IFC International Finance Corporation World Bank Group

GSMA Green Power for Mobile

In partnership with the Netherlands

Site Selection, Procurement, Operation and Maintenance for Energy Outsourcing

Best Practice Guide

August 2014

Contents

Glossary

Ah : Ampere hour
CAPEX : Capital expenditure
ESA : Energy saving agreement
ESCO : Energy Service Company
GDP : Gross Domestic Product
GWh : Gigawatt hour
IRR : Internal rate of return
KPI : Key performance indicator
KWh : Kilowatt hour
L : Litre
MNO : Mobile network operator
MPT : Myanmar Post and Telecommunication
NOC : Network operation centre
NREL : National renewable energy laboratory
OMETA : Operation, maintenance, engineering, training and administration
OPEX : Operational expenditure
O&M : Operation and maintenance
PPA : Power purchase agreement
PV : Photo voltaic
RFP : Request for proposal
ROI : Return on investment
TowerCo : Tower Company
SLA : Service level agreement

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Executive summary

Myanmar, a developing country as well as the last “greenfield” telecommunication market in the world, is focused on catching up with neighbouring countries and growing its mobile penetration rates. Currently, the mobile penetration reaches about 10% of the population and, as a response, the government has awarded Ooredoo and Telenor two new licences to operate as mobile network service providers and increase the country’s mobile penetration. The government of Myanmar targets to cover around 75% of its geographical territory by 2017.

To achieve this target, mobile network operators (MNOs) have to build and expand their network to rural areas where they will face infrastructure challenges, from road conditions to grid availability. To overcome this power issue, MNOs need to find their own solutions to power their base stations. The incumbent mobile operator (MPT) has deployed about 150 solar sites to tackle the current situation in Myanmar.

Implementing a solar technology solution will require a huge capital investment up-front for MNOs. They need to search for solutions that will minimise their initial investment to power off-grid base stations during the first years. Energy outsourcing can be an alternative for MNOs to reduce their investment while at the same time getting the service that they require. By giving the responsibility of power management, MNOs will be able to concentrate on their core business of providing mobile services to their customers.

This document will serve as a best-practice guide for MNOs, TowerCos and ESCOs to learn how to go through the different stages of selecting, procuring and powering green sites in Myanmar. GPM also has published a complete Myanmar Market Insight report to describe the potential of a green power for telecom sector in Myanmar.

Introduction

Myanmar's gross domestic product (GDP) per Capita in 2012 stood at around US$848; 36% of this GDP came from the agriculture sector[1]. To increase the GDP, the government has been looking into the telecommunication sector. With a population of 60 million people, Myanmar will become an interesting country in South East Asia in terms of the development of its mobile industry.

As the government announced, Ooredoo and Telenor have targeted to launch their service this year. The new incoming MNOs have brought a market momentum in Myanmar's telecom industry and the incumbent mobile operator (MPT) has committed to a joint operation with KKDI in July 2014.

The electrification rate in Myanmar is less than 30%[2], and this is creating a serious roadblock for MNOs to build and expand their coverage. GPM has estimated that a tower would require about 200 GWh in 2015, and this would climb to 455 GWh in 2017[3], while the current power production is still lagging at about 50% of the current demand.

MNOs/TowerCos need to overcome the power shortage in the country by exploring alternative energy solutions to power up their sites. Green technology options – from solar, micro hydro or fuel cell – are available on the market, but MNOs/TowerCos need to have a proper mechanism and process in place to acquire an adapted green technology solution, based on their needs.

This document will provide guidelines for MNOs, TowerCos or energy service companies (ESCOs) to understand the steps to go through – from site selection and categorisation to procurement, as well as operation and maintenance (O&M) – to deploy a green technology solution in Myanmar.

[1] BIMSTEC – www.bimstec.org

[2] MOEP – www.moep.gov.mm

[3] GPM Research

Green site selection process

Deploying a green site in Myanmar is a big decision for an MNO/TowerCo to make, given the size of task. New MNOs on the market, such as Telenor or Ooredoo, are rushing their deployments to meet their commercial launching targets and provide their services for the country's population. One of the main reasons why an MNO will choose a green technology solution is due to the very limited access to reliable grid, or the grid at all.

This section will guide MNOs, TowerCos and ESCOs on the process of selecting a site. Below is the process flow for the green site selection.

Figure 1: Green site selection process

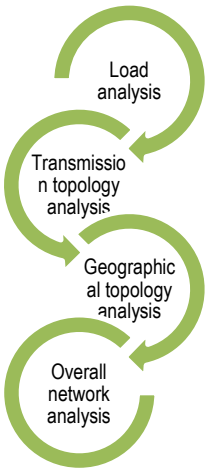
Site categorisation

Identifying a target site and converting it into a green site may be tricky in the early phase of a site deployment for both MNOs (Telenor and Ooredoo) as well as for TowerCos, whereas it can be much easier for Myanmar Post and Telecommunication (MPT), as the latter has operated in Myanmar for a few years and has managed the power situation. Currently, MNOs and TowerCos are spending time doing desk research to analyse and categorise their sites, in order to complete site modelling based on each situation that might occur.

MNOs and TowerCos can follow these steps for their analysis:

1. Site Categorisation based on load
2. Site Categorisation based on transmission topology
3. Site Categorisation based on geographical analysis

Figure 2: Site categorisation process

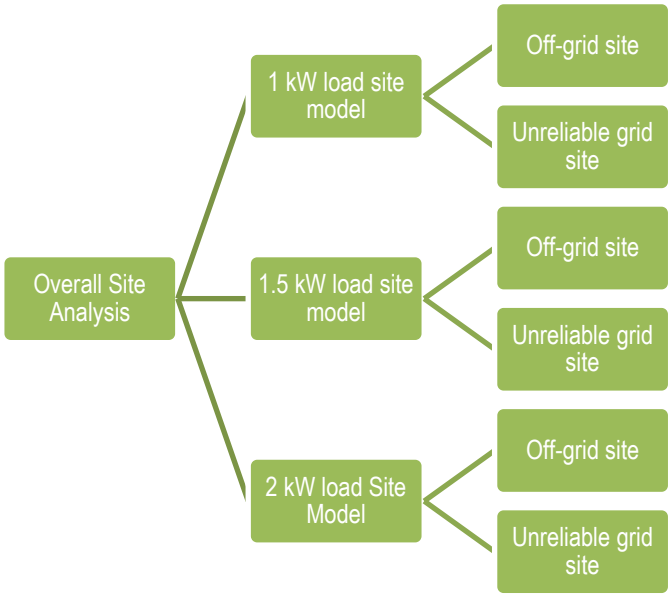


A “site categorisation” method may vary from one MNO/TowerCo to another. The three categorisations proposed above describe and apply in the case of Myanmar at the moment.

Site categorisation based on load

The first step in the site selection process is a load analysis. The load grouping will help engineers to plan and to design a power solution based on each group. The grouping will be based on estimated power consumption for the next six months or one year depending on the future network expansion strategy of the MNO.

