on the construction of new towers:

(a) Infra Quest Sdn Bhd in Kelantan;
(b) Melaka ICT Holdings Sdn Bhd in Melaka;
(c) Rangkaian Minang Sdn Bhd in Negeri Sembilan; and
(d) Sacofa in Sarawak.

It is appropriate, therefore, for the MCMC to consider whether some form of ex ante price regulation might be needed to avoid the possibility that these operators at least and, potentially, others within the sector might exercise their market power to the detriment of consumers.

The Towers model is used to calculate costs for Mobile Infrastructure Sharing which includes access to towers and associated tower sites. This service is provided by a mixture of nationwide operators and those whose footprint covers a single State, or a small number of States. It is provided using a variety of structures of different designs and heights.

MCMC has analysed the 2016 capital and operational cost data provided by thirteen tower providers. Ten of the thirteen state backed companies (SBCs) provided data, namely Desabina Industries Sdn Bhd (Terengganu), Infra Quest Sdn Bhd (Kelantan), Perlis Comm Sdn Bhd (Perlis), Yiked Bina Sdn Bhd (Kedah), PDC Telecommunication Services Sdn Bhd (Penang), Perak Integrated Networks Services Sdn Bhd (Perak), Konsortium Jaringan

Selangor Sdn Bhd (Selangor), D'Harmoni Telco Infra Sdn Bhd (Johore), Sacofa Sdn Bhd (Sarawak) and Common Tower Technologies Sdn Bhd (Sabah). The other 3 tower companies that provided data are Stealth Solutions Sdn Bhd, Asiaspace Sdn Bhd and edotco Malaysia Sdn Bhd, some of which have coverage beyond a single state or nationwide.

The business model of the tower companies is primarily to build facilities (towers and poles) and lease space for antennas on them. The model calculates cost per site of the different type of towers by height as the basic unit. This is then shared amongst several mobile operators. For example, for a standard allocation covering an average of 3 sharing mobile operators, the tower company then divides the cost 3 times of the calculated price. The model does not account for mark up in leasing with additional sharing parties nor tenure of the lease with longer duration that offers higher discounts. These are left to commercial negotiation.

The purpose of the model is therefore to provide the MCMC with some insight into the efficient costs of providing such a service. It is therefore also necessary to consider what form of regulatory controls should be taken, including, but not limited to, the structure and level of prices that should be allowed.

## 19.2. Modelling approach

The MCMC proposes a simple, bottom-up model, using tilted annuities as the annualisation method and with assets valued at current cost. The prices paid by operators for assets are likely to change over time and, since the inputs are mainly a mix of property and civil engineering items, it seems likely that the cost trend will be upwards. Nevertheless, developments such as the experimental use of new materials (carbon fibre, bamboo[23]) suggest that there is room for further innovation in the sector. This and uniquely large number of participants in the sector in Malaysia suggests that structural change is not unlikely, potentially including new entrants with more efficient technological solutions. In view of this, a costing approach using assets valued on a current cost basis and tilted annuities seems appropriate.

## 19.3. Modelling issues

### 19.3.1. Modelling precedents

A key issue for modelling this service is that there are limited sources of comparator data, as there are for fixed and mobile operator models. Although towers costs are generally

[23] http://edotcogroup.com/media/edotco-the-first-towerco-to-deploy-innovative-bamboo-telecom-tower/
http://compositesmanufacturingmagazine.com/2016/08/malaysian-company-builds-first-carbon-fiber-tower-asia/

included as part of the total in mobile models, the level of detail tends to be very limited. It is necessary therefore to apply general principles for cost modelling in a way that is reasonably consistent with the approach taken in the other models, but that responds to the particular characteristics of this sector.

### 19.3.2. Industry structure

The structure of the sector in Malaysia is unusual, if not unique, in having a number of localised operators, sometimes with direct ties to state government bodies, as well as nationwide networks of towers primarily composed of assets formerly belonging to mobile operators. In addition, the mobile operators themselves operate tower-sharing arrangements, often on a non-monetary exchange basis. It is difficult to decide, therefore, whether these arrangements are likely to reflect an economically efficient configuration. However, since there is little in the way of detailed cost benchmarking available from published sources with which to test this. The MCMC proposes, therefore, to model the costs of a notional tower operator on the basis of the costs provided by the operators, unless these can be shown to be clearly inefficient.

### 19.3.3. Varieties of location and structure

It may be expected that the costs of individual operators will vary according to the different practical and economic characteristics of doing business in different locations, for example Sabah and Sarawak versus Peninsular Malaysia and in localities that may vary from the remote and rural to dense urban areas. Equally, tower structures vary widely in their design and height, imposing further variability in costs. Furthermore, the mix of structure type and location type varies widely from one operator to the next and so it is difficult to make clear comparisons between one operator and the next.

In mobile network models the variation in geography is normally captured using geotypes (urban, suburban, rural, etc.), but this is intended to be a proxy measure for the area each cell is intended to cover, which is a matter for mobile network planners and is not directly a reflection of operating conditions for a tower operator. As a result, the tower operators were not able to include this distinction in the data they provided.

It is probably impractical to construct a fully differentiated cost model that captures all of the possible variations in tower structure and geography, supported by enough data points for each permutation to be sure that it reflected differences from one operator to another.

