



WORLD BANK GROUP

# **TECHNICAL ADVISORY GROUP REPORT TO THE CONSULTATIVE GROUP ON THE ENERGY TRUST FUND PROGRAMS: ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAM**

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# CONTENTS

ABBREVIATIONS.....	i
FOREWORD.....	ii
EXECUTIVE SUMMARY.....	iii
1  SUMMARY OF RECOMMENDATIONS.....	1
2  RESPONSES TO LAST TAG REPORT.....	3
2.1 Financial and Performance Reporting.....	3
2.2 Risk Management.....	3
2.3 Geospatial Planning.....	3
2.4 Energy Sector Wide Assessments.....	3
2.5 Subsidy Reform and Tariffs.....	4
2.6 Technical Integration of Renewables.....	4
2.7 Utility and Sector Reform.....	4
2.8 Communications.....	4
3  CONTEXT.....	5
3.1 Progress towards SDG Goals.....	5
3.2 Energy Disruption.....	5
3.3 Sector Governance.....	7
3.4 The Reform Agenda.....	7
3.5 Markets, Planning and Uncertainty.....	8
4  FUNDING & PRIORITISATION.....	10
5  CONTROL PROCESSES (M&E).....	11
5.1 Economy, Efficiency and Effectiveness.....	11
5.2 ESMAP's Role in Maximizing Finance /Cascade Approach.....	12
5.3 ESMAP Independent Review.....	13
6  SEFORALL KNOWLEDGE HUB.....	15
7  GOVERNANCE, PLANNING, & MARKETS.....	16
7.1 Application of ABGs.....	16
7.2 Current and Planned ABG Activities.....	18
7.3 Power Sector Reform.....	19
7.4 Utility Viability and the Future of the Utility.....	20
7.5 The Market Problem.....	22
7.6 Regional Power Markets.....	24
7.7 Utility Benchmarking.....	25
8  ENERGY SUBSIDY REFORM.....	26
8.1 Fossil Fuels.....	26
8.2 Power Sector.....	26
9  ENERGY ACCESS.....	29
9.1 Mini-Grids.....	30
9.2 Urban Poor and Displaced.....	32
9.3 Clean Cooking and Heating.....	33
10  RENEWABLE ENERGY.....	39
10.1 Global Geothermal Development Plan.....	40

10.2	Renewable Energy Resource Mapping: .....	41
10.3	VRE Grid Integration .....	43
10.4	Solar Scale-Up Program .....	45
10.5	General .....	46
11	ENERGY EFFICIENCY: EFFICIENT BUILDINGS & ENERGY EFFICIENT CITIES .....	48
12	GENDER EQUALITY .....	50
13	COMMUNICATIONS & KNOWLEDGE .....	52

# ABBREVIATIONS

ABG	Annual Block Grant	IOT	Internet of Things
ADALY	Averted Disability Adjusted Life Years	IPP	Independent Power Producer
AfDB	African Development Bank	IRENA	International Renewable Energy Agency
AFR	Africa Region	LAC	Latin America and Caribbean Region
BLEN	Biofuels, LPG, Electricity & Natural Gas	LPG	Liquefied Petroleum Gas
BO	Build-Own	M&E	Monitoring and Evaluation
BP	Business Plan	MENA	Middle East and North Africa Region
BOT	Build-Own-Transfer	MTF	Multi-Tier Framework
CEM	Clean Energy Ministerial	NCD	Non-Communicable Disease
CEO	Chief Executive Officer	NDC	Nationally Determined Contributions
CGAP	Consultative Group to Assist the Poor	NREL	National Renewable Energy Laboratory
CIFF	Children's Investment Fund Foundation	OECD	Organization for Economic Cooperation and Development
CSP	Concentrated Solar Power	PAYG	Pay-As-You-Go
DFI	Development Finance Institution	RBF	Results Based Financing
DFID	Department for International Development (UK)	PPA	Power Purchase Agreement
DPL	Development Policy Lending	PPIAF	Public-Private Infrastructure Advisory Facility
DTU	Technical University of Denmark	PPP	Public-Private Partnership
EAP	East Asia Pacific Region	PSP	Private Sector Participation
EAS	Energy Assessment and Strategy	PV	Photo Voltaic
ECA	Europe and Central Asia Region	RISE	Regulatory Indicators for Sustainable Energy
ECOWAS	Economic Community of West African States	SAFE	Safe Access to Fuel and Energy
ESMAP	Energy Sector Management Assistance Program	SAR	South Asia Region
FIT	Feed-In-Tariff	SEAR	State of Energy Access Report
FY	Fiscal Year	SDG	Sustainable Development Goal
GCF	Green Climate Fund	SIDS	Small Island Developing States
GGDP	Global Geothermal Development Plan	SEforALL	Sustainable Energy for All
GP	Global Practice	SOE	State-Owned Enterprise
GRM	Grant Reporting and Monitoring	TA	Technical Assistance
GSEP	Global Sustainable Electricity Partnership	TAG	Technical Advisory Group
GTF	Global Tracking Framework	UN	United Nations
HAPIT	Household Air Pollution Intervention Tool	UNHCR	United Nations High Commission for Refugees
IDA	International Development Association	VRE	Variable Renewable Energy
IEA	International Energy Agency	WB	World Bank
IFC	International Finance Corporation	WHO	World Health Organisation
IGA	International Geothermal Association		