Figure 3: Site categorisation based on load

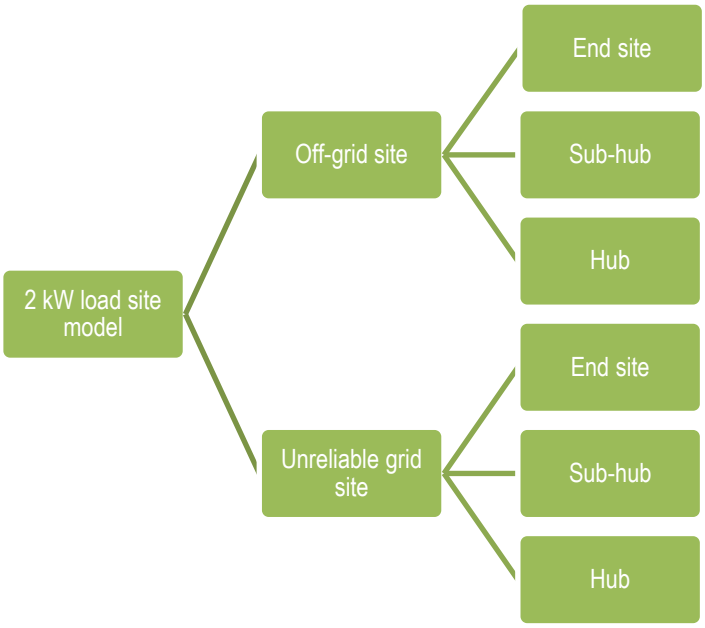


The site load analysis will group the sites based on their particular load and power situation.

Site categorisation based on transmission topology

The second step is a site categorisation based on transmission topology identification. The purpose of this is to see how a particular site will have an impact on another site if the former experiences outages due to transmission losses.

Figure 4: Site categorisation based on transmission topology



Note: End site is a single site that only connected with one site

Hub is a backhaul/backbone site with multiple sites connected to that site

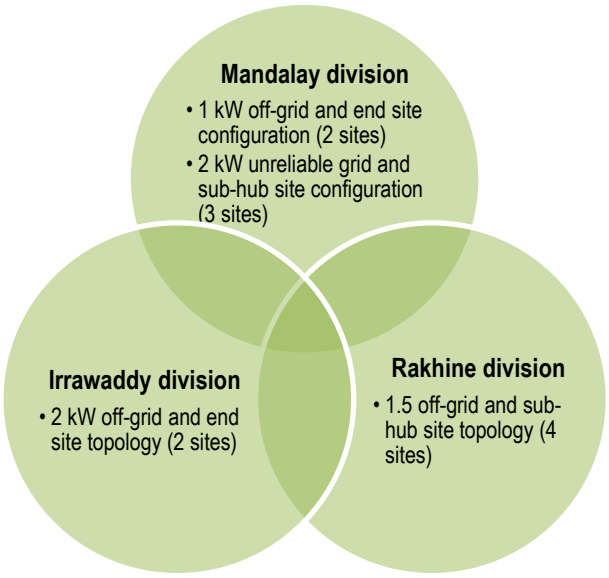
Sub-hub is a medium transmission capacity below STM-1 capacity with multiple sites connected to that site

Taking the transmission topology into account will highlight the importance and the impact of a particular site on the network.

Site categorisation based on geographical analysis

The final step of site categorisation is geographical analysis. The geographical analysis will facilitate site modelling, because any site that has the same load characteristics and transmission topology will follow one single model.

Figure 5: Site categorisation based on geographical analysis



For example in Mandalay, there are two sites located nearby with the same configuration and these will therefore be considered as the same site model.

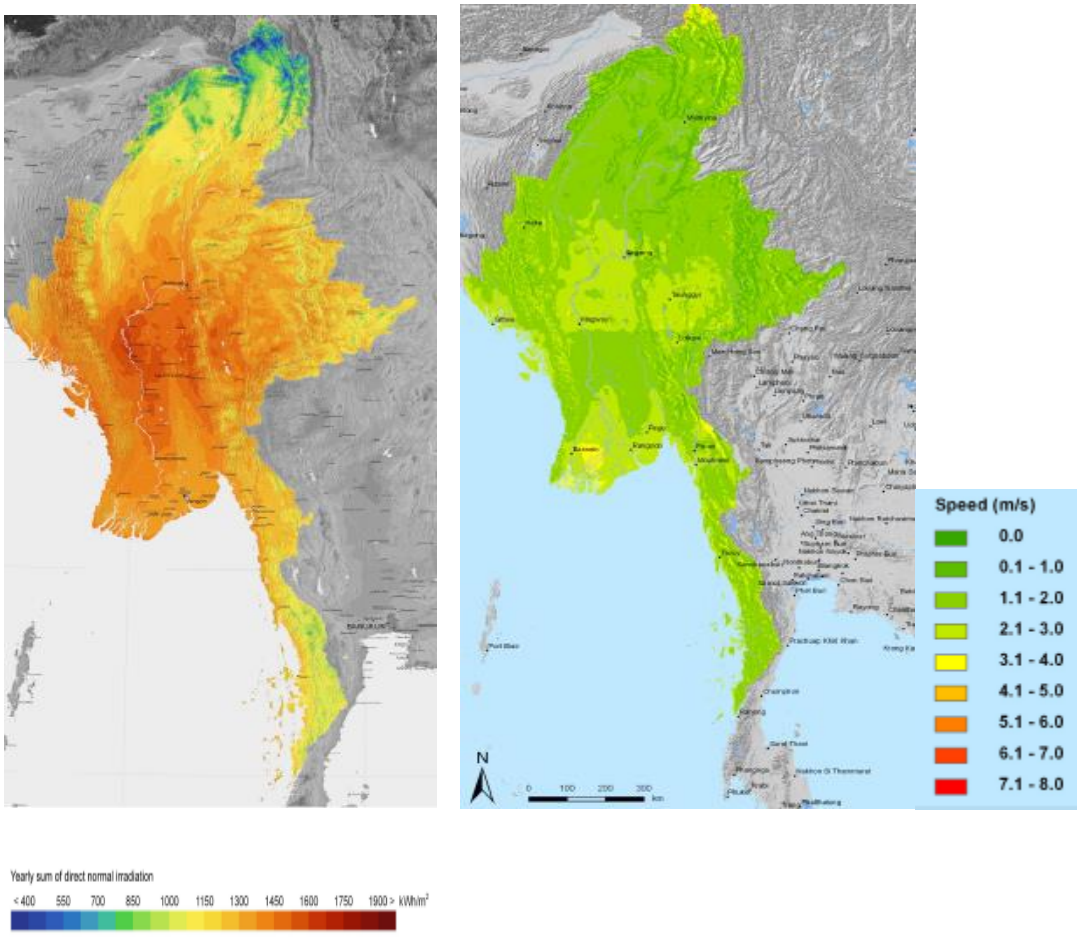
Renewable resources analysis

A proper analysis of Myanmar's renewable resources needs to be completed before implementing any green technology solutions. ESCOs and TowerCos must have a good understanding of all available green resources in the country.

Solar and wind

Solar radiation and wind speed data will be easy to collect from the local government or from the private sector in some countries. International researchers, such as NASA, Solargis or 3tier[4], have also developed these banks of data. In Myanmar, there are no solar and wind database available at the moment.