On the other hand, it is the MCMC's understanding that the pricing structures applied in the industry do not themselves make detailed distinctions about tower structure by geo-types. Instead towers are priced by: location i.e. Peninsular Malaysia and Sabah and

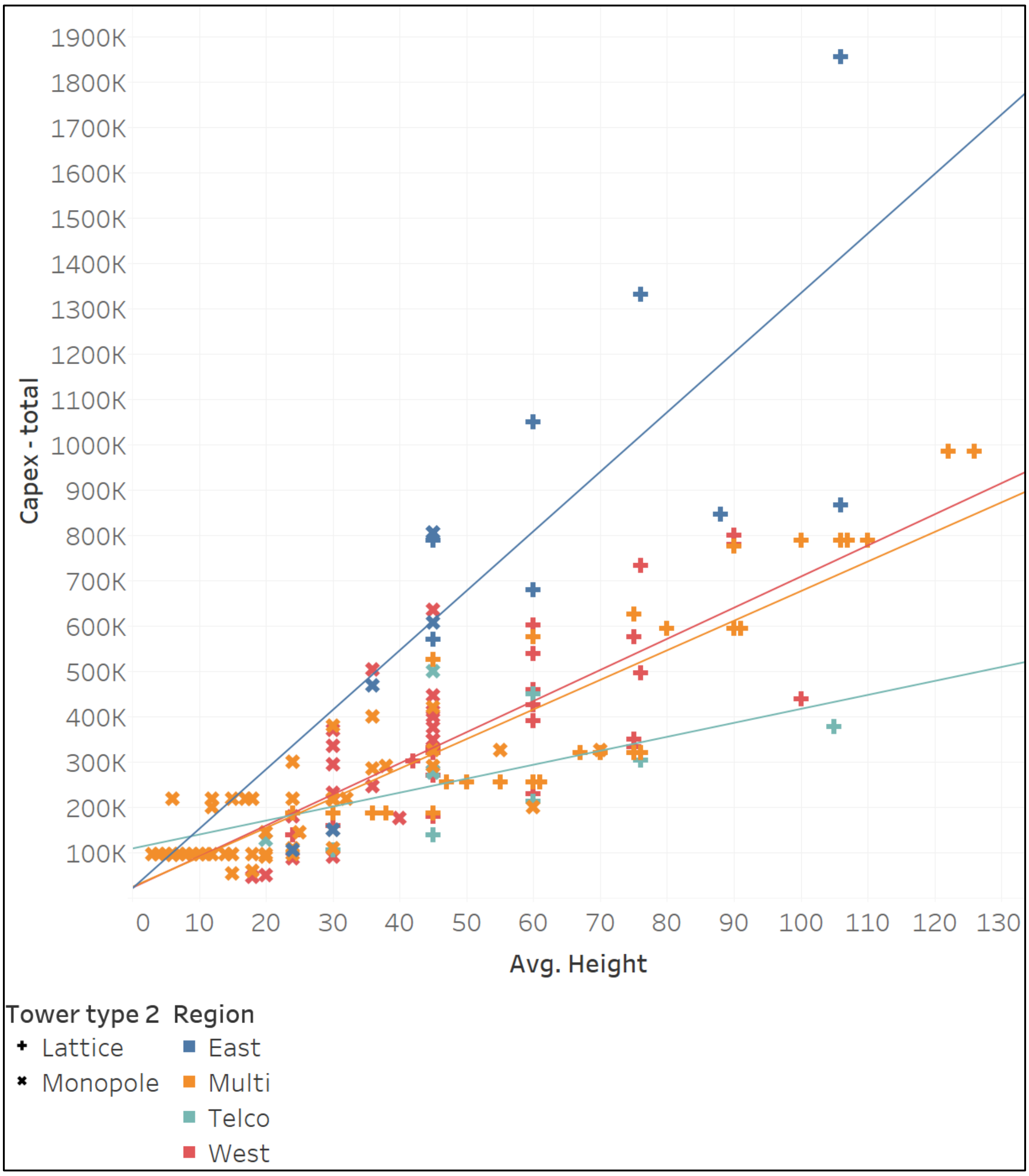
Sarawak, height, number of sharing parties and tenure. In addition, the MCMC understands that property costs (site rental and the like) are sometimes treated on a "pass-through" basis. In other words, in addition to a standardised price per site for everything else, the tenant is asked to pay a share of the site rental that varies from site to site to reflect local conditions and landlord demands. This is a way of offsetting the risk to the tower operator, or at least sharing it with the tenant.

The graph below shows the unit CAPEX costs for different tower types and heights for tower operators based in Peninsular Malaysia and Sabah and Sarawak, as well as for multi-state operators and telcos. Each mark on the graph represents a data point (a cost provided by an operator for a structure type and height). The data for lattice and monopole types only are presented, in the interests of clarity. The graph also shows linear trend lines relating CAPEX cost to structure height. In the case of operators based in Sabah and Sarawak and Peninsular Malaysia and the multi-state operators, the linear trend relating structure height to cost relationship is strong and statistically significant, but this is not so for the telcos, perhaps because there are too few data points. The data for Sabah and Sarawak-based operators also only rests on the data provided by two operators, so care must be taken in interpreting the data, as it is difficult to be sure that differences between them and other groups are not attributable to the characteristics of those particular operators and not regional differences.

In addition to the operators whose activities are confined to a single state, there are three who operate across several states, of which one, edotco operates in both Sabah and Sarawak and Peninsular Malaysia. The graph suggests that the relationship between cost and structure height is similar for these two groups of operators.

In conclusion, it is the MCMC's view that the cost model should primarily give a view of the average level of costs for a small number of variants on the basic service, but with flexibility to substitute different elements of cost where the task in hand demands it, or to exclude elements of cost where they are passed through.

**Figure 7: CAPEX costs for tower structures (lattice and monopole structures) by height and region (Sabah and Sarawak and Peninsular Malaysia and multi-state operators)**




Whilst the main objective is for the model to give a view of the overall average cost, it was felt to be desirable that the model give some insight into the effect of different configurations on that central estimate. Operators have in place a wide variety of different tower types and sizes and in many cases there is only one reported instance[24] of a specific size x type combination. For the purposes of this section of the model, only size x type combinations with at least three reported instances were included in the averages.

[24] A CAPEX cost reported by an operator for a particular type and height of tower. The operator in question may have more than one site of this type.