All currency in United States dollars (USD or US\$), unless otherwise indicated.

# FOREWORD

- i. This report has been prepared by the Technical Advisory Group composed of **Budak Dilli**, Senior Energy Adviser (Turkey); **John Heath**, Independent Consultant and Team Leader, East Africa Geothermal Energy Facility (UK); and **Richenda Van Leeuwen**, Chair of International Institutions for the Global LPG Partnership (USA).
- ii. This year, in response to feedback from the Consultative Group in 2017, rather than providing an overview of ESMAP's entire portfolio, TAG are taking up a number of themes included within the FY2017-20 Business Plan for evaluation and discussion within this report. TAG has used certain key publications from ESMAP as well as the in-depth briefings and presentations provided by the ESMAP team. TAG would like to thank the ESMAP management and team for an intensive, robust week of in-depth and dynamic discussions in January 2018 and notes the high level of preparedness and quality of presentations that had clearly gone into the preparations to meet TAG. Additionally, TAG members benefited from inclusion in the Knowledge Exchange Forum in November 2017, hosted by ESMAP and DFID in London.

# EXECUTIVE SUMMARY

- iii. This year's TAG report focuses on several key areas of ESMAP activities. While TAG recognizes that these are not the only ESMAP priority areas, this year TAG's review considers a number of current and emerging issues within the energy sector, within the framework of the broader context of ESMAP's larger portfolio, the Bank's overall goals and existing and anticipated donor support. It does so, offering a number of recommendations in the areas it has reviewed, while recognizing the overall strength of ESMAP's ongoing work and continuing contributions to the Bank and key areas pertinent to the global energy sector.
- iv. A considerable achievement of ESMAP has been to convert sector and country activities and specialist expertise into “global” interventions that can contribute to poverty reduction and climate change mitigation with much reduced donor support. This represents an efficiency gain that individual donor programs cannot readily achieve. Examples include the SEforALL target measurement process, the Global Solar and Wind Atlases and other “products” that are moving into a position of enabling policies and investment to meet global targets without as much direct support. TAG fully supports this strategy and comments in the report on other emerging and nascent opportunities that can follow this path.
- v. Given the constraints on funding TAG recognises the decisions on the allocation of grants as fair in the circumstances. TAG recommends that ESMAP records for donors the activities that are not approved for grants so that there is a broad understanding of the demand not met, the reasons for prioritisation and the implications for Bank lending. This would be additional to the front loading of grant allocations which highlights the potential squeeze in the second half of the business plan.
- vi. TAG notes in the report particular areas where additional funding would be beneficial. On a wider scale it is considered that clean cooking will require significant additional funds if SEforALL targets are to be reached, while energy efficiency demand could grow exponentially as lower income countries become engaged. This raises the possibility of separate funding for these activities, or even a separate trust fund. On energy efficiency the fund could have specific targets of facilitating commercial lending schemes and private sector investment.
- vii. TAG notes the balance of activities between middle income and low-income countries. Although the balance of funding is moving towards sub Saharan Africa it is right that certain interventions are initially focused in middle income countries where change can be leveraged through commercial finance or where there is greater opportunity to manage the necessary changes. Examples are energy efficiency and subsidy reform. Products developed in middle income countries can be transferred to low income countries. In addition, the climate change agenda necessitates action across Asia, where fossil fuel use is most embedded.
- viii. With the “coming of age” of renewables which are now factored into energy planning in almost all countries and are increasingly competitive with other sources, ESMAP expertise that originated in the facilitation of renewables can now be used readily in the wider energy sector. This can help rectify weaknesses in key sector processes, such as tariff and subsidy strategies, system planning and operations, regional trading, power procurement and risk management. In particular, the VRE integration sub-program in Renewables can be developed further in the way suggested in the 2017 report. This program can provide a more complete service, which can be a key element in delivering better governance, planning and markets through the ABG process.