Figure 6: Solar radiation and wind speed map in Myanmar[5]



[4] NASA (https://eosweb.larc.nasa.gov), Solargis (http://solargis.info/imaps), 3tier (www.3tier.com)

[5] 3tier – www.3tier.com

Solar is one of the most recognised and available source of clean energy around the globe. The average solar radiation in Myanmar is about 5 kWh/sq.m/day during the dry season, and its exploitation of solar energy is still at a very early stage and limited to rural electrification project in the country. But nowadays, a lot of organisations (i.e. ADB, NGO) and the government are introducing and encouraging private sector organisations to adopt solar solutions.

For wind speed, the average wind speed in Myanmar is low, between 1-3 m/s in most of the country, but in some coastal areas the wind speed can reach up to 3-4 m/s. Therefore, the uptake of wind technology has been slow to date.

Hydro

The potential and feasibility of adopting pico hydropower has yet to be explored for Myanmar's telecom sector. This solution really depends on tower sites being located near a river flow area, but Myanmar itself has a hydropower potential of around 100,000 MW.

Hydropower presents its own challenges to be implemented in the telecom network, requiring notably significant CAPEX investment as well as the costs of O&M. However, all challenges can be reduced by involving the community surrounding a tower location.

TowerCos and ESCOs can share their excess of energy and sell it to community and at the same time give O&M jobs to local technicians in these communities.

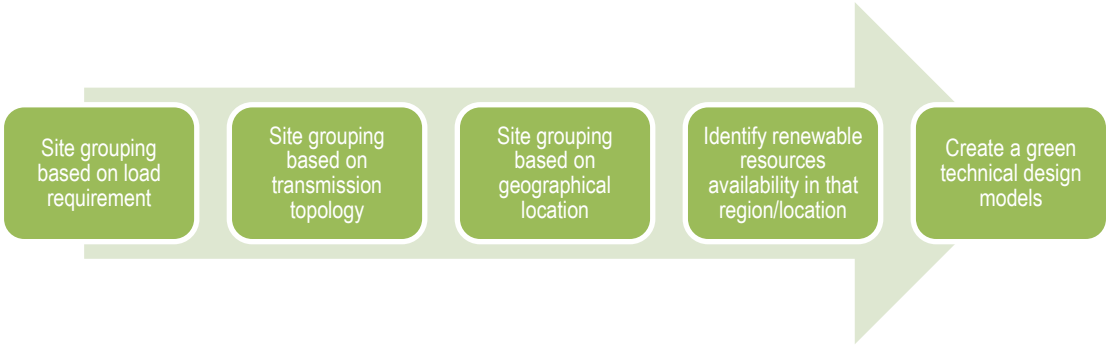
Other resources

The other green technology options are biomass and fuel cells. More than 50% of the total land area of Myanmar is forested. This creates an opportunity for biomass, based on crop residues (or even based on rice husks). Biomass based on animal waste presents another option as a fuel.

Fuel cell technology could be a suitable clean energy source, provided that methanol or hydrogen supplies are available in Myanmar. The technology has a low noise contribution and is well adapted to unreliable grid conditions as a backup system. A trial is needed to prove the feasibility of using fuel cell power for the telecom sector in Myanmar.

Site design and modelling

Figure 7: Site design and modelling process



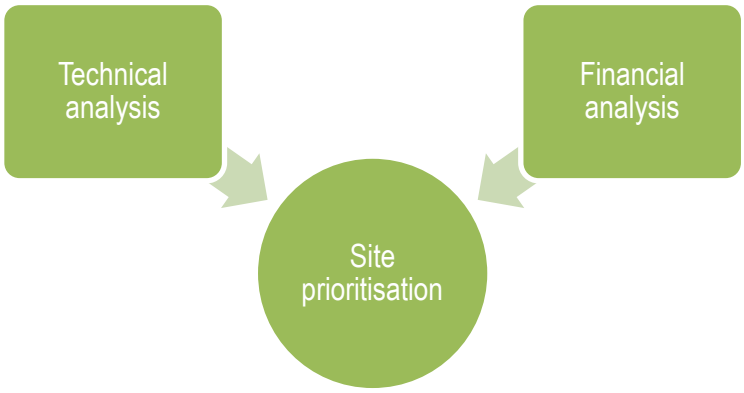
Once the site categorisation and the renewable resources analysis have been completed, the next step is to design and create a greens site model. This site modelling will depend on technical requirements, an available green resources technology selection and site location. Each model design has to present a technical and financial feasibility.

In this document, GPM outlines how to model a site, using HOMER software from the National Renewable Energy Laboratory (NREL).

Site prioritisation

Site prioritisation will be considered after the modelling and technical design of a green power solution. The prioritisation process is a combination of two activities: technical and financial perspectives.

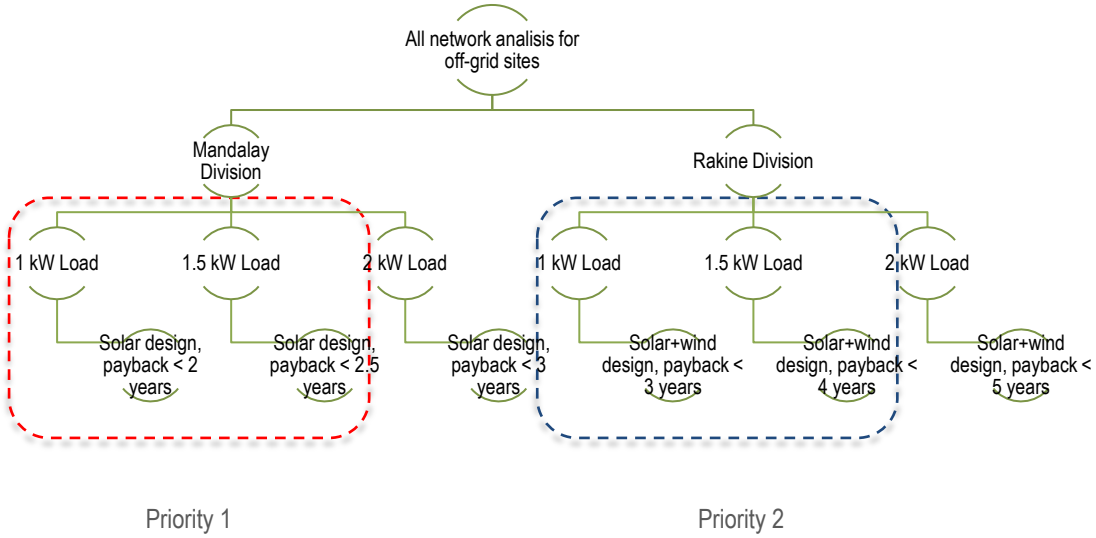
Figure 8: Site prioritisation process



The technical analysis plays an important role here, especially in selecting a green technology solution and for the load analysis. The technical analysis will consider space availability and community power if ESCOs or TowerCos want to sell their excess of energy to the community surrounding the tower site. The technical analysis also will consider power requirements in the next six months to accommodate network expansion and network traffic.

In the financial analysis, one key indicator is Return on Investment (ROI). The focus is to determine which of several solutions offer the fastest repayment rate in order to recommend the implementation of one specific green technology solution.

Figure 9: Example of site prioritisation



Based on the example above, the Mandalay Division is prioritised, first because it gives a better payback period compared with the same site load in the Rakhine Division, which becomes the next target in terms of priority. Figure 9 serves as an illustrative example of the final step of the site selection process.