The annualised total tower site costs calculated by the model using tilted annuities and straight line from 2018 to 2020 with WACC of 12.11% is shown in the table below.

**Table 99: Total annualised tower site costs (RM per year) based on the tower structure variants available in the model**

| Annualised total cost per site for Lattice | WACC 12.11% -Tilted annuity | | | WACC 12.11% -Straight Line | | |
|---|---|---|---|---|---|---|
| | **2018** | **2019** | **2020** | **2018** | **2019** | **2020** |
| **60 m (RM/year)** | 130,189 | 136,438 | 143,061 | 164,733 | 173,226 | 182,258 |
| **75 m (RM/year)** | 134,795 | 141,345 | 148,290 | 173,037 | 182,073 | 191,686 |
| **90 m (RM/year)** | 154,241 | 162,066 | 170,369 | 208,096 | 219,430 | 231,491 |

The preliminary model contained some additional tables that were designed to vary site preparation and civils costs and also OPEX in line with the above variants, based on linear models. These tables appeared to cause some confusion amongst operators and they have been removed from the model.

Edotco and TM both commented on the preliminary model that the costs for 45m to 75m towers vary between Peninsular Malaysia and Sabah and Sarawak by 15-20%. Although the data would suggest that the differential may be at least this much, there are too few data points to reach the criterion for inclusion of this distinction in the model.

### 19.3.4. Per-tenant pricing

An essential part of the business model for tower companies is the possibility of sharing tower facilities with more than one operator. This raises the issue of how such costs should be shared. It is the MCMC's understanding that the general approach is to reduce the charges to existing operators as additional tenants are added. However, it is not necessarily the case that costs are shared equally amongst all tenants, or that an additional tenant would reduce charges proportionately. There may be valid economic reasons for this. For example, one operator commented that the risks borne by tower operator are highest when a site is first established and that it is their and the initial "anchor" tenant's interests to share this risk and for the anchor tenant to benefit from some preferential treatment in return.

An alternative pricing strategy would be for the tower operator to take a risk on the number of tenants they could attract to a new tower by charging a standard price, that might be slightly higher than the average under the sliding-scale approach described above. This would give tenants increased certainty about their costs, but might be less efficient at rewarding differential risk.

It was the MCMC's initial assumption that adding additional tenants would not add greatly to the costs borne by the tower operator. However, it was pointed out by some commentators that commercial landlords sometimes increase the rent charged to the tower operator as new tenants are added. It is unclear how widespread this is, or how large such increases are.

It will be clear from the above discussion that a cost model is not a tool that is very well suited to determining the proper scheme for sharing site costs amongst tenants. In view of this, the MCMC proposes to model the costs per site and not per tenant. The current SBC price list discounts the single-tenant price by around 43% on average for two tenants and by 54% where there are three tenants. The MCMC is minded to apply these rates in relating modelled total site costs with multi-tenant prices.

### 19.3.5. USP costs and subsidies

The USP operates by collecting a levy from operators and distributing funds to operators who are willing to make otherwise uneconomic investments that contribute to the objectives of the programme, particularly in extending the coverage of communications services to consumers who would otherwise not be served. Towers companies have been significant beneficiaries from, as well as contributors to the scheme. It is appropriate to consider, therefore, how these payments into and out of the scheme should be reflected in costs.

It is intended that the costs calculated by the model should convey a view of the average costs, including a suitable mark-up for the cost of capital, that should be passed on to tenants through prices. To this extent, it seems clear that subsidies should be reflected in the prices paid by tenants, because the tenants also need to be incentivised to take up the space created by the tower company in order for the objective of extending coverage to be met.

On the other hand, subsidies of this kind are, by their nature, specific to certain (generally, but not exclusively rural) areas and different operators may have a widely different balance between contributions and receipts from the fund, depending on their participation in schemes operated by the USP. It may well be relevant for the MCMC to consider the position absent the USP, or considering contributions only. In this case, the model is designed with the flexibility to exclude this element, or to substitute a different value.

Digi commenting on the preliminary version of the model circulated for comment suggested that the net USP payment should be averaged over 3-5 years. The MCMC agrees with this and the figure inputted to the model has been amended to reflect an average for 2015 and 2016, which are the years for which data was collected. The average payment to tower operators per site over 2015 and 2016 was RM7,251.68.

Contributions to the USP fund are levied as a percentage of revenue. Whilst this cost is not avoidable by the operator, provided that they are liable to pay it under the rules of the scheme, it can in a straightforward way be passed on to the tenants as, to all intents and purposes, a tax. It is likely, therefore, that the cost of providing services excluding this levy would be more relevant to the MCMC than the inclusive cost. In any case, if the situation required the inclusive cost to be considered, it could be calculated as a simple mark-up. It is proposed, therefore to take contributions to the fund out of consideration for costing purposes, but to include average payments from the fund. For purposes of comparison, the average cost without USP contribution is also shown as a sensitivity.

**Question 27:**

Do you have any comments on the approach to the modelling of tower costs?

## 19.4. Sensitivity analysis

In addition to the point estimate assumption of a WACC at 12.11%, it was estimated in Section 14 that the WACC for Towers fell within a range with lower and upper bounds of 9.25% and 14.88%, respectively. Model results on the effect of different annualised methods on these upper and lower WACC values for towers cost are shown in the tables below.