- ix. Utility reform and re-definition remains a key issue in sub Saharan Africa, in particular. ESMAP products such as geospatial planning as updated in the last year and the tariff and subsidy analysis framework are critical in helping to change the view of what the utility can and should do in future. This will have significant implications for traditional Bank lending for grid extension.

# 1 | SUMMARY OF RECOMMENDATIONS

1. In order to stay within budget, demand is being constrained by way of preliminary discussions with Bank Global Programs and by informal screening within ESMAP. It is recommended that ESMAP teams record instances of where demand cannot be met and the reasoning behind prioritisation as information for both the Bank Global Programs and donors.
2. TAG does not suggest making changes to the measure of effectiveness, but it is likely that the data used in the internal GRM reports is as yet somewhat inconsistent with the information in the Portfolio Report. In the longer term the M&E team may wish to look at clarifying the form of leverage reported in line with the analysis in the report.
3. TAG notes that one key area missing in the overall portfolio of SEforALL reports is a SEAR related to cooking access. While ESMAP together with the Global Alliance for Clean Cookstoves co-authored a state of clean cooking report in 2015, it has been three years since it was updated. Given the continuing need to promote clean cooking and particularly given further research results providing more clarity in the evidence base in the last several years around those solutions that can drive the most impact at household level as well as ESMAP's own base of evidence and experience, TAG recommends development of an SEAR for cooking. It would make sense were this to be developed together with WHO (since they have the lead for SDG7 measurement on cooking access) to highlight issue areas pertaining to health outcomes.
4. It is noted that the requirements of the Africa region on sector viability relate primarily to operational management and least cost planning. While these are important issues they represent only part of the viability problem of grid utilities. ESMAP clearly offers a wider level of service based around its expertise on tariffs and subsidies, system planning and operations, and now markets. In addition, ESMAP could help in moving country utilities from just least cost planning into risk orientated power procurement as a step in reducing the level of risk allocated to weak distribution utilities. TAG also reiterates the point made in the 2017 report that the viability of utilities may be better protected by increasing off-grid supplies relative to grid extension, something not addressed in conventional least cost planning studies.
5. TAG noted that there is significant demand for ESMAP services on the technical integration of variable renewables, and that this demand in reality is moving into a general requirement for support on system planning and operations where advances in developed countries have been slow to filter through to developing countries. In line with last year's TAG report, this is considered to be an area where ESMAP can make a greater contribution, and a linkage with market expertise is critical in ensuring a more efficient and commercial outcome for client countries of the Bank.
6. TAG recommends that ESMAP considers a change in the focus of VRE Integration from Renewables to a more general planning and markets capability within the next year. It would encourage donors to consider support to this activity as an enabler of greater reliability, risk management and efficiency within the energy sector.
7. TAG notes that subsidy reform is an area which is currently fully funded and where the expertise can play a larger role in Bank projects. It supports the progress made in the methodology. Wherever utility

viability is an issue impeding progress in a country the expertise in this team can assist in identifying many of the steps required to improve the sector's performance.