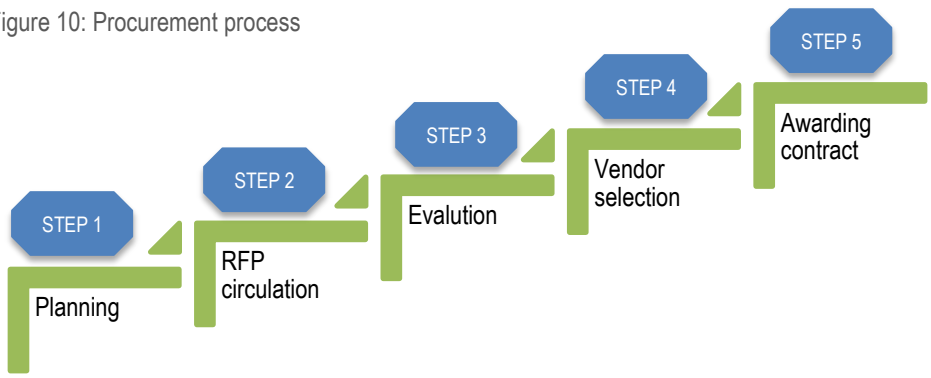
By completing a site prioritisation, ESCO/TowerCos will be able to give a real technical design proposal based on economic considerations.

Green procurement

Green procurement means purchasing goods or services that cause minimal adverse environmental impacts. The only difference between normal procurement and green procurement is that environmental and social considerations are taken into account while procuring the solution.

Procurement process

Figure 10: Procurement process



Step 1 – Planning

Demand and supply planning is necessary in the supply chain and procurement process. It is to ensure the availability of goods or services to support the project and at the same time maintains the company's CAPEX cash flow.

Step 2 – RFP circulation

The 'Request for Proposal' (RFP) is a document that aims to get any response/proposal from the supplier/vendor based on technical requirements, local support, warranty and post-warrant support. The RFP also needs to include financial and legal aspects to let the supplier/vendor understand its obligations.

Step 3 – Evaluation

An evaluation mechanism is needed after receiving a feedback from the supplier /vendor. The evaluation matrix needs to accommodate all the requirements of RFP with a proper scoring methodology so that it will be easy to compare one supplier/vendor with the others.

Table 1: Evaluation matrix

No	Vendor name	Requirement 1	Requirement 2	……..	Requirement n	Total
1	Vendor 1	1	0	……..	1	2
2	Vendor 2	1	1	……..	1	3
3	……..	……..	……..	……..	……..	……..
4	Vendor n	0	0	……..	1	1

Note: 1: Compliance, 0: No Compliance

So according to the example in Table 1, Vendor 2 has complied with all criteria and got the highest score during evaluation.

Step 4 – Vendor selection

Based on the evaluation and analysis of each proposals, the procurement team will work together with the procurement committee to select a 'winner' for a contract. The procurement committee will consist of representatives from the technical, legal and finance departments, or from any related department.

Step 5 – Awarding contract

This is the final stage of the procurement process. The contract will be given to the party that has been chosen by procurement committee based on the results of the evaluation matrix.

Different procurement models

In acquiring a good/product, an MNO has two options as to which business model to use, based on financial scheme.

1. CAPEX or in-house model
2. OPEX or outsourcing model

The table below differentiates, from an MNO's perspective, the ownership between CAPEX and OPEX business models.

Table 2: The ownership

Activity	CAPEX model	OPEX model
Power system assets	MNO	ESCO/TowerCo
Power system engineering	MNO	ESCO/TowerCo
O&M	3rd Party	ESCO/TowerCo
Site refuelling	MNO	ESCO/TowerCo
Site monitoring	MNO	ESCO/TowerCo
Site security	TowerCo	ESCO/TowerCo

CAPEX model

The in-house or CAPEX model requires a huge investment from the MNO to implement a renewable energy solution, but at the same time the MNO will get a significant saving through the initiative. The CAPEX model is the most recognised model to acquire the solution from a vendor/supplier. One of the key elements of this model is warranty and post-warranty support from the supplier/vendor to ensure the availability of spare parts.

The figure below describes the CAPEX model's process flow from the MNO/TowerCo's point of view. The process may vary from one company to another.