**Table 100: Model outputs for Towers (WACC=9.25%)**

| Annualised total cost per site for Lattice | WACC 9.25% -Tilted annuity | | | WACC 9.25% -Straight Line | | |
|---|---|---|---|---|---|---|
| | 2018 | 2019 | 2020 | 2018 | 2019 | 2020 |
| **60 m (RM/year)** | 122,211 | 128,019 | 134,169 | 152,054 | 159,820 | 168,073 |
| **75 m (RM/year)** | 126,025 | 132,083 | 138,499 | 159,093 | 167,321 | 176,064 |
| **90 m (RM/year)** | 142,130 | 149,243 | 156,784 | 188,812 | 198,987 | 209,807 |

**Table 101: Model outputs for Towers (WACC=14.88%)**

| Annualised total cost per site for Lattice | WACC 14.88% -Tilted annuity | | | WACC 14.88% -Straight Line | | |
|---|---|---|---|---|---|---|
| | 2018 | 2019 | 2020 | 2018 | 2019 | 2020 |
| **60 m (RM/year)** | 138,528 | 145,241 | 152,365 | 177,014 | 186,209 | 195,997 |
| **75 m (RM/year)** | 143,971 | 151,041 | 158,545 | 186,542 | 196,362 | 206,815 |
| **90 m (RM/year)** | 166,951 | 175,528 | 184,636 | 226,774 | 239,230 | 252,493 |

**Question 28:**

Do you have any comments on the sensitivities and outputs from the towers cost model?

## 19.5. Discussion of Operators' comments on the preliminary model

Celcom commented that there were no figures (in the scenarios section of the model) for lampoles. This has now changed, although there were only two structure heights for which the criterion of three or more data observations was met. Celcom also commented that the figures for monopoles did not correspond with the figures they submitted. It is in the nature of a notional operator model that individual data submissions are not visible. In any case, the model is based on tower operators' data, as previously discussed.

Digi commented that 12 years was too short an asset life for tower structures and that 30 years would be more appropriate. The figure used in the model is based on the tower operators' inputs and although Digi did not include a figure for this parameter in their data submission, the only other mobile operator to do so estimated this figure at 10 years. Most of the data submitted were within the range of 10-25 years. Based on the comparison done from various other countries such as US, India, Ghana and New Zealand, the 12 years indicate a lower end. Hence, the MCMC has revised the asset life for towers to be 15 years.

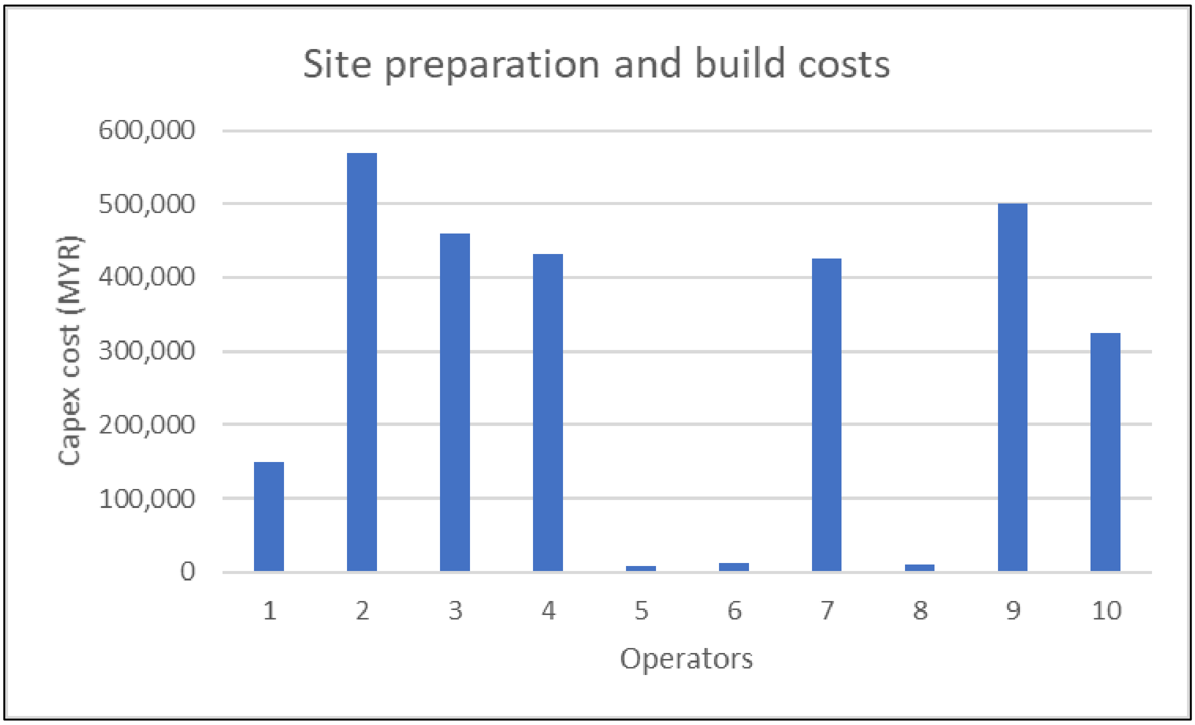
Operator C commented that the data on which the model is based is patchy and that the costs submitted by the dominant operators are likely to be excessive. Whilst the MCMC acknowledges that the data are imperfect, this is partly a consequence of the fragmented nature of the sector. However, though there are operators found to be dominant in this sector, there is no evidence of excessive costs having been submitted.

Celcom commented that the operating costs for rooftop structures as a percentage of CAPEX was high when compared to tower structures. The figure was arrived at taking into account operators' estimates of the absolute value, which is similar to that for tower structures. It seems not implausible that the costs incurred in maintaining these two types of structures would be similar in magnitude, despite the CAPEX costs being different.

Celcom and TM commented that the annual price trend applied to power supplies, shelters and gantries was too high at 10% per year. The estimate for power supplies was based on an average of the figures provided by operators. However, the estimates ranged from 5% to 20%. No operator provided estimates for the price trend on the other two items and so the consultants provided an estimate. This has been reviewed and reduced to 6%, which is in closer alignment with the trend applied to other passive elements of the cost structure.