8. TAG believes that ESMAP expertise in system planning and markets can contribute to a better understanding of the opportunities and benefits of regional power trading beyond bulk power transfers as these projects are developed through the Bank.
9. It is noted that hydropower is a major theme for Bank regions. TAG considers that ESMAP's best contribution at this stage would be in supporting the analysis of hydro projects based on their role and value within current and future wholesale electricity markets at both country and regional level. This would go beyond the initial evaluation of bulk movement of electricity and cover also how hydropower with storage can fill the gap in the market for flexible generation that can meet the challenges of intermittency in other renewables.
10. TAG recommends that ESMAP enhances its efforts in energy storage, together with the IFC and in its own operations. In the short term, storage may merit its own activity if funds can be found, until its cost and value are clear in the market and the activity could then be absorbed into planning and markets, while noting its relevance to mini-grids and more broadly in energy access as well.
11. A Bank led initiative to develop utility benchmarking in each region could become an ESMAP product as a means of addressing the endemic problem of non-viable utilities in some regions. As a product it would have the advantage of being readily transferred to the private sector in due course. It is suggested that a standardised benchmarking process would be more durable than repeated interventions.
12. There is a trend for demand side participation to merge with more conventional energy services and energy efficiency activities. Some form of demand side participation can be considered wherever there is sufficient transparency regarding marginal power prices. TAG recommends that ESMAP considers the opportunities that are available through cooperation between the energy efficiency team and the expertise in markets and planning.
13. TAG recommends where feasible connecting with other existing bodies of work that look at gender and energy and continuing to partner to share best practices.

## 2| RESPONSES TO LAST TAG REPORT

14. In the course of the review the TAG members noted a number of areas where ESMAP has developed its products, its thinking and its processes in a manner consistent with the recommendations in the 2017 TAG report.

### 2.1 FINANCIAL AND PERFORMANCE REPORTING

15. TAG sought greater clarity in the presentation of financial and performance measures and it considers that there has been significant progress in this area. As a consequence, the TAG members have undertaken less financial analysis for this year's report as this would only replicate ESMAP's own reports.

### 2.2 RISK MANAGEMENT

16. TAG welcomes the progress made on activity risk management in the last year. The GRM (Grant Reporting and Monitoring) system has been implemented and all reports were made available to the TAG. Understandably perhaps the quality of the reports in the first year is not consistent in terms of the definition of outputs and the contribution to Bank and activity goals. No doubt there will be refinements and improvements in the process in the current year, so that ongoing accountability for interim deliverables and final outputs and results is more clearly demonstrated. There appears to be some concern regarding the bureaucracy involved, and some simplification of the format may be possible. However, this form of reporting would be typical in comparable organisations in both the private and public sectors.

### 2.3 GEOSPATIAL PLANNING

17. TAG welcomes the development in the geospatial planning tool of alternative scenarios that begin to take account of the risk that increasing access by way of grid extension may not be viable given the level of demand and tariffs in any one country, and given the changing economics of off-grid options. The enhancements cover in particular the issue of low demand, and the consequence—depending on the decisions made by any one country—would be to reduce the number of new grid connections while leaving more of the market to the off-grid sector. This clearly includes mini-grids that may eventually be interconnected to the central grid in certain instances.
18. In any one country there would be a need to take account of actual and planned tariffs and any form of economic regulation that might allow subsidies and cross subsidies that would also maintain the viability of the utility. Beyond the geospatial planning outcomes, any plans for grid extension should be commensurate with the financial and management capability of the utility that would be tasked with delivering and maintaining the new connections.

### 2.4 ENERGY SECTOR WIDE ASSESSMENTS

19. TAG notes that the South Asia Region has utilised the concept of a sector wide assessment (Energy Assessment and Strategy – EAS) as a means of directing future Bank funding for each of its countries, as it planned last year. This is consistent with TAG recommendations to strengthen coordination through integrated ESMAP analysis of individual countries.

## 2.5 SUBSIDY REFORM AND TARIFFS

20. TAG recommended that the subsidy reform and tariff activity could make a greater contribution to the understanding of the problems in countries with failing utilities, beyond the tariffs and subsidy issues alone. It is noted that the Subsidy Reform Team is actively upgrading its analysis product to incorporate these wider issues. It remains a challenge as to how to market this approach within the Bank so that country teams can see its value. The fact that tariff and subsidy issues cannot be viewed in isolation from all the other elements of energy sector improvement (e.g., planning and markets, utility reform, energy efficiency) means that the activity can complement ESMAP's work under all its other work-streams. In addition, energy subsidy reform is a key element of the enabling framework for energy transition. Specifically, cost reflective pricing creates incentives for conservation/energy efficiency; removing fossil fuel subsidies levels the playing field for renewables; subsidy reform or removal also frees up fiscal resources that can go towards priority sector spending (reliability, access); and it enhances the financial viability of utilities, permitting them to raise commercial financing and break their reliance on Government funding.