Figure 11: CAPEX model: Process flow

Process	MNO/TowerCo	Vendor

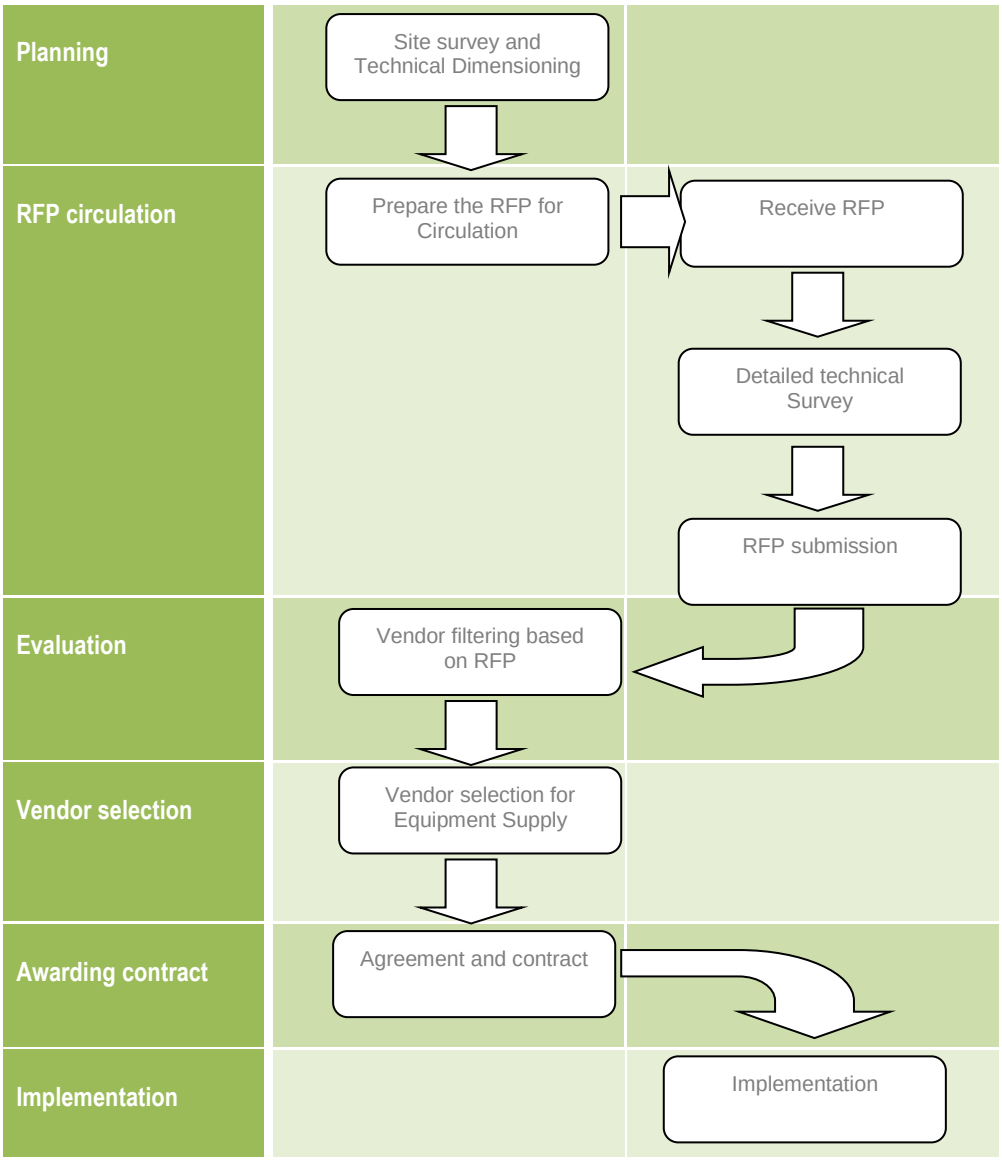


Table 3: CAPEX model: Process descriptions

Process	MNO/TowerCo	Supplier/vendor
Planning	The MNO/TowerCo needs to define its technical requirements by conducting technical site survey and write it into the RFP.	
RFP circulation	The RFP must consist of technical and non-technical requirements and should be circulated to all vendors at the same time.	The vendor/supplier needs to clarify any unclear requests and responds to it according to the timeline. The vendor and supplier must make

	The RFP has to put a deadline for response to the proposal.	sure that all SLAs and KPIs will be achievable and measurable.
Evaluation	All responses must be addressed to the procurement department, and procurement will filter based on all criteria and do a negotiation.	
Vendor selection	A procurement committee that consists of multiple parties from technical to finance departments will review and select a winner from the tender bids.	
Awarding contract	The legal department will prepare a contract based on the scope of work and SLA/KPI inside the RFP or based on final negotiation.	The vendor needs to ensure the contract will be based on the last negotiation.
Implementation	The technical and supply chain department supervises the implementation process and does a proper handover.	The vendor needs to implement its solution according to an agreed timeline from MNO/TowerCo.

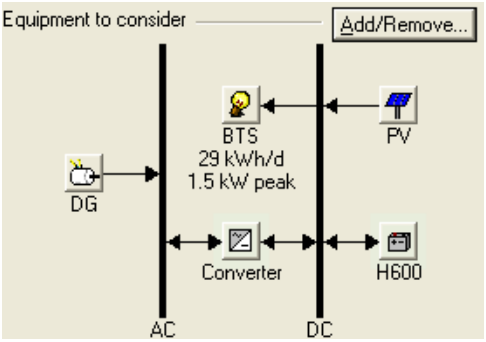
Sample CAPEX model

To give a better understanding of the CAPEX model, GPM has developed an example of technical design and dimensioning based on the following assumptions:

- 1.2 kW load design for a new site between Yangon to Naw Phi Taw
- DG capacity is 15 kVA
- Diesel price is around US$1.2/L (including transportation)
- A renewable design will be based on PV solution

The design will use HOMER and it will look as follows:

Figure 12: CAPEX model: HOMER design



	PV (kW)	DG (kW)	H600	Conv. (kW)	Initial Capital	Operating Cost ($/yr)	Total NPC	COE ($/kWh)	Ren. Frac.	Diesel (L)	DG (hrs)
	6.50	12	48	12	$ 46,530	2,781	$ 62,245	1.052	0.82	747	204

The results are shown in Table 4, below:

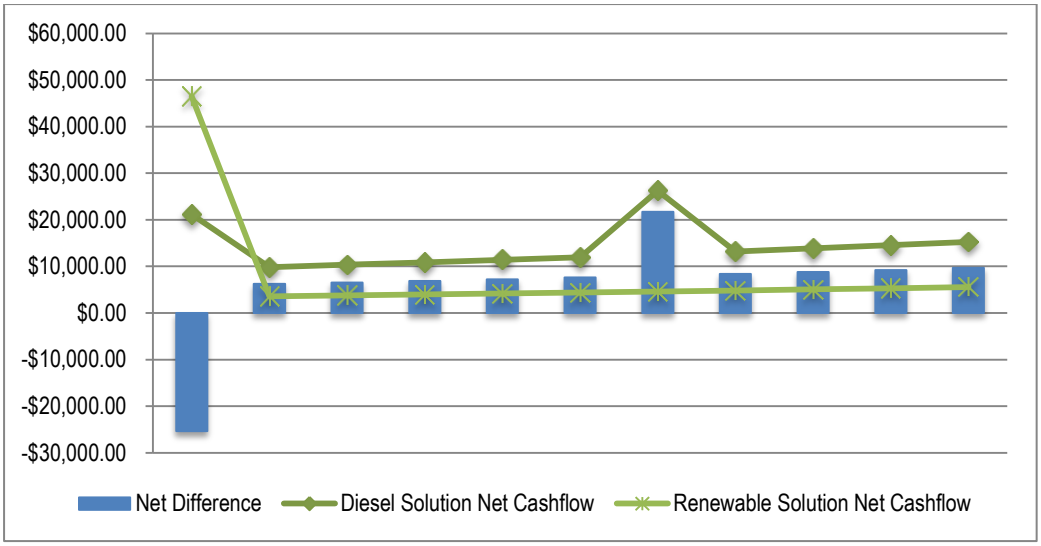
Table 4: CAPEX model: HOMER result

System	1.2 kW	
Site	Off-grid	
PV	6.5 kW	
DG	15 kVA	
Rectifier	4*2kW	
Battery	2*600Ah	
CAPEX	US$46,530	
Excess electricity	4.61%	
Power contribution	PV	82%
	DG	18%
DG	RH per year	204 hr
	Fuel consumption	747 L
Battery	Capacity	2*600 Ah
	Autonomy	33.7 hr

The number of CAPEX can be reduced by decreasing the number of battery strings, but it will have an impact on battery autonomy and life cycle.

CAPEX model cash flow

Figure 13: Diesel solution versus Solar solution cash flow



The cash flow diagram above shows a ripple on diesel-based solution due to battery replacement costs. Below is the financial summary based on a solar solution against a diesel solution.

Table 5: Financial summary for CAPEX model

Payback (year)	**2.75**
ROI	**36.4%**
IRR	**29.40%**
Discount rate	**15%**

OPEX model

The desire to develop the telecom market in Myanmar also creates the opportunity to develop the energy sector to support the burgeoning telecom industry. MNOs have realised that they will face a big challenge in extending their network in Myanmar due to the limitations of grid connectivity in most parts of the country.

Energy outsourcing offers an alternative solution for MNOs to tackle the power issue in Myanmar. At the moment, a few energy-outsourcing companies have introduced their solutions and business models, but nothing has yet actually been implemented.