Several questions were raised by operators about the cost input "Site preparation and build costs". This is a significant element of the capital costs of a tower site, estimated at RM 353 thousand. This estimate is based on an average of the figures provided by both tower and telco operators. The inputs from those who provided an estimate for this cost are shown in the figure below. It is clear from this that there may have been different interpretations of the question, in that the responses are of a distinctly bi-modal character. Operator E, for example, questioned whether there might be double-counting, given that their estimate for the overall CAPEX per tower site was only around half that included in the model.

**Figure 8: Site preparation and build cost inputs from 10 operators**



In the MCMC's opinion, the costs that should be included in this category are reasonably clear, in that operators are asked to input details of tower structure costs separately. However, in that separate table, tower companies were asked to input tower structure and civils and construction costs separately, because it was anticipated that the latter would vary to some degree with different structures and heights.[25]

**Table 102: Macrocell site acquisition and preparation cost benchmarks from mobile cost models**

| | Year | CAPEX cost (RM) | Exchange rate |
|---|---|---|---|
| **UK** | 2015 | 489,458 | 5.56 |
| **Sweden** | 2016 | 1,224,040 | 2.04 |
| **France** | 2014 | 385,511 | 4.71 |
| **Australia** | 2007 | 454,260 | 3.39 |

As a cross-check, the CAPEX costs for tower sites taken from several recently published cost models are shown in the above table, with the costs converted to RM. The Swedish figure appears to be anomalous, but it includes electronics costs, as well as the civils and structure costs included in the other figures. The total average CAPEX cost for a tower site based on the averaged inputs under the intended interpretation is RM757,102, whereas if the inputs in the hundreds of thousands are taken to be double-counted and excluded and an average of the lower figures (RM9,751) is used instead, then the total average CAPEX cost for a tower site falls to RM413,714, which is within the range of the benchmarks shown in the table. The average of the benchmark figures, excluding Sweden, is RM443,076. In consequence, the lower figure has been adopted as being more likely to reflect a correct interpretation of the cost inputs.

## 19.6. Proposed approach to price regulation for the Mobile Towers Service

It will be clear from the discussion of the modelling results that the pricing structure for mobile towers services is necessarily more complex than, say, call termination and origination services. It would not be desirable, or probably feasible, to set prices for every possible combination of tower structure, height and ancillary services. The evidence also suggests that there are likely to be local variations where an operator incurs substantially higher costs because of such factors as the inaccessibility of the site and the MCMC recognises that some operators may face issues of this kind more frequently than others.

In recognition of this, the MCMC proposes to publish a set of prices for frequently-used tower configurations, based on the costing provided by the model. Tower operators would

[25] This expectation was confirmed, in that there was overall a positive and highly statistically significant correlation of 0.71 between these two parameters in the data submitted by operators.

be free to offer different configurations, or to add or subtract elements of the service, for example by including backhaul services and to reflect this in the price charged, provided that the variation is reasonably cost-reflective by reference to the model. For example, an operator might offer a special structure of some kind to deal with the demands of a specific location. The reasonableness of any resulting special price would be judged by the MCMC by substituting the relevant structure-related CAPEX and OPEX costs associated with this structure into the model.

Tower operators would be free to offer or agree prices below the reference price, although, for the avoidance of doubt, the MCMC's duties and powers to take action in case it identifies that such prices were exclusionary in intention or effect would not be affected by this. Where such concerns arose, the MCMC would be likely to seek further cost justification from the operator concerned.

Per-tenant prices would be derived by applying suitable discounts to the single-tenant price, based on the levels of discount currently applied in the SBC price list, as discussed in Section 19.3.4, above.

In instances where an operator faces exceptionally high costs for reasons beyond their reasonable control for a particular site, as discussed above, prices above the reference cost would be allowed, subject to the provision of evidence by the operator. Since costs might be expected to vary to some degree from site to site around an average, the MCMC is minded to apply threshold values, which costs would have to exceed in order to result in an allowable variation above the price. The MCMC is minded to set the threshold values as follows:

(a) 30% above the model input cost for individual cost input lines (e.g. tower structure CAPEX), and;
(b) 20% overall increase in the annualised overall cost as calculated by the model.

In addition, where an operator can show that the above thresholds would be met in 30% of more of its sites within its footprint, or within a given state if the operator covers two, or more states, a blanket variation to the reference price may be agreed with the MCMC for the area in question. In the case of multi-state operators, the operator would be required to demonstrate that any such blanket variation did not result in their recovering more than the reference prices on average, for example by adjusting prices downwards in lower-cost areas.

Finally, the current practice is for tower operators to apply significant discounts for longer tenure. In the SBC price list these amount to around 25% for the eighth year and after and 35% for the 11th year and after. Whilst it is quite possible that there is some cost justification for a non-uniform tariff, for example to recover set-up costs over the initial few years of tenure, the MCMC has significant concerns that structures of this kind might be anti-competitive in its effect on the downstream mobile sector, setting newer operators rolling out their network at a substantial cost disadvantage over established competitors. The MCMC is therefore minded to require cost-justification for any such arrangement. However, although the MCMC does not have any data on tenure profiles, it is sensitive to the fact that phasing such a structure out might have disruptive effects, including a significant net increase in average prices paid. Removal of these discounts might also breach existing contracts between tower operators and their tenants. The MCMC therefore proposes that, unless tower operators can satisfy the MCMC that there is cost justification for such discounts that:

(a) they should be phased out over a maximum of [three] years for sites not covered by contracts in force on the date of publication of this document, and;
(b) tower companies should demonstrate to the MCMC's satisfaction that any such price rebalancing is revenue-neutral for them overall.

In the MCMC's view this arrangement has a number of benefits:

(a) Ex ante safeguard against excessive pricing by the tower operators;
(b) Flexibility to allow for variations in structure and services;
(c) Flexibility to allow for exceptional local conditions;
(d) Ability for more efficient operators to choose whether to retain the financial benefit of their greater efficiency, or to share it with customers in the form of lower prices.