## 2.6 TECHNICAL INTEGRATION OF RENEWABLES

21. TAG welcomes the appointment of an electricity markets specialist in to ESMAP and this is in line with the recommendation that the technical integration activity is linked with commercial integration and risk management.

## 2.7 UTILITY AND SECTOR REFORM

22. TAG notes the progress made with funding through the ABG stream on the review of energy sector reforms. At this stage the analysis is inevitably backward looking – why has the sector reform process failed or stalled in some countries even though it has broadly succeeded, especially in Asia and Latin America. In general, it would seem that an institutional framework alone will not deliver sustainable progress if certain processes assumed to be in the framework are either missing or inadequate.
23. While this work is in progress it will be desirable for the Bank and ESMAP to pursue activities that improve the performance of utilities and sectors in countries as requested. The entry point to address the issue is always likely to be the service and financial failure of utilities, especially the distribution sector, with Finance or Energy Ministries the typical client. A reiteration of the traditional institutional reform approach is unlikely to succeed as vested and political interests know how to manipulate these reforms, and another bout of institutional change is unlikely to address existing problems with key processes.

## 2.8 COMMUNICATIONS

24. TAG welcomes the clarity in the strengthening of the ESMAP brand and its value in line with its recommendation in the 2017 Report.

### 3.1 PROGRESS TOWARDS SDG GOALS

25. The work of ESMAP continues to be guided by broad contributions to help foster progress towards achievement of the Sustainable Development Goals, in particular SDG7 on energy, as well as addressing climate change, as outlined in county Nationally Determined Contributions (NDCs). ESMAP continues to focus on low income countries. As outlined in the annual report:
- “41% of its active portfolio in FY2017 focused on International Development Association (IDA) countries”
26. The annual report also outlined how Africa remains a focus, with just over one quarter of the portfolio (56 of 218 activities) and 37% of the funding (\$45 million of \$123 million). It was also the largest portfolio in new approvals in FY2017.
27. The achievement of SDG7, with the focus on delivering energy access in particular to underserved areas is sometimes seen as at odds with a focus of climate change mitigation activities, given that sub-Saharan Africa is not a large CO<sub>2</sub> emitting region. TAG believes that ESMAP is currently balancing the differing needs and priorities well, recognizing that donor priorities differ in this regard, while all are looking towards the goal of sustainable energy in a lower carbon context. The challenge comes when funding is constrained. TAG does not see a need at this stage in the Business Plan to guide ESMAP or its donors to choose climate change over energy access or vice versa: while there may at times be difficult choices around individual countries or projects, it is clear that renewable energy solutions and energy efficiency measures are needed across the board. Indeed, there is growing evidence that countries are taking full account of renewable energy in their planning as clean energy sources become increasingly competitive with fossil fuels. Renewables will drive the growth in off-grid and distributed electricity, and the cost and development speed of solar in particular makes it attractive for on-grid system planning, subject to the management of intermittency. In addition, at grid level hydropower with storage can represent the most economical solution to balancing variability and intermittency.
28. Where ESMAP can further enhance its existing work is strengthening its cross-sector goal delivery: water shortages, for example are coming into play in Southern Africa acutely and the role of renewable energy solutions for e.g., desalination as well as renewable energy combined with appropriate water conservation measures (e.g., solar drip irrigation where suitable) can be looked at holistically. The same is true in the use of solar power in energy access at community level where more focus can be made on agricultural improvements through the use of solar enabled technologies like solar milling machines that can improve local productivity and retain more revenue at community level (rather than middlemen). Additionally, a strong focus on pursuing improved health outcomes from the adoption of clean cooking solutions would be an appropriate focus.