This section provides an overview of the energy outsourcing business model, and examples of three different business models:

1. Monthly flat fee model
2. Power purchase agreement (PPA) model
3. Energy saving agreement (ESA) model

Figure 14: OPEX model: Process flow

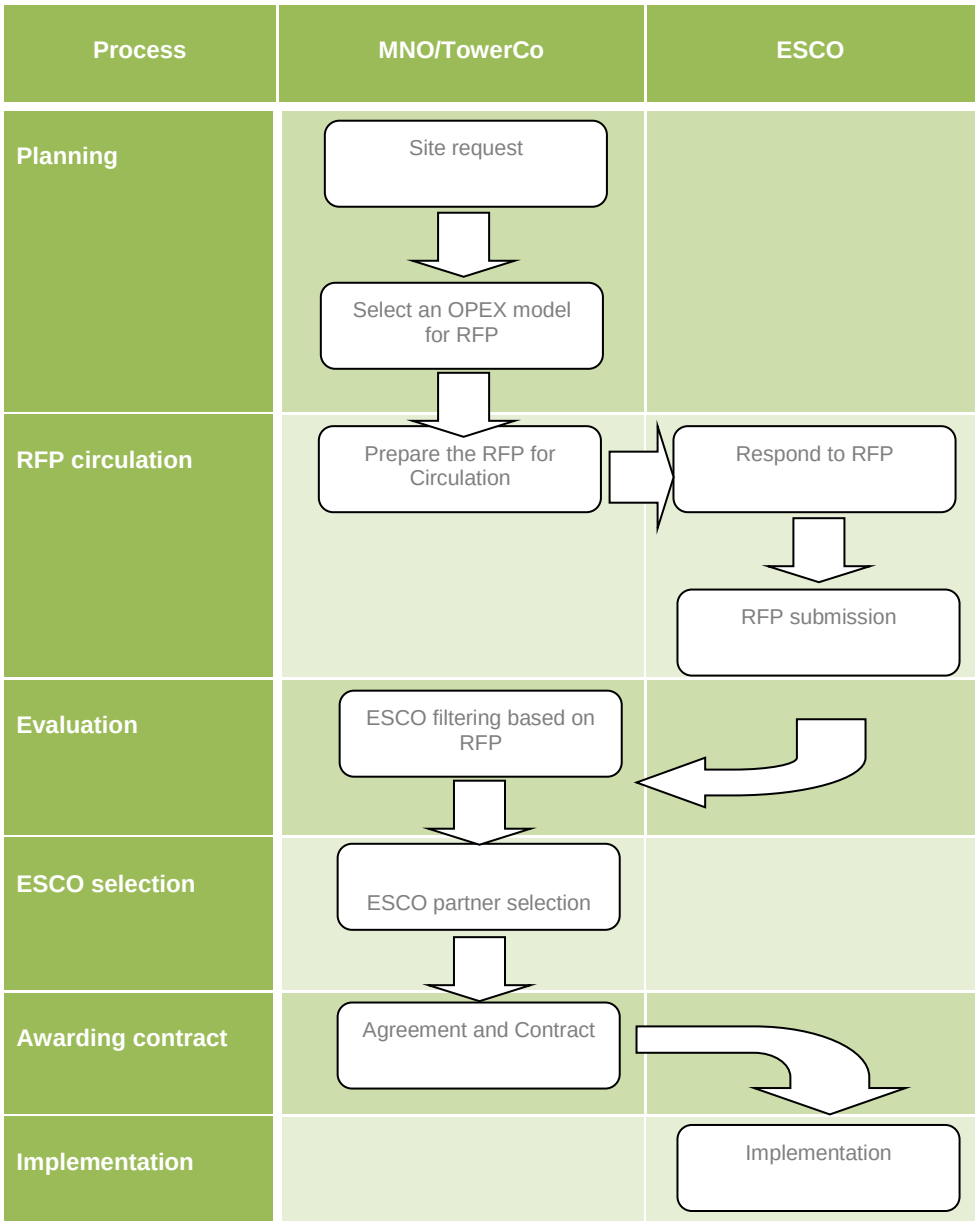


Table 6: OPEX model: Process description

Process	MNO/TowerCo	ESCO
Planning	On RFP preparation, the MNO/TowerCo has to define energy outsourcing business model along with technical requirements.	
RFP circulation	MNO/TowerCo needs to define a clustering methodology inside the RFP document and SLA/KPI for	ESCO needs to prepare its quotation based on financial model and site clustering.

	ESCO.	
Evaluation	All feedback from supplier needs to filter to one department and be collected, based on a deadline submission date inside the RFP.	
ESCO Selection	The ESCO will be selected based on their offered technical and financial solution.	
Awarding contract	Once the selection is made, the final process is the award of a contract to the ESCO.	The ESCO needs to check all SLA/KPI points and penalties before signing a contract.
Implementation	The implementation will be full of The ESCO will have full responsibility for the implementation of the deployment.	The ESCO needs to ensure on implementation will be met the target date.

The OPEX model is a long-term commitment between the MNO and TowerCo/ESCO. The MNO needs to select the right partner to get power services for its base stations; one of the criteria for selection is that the TowerCo/ESCO has strong technical team support as well as a good financial background.

Another key factor in the OPEX model is a site clustering methodology, because clustering the sites will help the TowerCo/ESCO with maintenance and quicker response times to deal with any failure in the network.

The remainder of this section will give an example of multiple cash flows from different OPEX business models, and will describe potential savings that can be achieved by MNOs by shifting the power management responsibility to TowerCo/ESCO.

Monthly flat fee model

A monthly flat fee model is a simple way to buy the energy for an MNO from the TowerCo/ESCO. The MNO will have a fixed OPEX cost and the TowerCo/ESCO will be able to easily control its income from its energy outsourcing business. This model will give a minimum window power consumption commitment between two parties and any consumption beyond the commitment will be charged separately.

A challenge for this model is its susceptibility to any fluctuation in diesel prices that can impact to a TowerCo/ESCO's ROI. This is a real problem in countries such as Myanmar. The other challenge in running the

energy outsourcing business model is that the TowerCo/ESCO has to control the site environment by installing a power monitoring system.

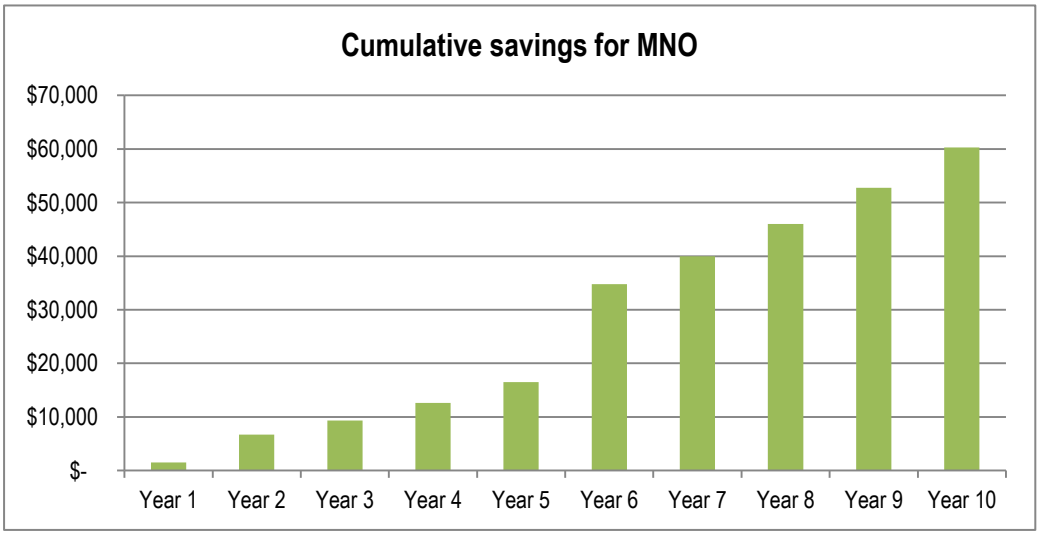
The power monitoring system will provide real time data to identify the feasibility for TowerCos/ESCOs to convert their sites. At the same time, it will provide performance data for each individual power equipment, particularly regarding power and fuel consumption data, so that TowerCos/ESCOs will be able to secure their business case by monitoring the system.