## 19.7. Proposed regulated prices

The MCMC proposes to set regulated prices for lattice type towers for 60 m, 75 m and 90 m. The proposed prices are based on those calculated in the tower model based on tilted annuities and WACC value of 12.11%. Table below shows the tower model for 2018 to 2020. The figures averages cost per site per year on an annualised basis. Hence, for a standard allocation covering an average of 3 sharing mobile operators, the tower company then divides the cost 3 times of the calculated price. The model does not account for mark up in leasing with additional sharing parties nor tenure of the lease with longer duration that offers higher discounts. These are left to commercial negotiation.

**Table 103: Model outputs for Towers (WACC=12.11%)**

| Annualised total cost per site for Lattice | WACC 12.11% - Tilted annuity | | |
|---|---|---|---|
| | **2018** | **2019** | **2020** |
| **60 m (RM/year)** | 130,189 | 136,438 | 143,061 |
| **75 m (RM/year)** | 134,795 | 141,345 | 148,290 |
| **90 m (RM/year)** | 154,241 | 162,066 | 170,369 |

**Question 29:**

Do you have any comments on the proposed regulated prices?

## 19.8. In-Building Common Antenna Systems (IBCA)

A related form of infrastructure sharing occurs when an operator installs an antenna system within a large public indoor space, for example a shopping centre and this local antenna network is shared by two, or more, operators. Generally, the model for this in Malaysia is that such systems are installed by the mobile operators, who then allow access to other mobile operators on the basis of reciprocal access to their own sites. There are also operators that offer IBCA facilities to mobile operators.

IBCA facilities were not provided by tower companies and were not included in the towers model. IBCA facilities are, however, included in the mobile model as part of the mix of site types represented there and account is taken of the degree of sharing that takes place.

The access to in-building common antenna systems and central equipment room depends on the specific arrangements in a building and may involve access charges by a building owner or non-price terms and conditions.

IBCA can vary considerably in size and scale and the MCMC is minded to look at any disputes where it is asked to intervene on a case-by-case basis. The information provided by the operators as part of the current costing exercise would form a part of the initial information base and supplemented by data gathered during the dispute would allow the MCMC to reach a conclusion.

The outputs of the mobile model for 2018 to 2020, given base case assumptions are shown in Table 101, below. The "reference" prices are the average cost per site per year on an annualised basis.

**Table 104: Model outputs for IBCA (WACC=12.32%)**

| Annualised total cost per site | 2018 | 2019 | 2020 |
| --- | --- | --- | --- |
| IBCA (RM/year) | 78,500 | 80,900 | 83,400 |

**Question 30:**

Do you have any comments on the approach to modelling in-building common antenna system?

# PART G: DTT MULTIPLEXING SERVICES

## 20. Digital Terrestrial Television (DTT) Broadcasting service

### 20.1. Background and Purpose

The DTT model is used to calculate costs and prices for the Digital Terrestrial Broadcasting Multiplexing Service on the Access List:

This is a new service for which one operator, MYTV has been licensed, in line with the concept of a Common Integrated Infrastructure Provider (CIIP). The CIIP's role is to provide a single, national service to broadcasters using digital broadcast television technology. The service has recently launched, ahead of the switch-off of analogue TV broadcasting. It will provide a range of services, including radio and both standard definition (SD) and high definition (HD) television channels. It is committed to offer three multiplexes with an initial 30-channel capacity, with the possibility of further multiplexes, if sufficient demand emerges.

To date, MYTV and the broadcasters have engaged in commercial negotiations on the price. However, as the MCMC have regulated Digital Terrestrial Broadcasting Multiplexing Service in the Access List, the MCMC is responsible to ensure that the terms and conditions, including the prices, offered to the broadcasters are reasonable. As a result, it is desirable for the MCMC to have some basis for understanding the likely economics of the business, including an estimate of efficient service costs.

### 20.2. Modelling approach

The Methodology Questionnaire proposed a simple, bottom-up model, using tilted annuities as the annualisation method and with assets valued at historic cost. In practice, the current and historical value of MYTV's assets is unlikely to differ very much, if at all, because the assets are generally new. However, the model looks ahead to future years in which it is possible that the cost of modern equivalent assets would differ from the historic cost. The current cost approach has the advantage that it reflects the cost base that would be available to a competing entrant to the market, were one possible, and so may provide a better approximation of the efficient costs from a regulatory point of view. In addition, it has proven impractical to use historic cost accounting (HCA) in other models and so, using current cost accounting (CCA) in this case would be more consistent. In practical terms, this means using the existing costs of capital assets and applying an indexing factor to determine the expected future price for similar assets over the next few years. The cost calculated by the model for any given year will then reflect the "tilt" applied to capital asset prices in this way.

## 20.3. Modelling issues

### 20.3.1. Economic characteristics of the DTT sector

A key issue for modelling this service is that there are no established best practices, as there are for fixed and mobile operator models. It is necessary therefore to apply general principles for cost modelling in a way that is reasonably consistent with the approach taken in the other models, but that responds to the particular characteristics of this sector.

One key difference with the fixed and mobile models is that MYTV is a wholesale-only operator with essentially one output: broadcast channels. The different types of channels are produced jointly within a given multiplex. Whilst it is possible to carry different mixes of, for example, HD and SD channels within the multiplex, the limitation on the number of channels is fixed per multiplex.

### 20.3.2. Other services

However, it is possible to add services such as videotext and interactive content at relatively small incremental cost when such services are broadcast within the channel bandwidth occupied by a TV channel. In the absence of information about the likely nature and take-up of these incremental services, however, they have not been costed within the model. If questions arise about the cost of such services in the future, it is a reasonable assumption that the avoidable costs of such services would equate to their direct costs. That is to say, although they would occupy some bandwidth within that allocated to their host channel, none of the costs of providing that bandwidth would be avoidable and so it would be reasonable to assign to the incremental services only the costs of additional equipment and activity required to support them. The MCMC would therefore be minded to look at such matters on a case-by-case basis should they be required to do so.

#### *20.3.2.1. HD and SD*

A second characteristic of the technology being used by MYTV is that there is no hard-and-fast definition of SD, versus HD channels. Whilst some assumptions have been made concerning the average bandwidth occupied by SD and HD, respectively, for the purposes of calculating overall costs, the model allows for channel-related and bandwidth-related costs to be calculated separately, so that the costs of a channel of any arbitrary bandwidth can be calculated. In practice, there would be limits imposed by the technology and by the broadcast spectrum available to MYTV on the amount of bandwidth available in total and for any one channel. However, the model assumes that such issues are resolved exogenously (for example that only channels of a bandwidth that is feasible with the technology are considered). Where this simplifying assumption might have its limitations is in situations where conflicting demands make the bandwidth available within a multiplex in effect a scarce resource. In such cases, it would be desirable to take a view of the opportunity costs of different options for the mix of channels (for example, adding an additional share of cost to a bandwidth-hungry channel, if it prevents several narrower-bandwidth channels from being broadcast). Such issues might be explored by a combination of different scenario inputs within the model and assessments of opportunity cost externally to the model.

MYTV commented that the differential in cost calculated by the model did not reflect the differences in value between, say, HD and SD that underlie current pricing. This is certainly true, as it is a cost and not a value model. However, given the predominance of fixed costs, it would not be unreasonable for an operator to apply a value-based pricing approach to sharing the recovery of such costs amongst the different outputs and indeed this would be likely to be economically efficient if it accurately reflected the relative willingness of customers to pay and consequent elasticities of demand.

### 20.3.3. Channel take-up

In the MCMC's view, a more likely challenge is likely to be filling the available capacity in line with MYTV's business plan, given that demand beyond the replacement of existing analogue channels is uncertain. Similarly, it is envisaged that additional multiplexes might be added once sufficient demand emerges. Given the substantial fixed costs associated with this, the timing of such a move in relation to the evolution of channel demand is likely to have a significant bearing on costs per channel taken by MYTV's broadcaster customers. These issues can be explored using different scenario inputs to the model.

### 20.3.4. Costing and pricing

It should be noted that the appropriate charge per channel cannot simply be decided by calculating the average costs per channel, or per channel and for bandwidth separately. This is a separate question that can be informed by the model calculations, but which will depend also on some additional policy considerations. For example, it may be appropriate from an economic point of view to allow some degree of price discrimination – charging different prices for channels that otherwise make identical technical demands on the system. Such discrimination exists in other industries and in other sectors of the telecommunications industry, for example between "anchor" and other tenants in shopping malls, or between prepaid and post-paid mobile subscribers. It is a well-established challenge for regulators to distinguish between instances where such discrimination is appropriate and beneficial, for example leading to optimum utilisation of the multiplex, or multiplexes, and hence to lower costs for broadcasters and their customers, and those cases where the discrimination is unfair and damaging to consumer welfare. Again, such matters will need to be addressed outside the model, though the model may be helpful in evaluating the cost implications of different options. However, the MCMC is minded to use average cost per channel as a starting point and would expect prices to be set with reference to this and without discrimination, unless a case can be made by MYTV or by broadcasters that a different approach is more likely to maximise consumer welfare.

MYTV also commented that it might be useful for the model to take into account the potential viewership, perhaps by expressing costs per potential viewer in some form. The MCMC is open to this suggestion if stakeholders consider that it would be beneficial to an understanding of the costs of this sector, but would need additional data in order to incorporate it into the model (in particular potential viewers per transmitter site, potential viewers added per gap filler).

### 20.3.5. Set-Top Box (STB) costs

One respondent, Media Prima, commented that the cost of providing free STBs should not be included, because the 5-year exclusivity awarded to MYTV was in exchange for this concession and that the concession had been offered unilaterally by MYTV in order to win the bid. The cost of the STBs cannot, therefore be considered a necessary cost of providing the network service. The MCMC is minded to accept this point and STB costs have been excluded from the costing.

**Question 31:**

Do you have any comments on the approach to the modelling of the DTT multiplex costs?

## 20.4. Model Results

**Table 105: Model outputs for DTT (WACC=11.57%)**

| Annualised total cost per channel | 2018 | 2019 | 2020 |
|---|---|---|---|
| SD (RM/year) | 7.2 million | 8.6 million | 7.8 million |
| HD (RM/year) | 11.4 million | 13.5 million | 11.5 million |
| Radio (RM/year) | 6.4 million | 7.6 million | 7.1 million |
| Weighted average (RM/year) | 7.3 million | 8.9 million | 8.2 million |
| | | | |

| Annualised total cost per channel | 2018 | 2019 | 2020 |
|---|---|---|---|
| Average channel cost (excluding bandwidth-related costs) (RM/year) | 6.4 million | 7.6 million | 7.1 million |
| Average bandwidth cost (RM/Mbps) | 0.334 million | 0.392 million | 0.295 million |

The outputs of the model, given base case assumptions, are shown in Table 105, above. The figures are annual costs per channel. In the upper part of the table, costs are shown for notional SD, HD and radio channels, assuming that their bandwidths are 2.5 and 15 Megabits per second and 64 Kilobits per second, respectively. The costs of other channel bandwidths can be calculated using the lower part of the table, by multiplying the bandwidth by the average bandwidth-related cost and adding this to the average channel cost.

## 20.5. Sensitivities

In Section 13, dealing with the calculation of the WACC for DTT services, a point estimate of 11.57% was given. This was used for the calculation, the results of which were set out in the table above. The Section 13 also provided estimates of the minimum and maximum points of the range in which the WACC is proposed to lie, at 8.04% and 14.67%, respectively. The results of applying these values are set out in the tables below.