Sample OPEX model: Monthly flat fee

Table 7: Monthly flat fee: Cash flow

	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
MNO cash flow		$15,617	$12,515	$15,617	$15,617	$15,617	$15,617	$15,617	$15,617	$15,617	$15,617
ESCO cash flow	-$13,959	-$10,386	-$10,431	-$10,478	-$10,528	-$10,579	-$10,634	-$10,691	-$10,751	-$10,814	-$10,880
ESCO gross profit	**-$13,959**	**$5,231**	**$2,084**	**$5,139**	**$5,090**	**$5,038**	**$4,983**	**$4,926**	**$4,866**	**$4,803**	**$4,737**

Figure 15: Monthly flat fee: Cumulative saving for MNO



The payback for a TowerCo/ESCO based on flat fee model is less than five years, with an implied margin of 30% where the MNO needs to pay around US$1,042 in monthly basis.

The cumulative saving that the MNO can achieve per year as shown in Figure 15. The MNO will achieve about US$60,000 in ten years' operation time.

PPA model

The PPA model is just like a pay-as-you-go basis business model. The MNO will pay the TowerCo/ESCO for its power per kWh, based on real consumption. The PPA will give the MNO the flexibility it needs to expand its network, but it will be difficult for the TowerCo/ESCO to cater to the MNO's demand without proper planning and design.

The PPA model also comes with its own challenges. One of the challenges is to set a fixed price per kWh during the agreed duration of the contract, such as eight or ten years. The TowerCo/ESCO has to carefully calculate the price using its business plan before making a price offer to the MNO, taking into account those variable factors, such as inflation rate, discount rate or diesel price, that can impact on the TowerCo/ESCOs daily operational costs.

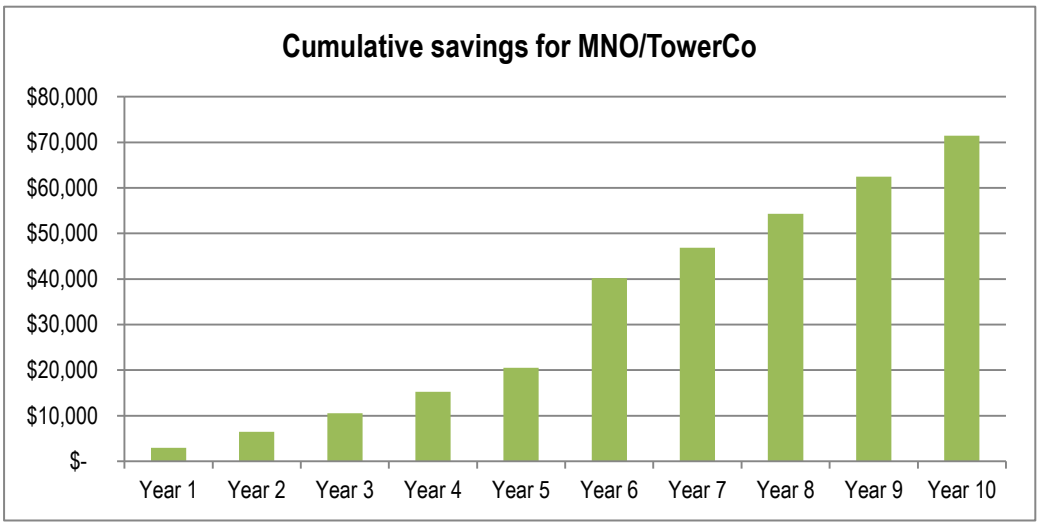
In terms of technical design, the TowerCo/ESCO has to build a 10-20% buffer, based on current power requirements, into its model to anticipate additional power demands from an MNO over a short-term period.

Sample OPEX model: Power purchase agreement (PPA)

Table 8: PPA: Cash flow

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Power Requirement	10,512	10,512	10,512	10,512	10,512	10,512	10,512	10,512	10,512	10,512
MNO Cash Flow	$14,191	$14,191	$14,191	$14,191	$14,191	$14,191	$14,191	$14,191	$14,191	$14,191

Figure 16: PPA: Cumulative saving for MNO



The PPA model differs slightly from the flat fee model, where the TowerCo/ESCO will charge the MNO on a per kWh basis, and the TowerCo/ESCO will define its payback period by defining the price for the MNO.

ESA model

The ESA business model is applicable to live networks, whereby the MNO is looking for better running costs to improve OPEX saving. The ESA model will be based on the MNO's initial power consumption; then the TowerCo/ESCO will look to find a better solution to power up its base station and make savings compared with the usual consumption and cost. The saving will be shared between the TowerCo/ESCO and MNO.

A challenge facing this model is the need to have accurate data on each site's existing power consumption before raising a RFP for tender because, without previous OPEX records, this model will be hard for TowerCo/ESCOs to

implement. However, a power management record can resolve this issue, if it has been implemented since the start of the tower's operations.

This model will not be active in Myanmar any time soon. It still needs data to be collected from live networks, and observations made on energy efficiency too.

Operation and maintenance guide

This section gives a guide to the general practice of O&M in the telecom sector, which can then be adapted as required for energy providers, without going into a detailed step-by step procedure

Definition

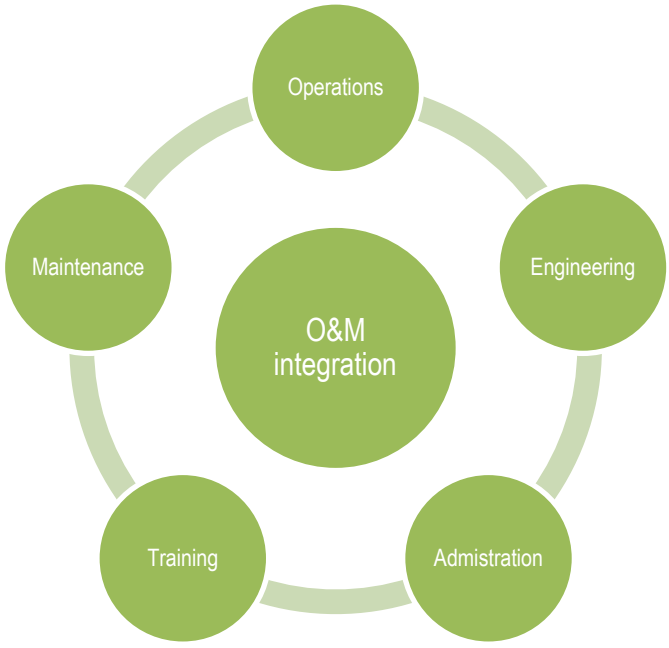
'Operation and maintenance' are the decisions and actions taken regarding the control and upkeep of property and equipment. There are inclusive, but not limited to, the following:

1. Action focused on scheduling, procedures, and work/system optimisation
2. Performance of routine, preventive, predictive, scheduled and unscheduled actions aimed at preventing equipment failure or decline, with the goal of increasing efficiency, reliability and safety

In the energy outsourcing business, good maintenance practices can generate substantial energy savings as well as reduce man-hours needed for maintenance.