**Table 106: Model outputs for DTT (WACC=8.04%)**

| Annualised total cost per channel | 2018 | 2019 | 2020 |
|---|---|---|---|
| SD (RM/year) | 6.7 million | 8.2 million | 7.4 million |
| HD (RM/year) | 10.9 million | 13.0 million | 11.1 million |
| Radio (RM/year) | 5.9 million | 7.2 million | 6.7 million |
| Weighted average(RM/year) | 6.8 million | 8.4 million | 7.8 million |
| | | | |
| Average channel cost (excluding bandwidth-related costs) (RM/year) | 5.9 million | 7.2 million | 6.7 million |
| Average bandwidth cost (RM/Mbps) | 0.330 million | 0.389 million | 0.292 million |

**Table 107: Model outputs for DTT (WACC=14.67%)**

| Annualised total cost per channel | 2018 | 2019 | 2020 |
|---|---|---|---|
| SD (RM/year) | 7.7 million | 9.0 million | 8.2 million |

| Annualised total cost per channel | 2018 | 2019 | 2020 |
|---|---|---|---|
| HD (RM/year) | 11.9 million | 13.9 million | 11.9 million |
| Radio (RM/year) | 6.8 million | 8.0 million | 7.4 million |
| Weighted average (RM/year) | 7.7 million | 9.2 million | 8.5 million |
| | | | |
| Average channel cost (excluding bandwidth-related costs) (RM/year) | 6.8 million | 8.0 million | 7.4 million |
| Average bandwidth cost (RM/Mbps) | 0.339 million | 0.395 million | 0.297 million |

The WACC sensitivities suggest that the weighted average cost per channel in 2020 lies within the range RM6.7 million to RM8.5 million per year, with a point estimate of RM8.2 million per year.

## 20.6. Proposed regulated prices

The MCMC proposes to regulate the prices of Digital Terrestrial Broadcasting Multiplexing Services as shown in Table 108. Based on the understanding of the MCMC, these are the most appropriate services and reflect the dynamics of the ongoing commercial negotiation. However, the MCMC welcomes comments on this.

**Table 108: Digital Terrestrial Broadcasting Multiplexing Prices**

| Annualised total cost per channel | 2018 | 2019 | 2020 |
|---|---|---|---|
| SD (RM/year) | 7.2 million | 8.6 million | 7.8 million |
| HD (RM/year) | 11.4 million | 13.5 million | 11.5 million |

**Question 32:**

Do you have any comments on the proposed regulated prices?

## ANNEXURE - ABBREVIATIONS

| | |
|---|---|
| 2G | Second generation wireless technology |
| 3G | Third generation wireless technology |
| 4G | Fourth generation wireless technology |
| BEREC | Body of European Regulators for Electronic Communications |
| BSC | Base Station Controller |
| BTS | Base Transceiver Station |
| BTU | Broadband Termination Unit |
| BULRIC | Bottom Up Long Run Incremental Cost |
| CAPEX | Capital Expenditure |
| CAPM | Capital Asset Pricing Model |
| CCA | Current Cost Accounting |
| CIIP | Common Integrated Infrastructure Provider |
| CMA | Communications and Multimedia Act |
| CPI | Consumer Price Index |
| DEL | Direct Exchange Line |
| DSLAM | Digital Subscriber Line Access Multiplexer |
| DTT | Digital Terrestrial Television |
| DWDM | Dense Wave Division Multiplexer |
| ED | Economic Depreciation |
| EPMU | Equal Proportionate Mark Up |
| ERP | Equity Risk Premium |
| EU | European Union |
| FDC | Fibre Distribution Cabinets |
| FDP | Fibre Distribution Point |
| FTA | Free to Air |
| FTTH | Fibre to the Home |
| FTR | Fixed Termination Rate |
| Gbps | Giga bits per second |
| GPON | Gigabit Passive Optical Network |
| HCA | Historic Cost Accounting |
| HD | High Definition |
| HLR | Home Location Register |
| HSBB | High Speed Broadband |
| IBCA | In-Building Common Antenna Systems |
| IP | Internet Protocol |
| IPTV | Internet Protocol Television |

| | |
|---|---|
| LRIC | Long Run Incremental Cost |
| LTBE | Long Term Benefit of End-users |
| LTE | Long Term Evolution wireless technology |
| M2M | Machine to Machine |
| Mbps | Mega bits per second |
| MCMC | Malaysian Communications and Multimedia Commission |
| MDF | Main Distribution Frame |
| MEA | Modern Equivalent Asset |
| MMS | Multimedia Message Service |
| MNO | Mobile Network Operator |
| MSAN | Multi-Service Access Node |
| MTR | Mobile Termination Rate |
| MVNO | Mobile Virtual Network Operator |
| MYTV | MYTV Broadcasting SDN BHD |
| NPO | National Policy Objective |
| NRA | National Regulatory Authority |
| ODF | Optical Distribution Frame |
| OLT | Optical Line Termination |
| OPEX | Operating Expenditure |
| OTT | Over The Top |
| PI | Public Inquiry |
| POI | Point of Interconnect |
| PSTN | Public Switched Telecommunications Network |
| QoS | Quality of Service |
| RAB | Regulatory Asset Base |
| RAN | Radio Access Network |
| RFR | Risk-free Rate |
| RM | Malaysian Ringgit |
| SD | Standard Definition |
| SIM | Subscriber Identity Module |
| SMS | Short Message Service |
| STB | Set-top Box |
| TM | Telekom Malaysia |
| TRX | Transceiver |
| TSLRIC | Total Service Long Run Incremental Cost |
| UPE | User Provider Edge |
| USP | Universal Service Provision |
| VDSL | Very-high-bit-rate Digital Subscriber Line |

| | |
|---|---|
| VoLTE | Voice over Long Term Evolution wireless technology |
| WACC | Weighted Average Cost of Capital |