O&M management is a critical component for the ESCO/TowerCo. The management function should bind the distinct parts of the programme into a cohesive entity. The programme should contain five very distinct functions making up the organisation: operation, maintenance, engineering, training and administration (OMETA).

Figure 17: OMETA[6]



[6] Pacific Northwest National laboratory – www.pnl.gov

The activities

Five well-defined elements of an effective O&M programme is found in R.J. Meador's *Maintaining the Solution to Operations and Maintenance Efficiency Improvement* (1995). The key to success in O&M lies in the collaboration between functional parts of the organisation, and the linkages between departments. This guideline describes how OMETA can be implemented in ESCO.

Operations

Control and monitoring are key activities in any operation. The ESCO/TowerCo needs to make sure that its equipment is up and running to provide power to the base station. The network monitoring centre (NOC) is responsible for the first level of monitoring. The NOC will not only monitor the status of equipment but will also ensure the equipment is running properly according to its functionality to provide the power.

What should the NOC use to ensure its activities are carried out properly?

1. A real-time monitoring system
2. A trouble ticketing (TT) system
3. A performance historical database
4. A fixed line or mobile connection to follow up if any alarm is raised

A monitoring system is mandatory for the NOC, to ensure 24/7 visibility of the network and to prevent any vandalism that might be happening to the network's assets. To escalate and log any historical incident, the NOC needs to implement a TT system which is able to track any alarm and its solution time to guarantee the ESCO/TowerCo meets the terms of the service level agreement (SLA) agreed with its customers.

The NOC will need a performance system database to improve a site's performance based on previous historical data, and the performance system will give exact data on each equipment's behaviour.

Maintenance

To keep equipment running properly, maintenance is needed to prevent any unexpected service interruption. The ESCO/TowerCo will assign this activity to a first-line maintenance team (usually called the field maintenance team). There are three different kinds of activities in maintenance:

1. Preventive maintenance: this maintenance is scheduled maintenance where, based on a calendar schedule or on the number of hours which a machine has been operating for, the field maintenance team will go to a site to detect and mitigate degradation of a system. The preventive maintenance will be defined on a weekly, bi-weekly, monthly, quarterly or yearly basis.
2. Predictive maintenance/Planned maintenance: a planned activity occurs when there is an indication that there might be a failure of equipment, so as to prevent an outage in the near future.
3. Corrective maintenance: A first action that the ESCO/TowerCo can take is to restore the current service to their customer. The corrective maintenance aims to bring the equipment back to a normal condition.

Engineering support

Engineering support aims to ensure the effective implementation and control of technical support. Engineering support will perform monitoring activities that optimise equipment reliability and efficiency. Any modifications on existing design will need approval from this department.

Engineering support also develops processes and procedures for the field maintenance team for the safe operation of the equipment.

Training

New product training is a mandatory activity to achieve operational excellence. An MNO/TowerCo needs to train its engineers, with both technical and non-technical training. Table 9 gives some examples of training that engineers might require to support their daily activities.

Table 9: Training

Technical training	Non technical training
Mechanical and electrical design and planning	Tower climbing
Power system O&M	First aid
	Safety training

Administration

Administration plays an important role here, to ensure a sustainable operation and maintenance activity for ESCOs and TowerCos. The administrative function does not only take care of financial issues but also looks after asset management, policies and resources management.

On asset management, administration needs to handle asset turnover and record it by implementing a proper warehouse management system in addition, deploying such a policy will help ESCO/TowerCos to maintain the standard and regularity of each process within the company.

Personnel planning and qualification management are part of resources management. The resources management department needs to ensure that highly qualified individuals will fill every position in the company. The administration department will monitor industrial safety standards for all employees to ensure a high degree of personnel and public safety within the company.

Quality measurement

Regarding quality measurement, O&M no longer focuses solely on a single organisation metric, such as reliability or maintenance. It has expanded its role to also encompass activities such as controlling costs, implementing a new technology to increase reliability, tracking and reporting of health and safety issues etc.

Every maintenance contract always comes with some measurement metric to control its activity. The purpose of the measurement metric is basically so that the ESCO/TowerCo maintains its level of maintenance quality. Tables 10 and 11, below, are an example of tracking and benchmarking for the energy outsourcing business model.

Table 10: Sample service level agreement (SLA)

Severity	Target	Response time	Resolution time	Communication
Minor	> 99.00%	< 8 hours	< 24 hours	Email/Call
Major	> 98.00%	< 30 minutes	< 6 hours	Call
Critical	> 99.00%	< 15 minutes	< 4 hours	Call

Note: The definition of severity may vary

Table 11: Sample key performance indicator (KPI)

Key performance	Variable and equation	Benchmark
Service availability	$\% = 1 - \frac{Total\ hours\ downtime}{Total\ hours\ in\ service}$	> 96%
Preventive maintenance completion rate	$\% = \frac{Total\ maintenance\ completed}{Total\ maintenance\ scheduled} \times 100\%$	> 98%
Critical alarm completion rate	$\% = \frac{Total\ resolution\ time\ of\ critical\ alarm\ solved\ <4hours}{Total\ of\ critical\ alarm} \times 100\%$	> 99%

Note: The benchmark will depend on corporate strategy

Conclusion

MNOs are still searching to find the right business model for purchasing power solutions, because they have realised that power will be one of the bottlenecks to the expansion of their networks in Myanmar. The pace of competition to get new subscribers will be the main driver to extend their coverage and capacity.

Relying on fossil energy will not be a good option for MNOs, with the challenge of fuel theft during delivery or operation. At the same time, running the CAPEX business model will put huge pressure on an MNO's capital where there is a possibility of theft or accident on some sites.

Therefore, MNOs have to identify an alternative solution, namely acquiring power supply by engaging an ESCO. The ESCO will take on all responsibilities from the MNO in exchange for a fee. The ESCO can secure the power supply with certain agreed SLA/KPIs.

Based on Myanmar's market analysis report, there is a significant saving opportunity for MNOs by engaging with to 3rd party ESCO for the provision of their energy. The savings will amount to US$79 million in OPEX every year by 2017. For an ESCO, the market potential will amount to an annual revenue of US$157 million per year, with an investment of US$466 million by 2017.

Myanmar's telecom market needs to find ESCO partners which will support the OPEX model that provides strong technical and financial opportunities.

About the GSM Association
The GSMA represents the interests of mobile operators worldwide. Spanning more than 220 countries, the GSMA unites nearly 800 of the world's mobile operators with 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in industry sectors such as financial services, healthcare, media, transport and utilities. The GSMA also produces industry-leading events such as Mobile World Congress and Mobile Asia Expo.

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Whilst it continues to serve mobile network operators globally, the programme will place key focus on a number of target markets in Africa and Asia including Indonesia, Bangladesh, Pakistan, Afghanistan, Nigeria, Ghana, Kenya, Tanzania, Uganda, Senegal and Cameroon. With Project Managers based in each of these regions, GPM is well positioned to engage with the industry and address the requirements of these markets.

For more information on the GSMA's Green Power for Mobile Programme, please contact us on greenpower@gsma.com

http://www.gsma.com/mobilefordevelopment/programmes/green-power-for-mobile