### 3.2 ENERGY DISRUPTION

29. The economics of the sector has changed rapidly over the last two to three years, and the wind, solar and even geothermal sectors have claimed that they are now competitive with other energy sources. As was evident from the presentation to the ESMAP Knowledge Exchange Forum in London by the Chilean representative, it is now possible to undertake an informed power procurement process that is neutral

to energy source and technology and see competitive participation by renewables, especially solar. A number of factors are important in understanding what is happening:

- In Chile solar was competitive despite the fact that it had to bid in under firm contractual obligations to supply. The generator has to meet balancing requirements caused by intermittency of supply, either through storage or by calling on supplies to the balancing market from gas fired generation.
- This is thought to be the first clear example of variable renewables not having either overt subsidies or hidden subsidies through despatch rights that leave other market players to meet the costs of handling intermittency. It is noted that in Turkey the regulator has begun to tackle the same issue by capping the despatch rights.
- The Chilean model depends on the existence of the wholesale balancing market, and the overall wholesale market is not blocked out by long term PPAs—indeed there is a risk of shortfall in secure capacity.
- The procurement strategy in Chile has clear risk allocations, with every generator forced to take on the contractual obligation to supply, while the risk of oversupply (contract cover over 100% at certain times) is shared between distributors through the introduction of single buyer procurement (and presumably as a matter of policy and regulation passed through to customers).
- Off-grid solar can be fully competitive, and customers can be given the choice between grid and off-grid supply. In East Africa customers are taking advantage of this choice even where grid supply is subsidised at connection and tariff levels.
- Previously agreed grid extensions may not just prove to be loss making because of low demand and tariffs that do not reflect even operating costs (especially where demand is at peak); they may—depending on the context—become somewhat redundant, as customers choose off-grid options from the market.
- In Kenya (as an example) distributed solar is competitive against current industrial and commercial tariffs (which subsidise residential tariffs), placing the utility in competition with solar providers.

30. A number of other more general consequences of this trend have been observed:

- Generation developers are looking to manage their risks by seeking out smaller projects that can fit more readily with the uncertainties of demand and the changing economics of supply. Their requirement is increasingly that they should be able to buy from viable distribution utilities, rather than competing for the level of sovereign guarantee that can be made available under political or fiscal constraints.
- Distribution utilities are facing increased risk when their existing level of risk is already not covered by policy or regulation in many countries. Either costs of supply could rise or demand could fall below expectations.

- The absence of even basic wholesale and balancing markets (or even basic cost transparency to aid decision making) through the failures of institutional reform mean that risk management capability is reduced to unacceptable levels.
- Central planning of grid and off-grid development does not reflect risks and market changes and uncertainty. The risk of unrecovered generation costs in weak utilities is increased. There is a lack of the risk based power procurement strategy of the type demonstrated by Chile.
- While lower off-grid supply costs will increase the number of households that can afford access to energy, this does not resolve the issue of supply to the poorest. Public sector interventions to support the poorest therefore need to be designed carefully to minimize commercial market distortions.
- Some form of basic wholesale market structure in grid supply will become necessary to enable effective system operations and economic management of multiple energy sources.

### 3.3 SECTOR GOVERNANCE

31. Good governance in the energy sector, especially good corporate governance in State-owned enterprises (SOEs) and utilities is a key factor in improving economic efficiency as well as investor confidence, which is vital for private investment. If countries are to get the full benefit of global capital markets, and in order to obtain sustainable results from ESMAP work in all fields, corporate governance arrangements should be credible and follow internationally accepted principles.
32. Objectives for state ownership, their role in market places, autonomy, equitable treatment, transparency, independence of regulators, government interventions to the markets, appointment procedures and other measures are the issues related to governance. In this context, OECD principles on good governance and, specifically, The OECD guidelines on Corporate Governance on State Owned Enterprises provide a global benchmark for SOE governance. Otherwise, no matter how good the market design, or how much funding is allocated for ESMAP technical assistance and capacity building, how much WB lending is raised, the desired result cannot be achieved. If it is achieved it will be temporary and cannot be sustained. Without market-driven principles, energy suppliers will remain under political and bureaucratic control and fail to reach commercial standards in management practices, financial performance, and the pricing of products and services. Governance issues will be more important as technology disruption influences markets and utilities.

### 3.4 THE REFORM AGENDA

33. ESMAP technical assistance has played an important role in reforms for designing and implementing regulatory and institutional frameworks and for the establishment of efficient competitive electricity and gas markets. This helps to create the enabling environment for private sector participation.
34. There are significant differences between countries in pursuing sector reform. In general, the reform in developing countries lags behind what has been implemented in the developed world. However, there are differences among developing countries. Geography, system size, income level and political attributes have important influence.<sup>1</sup> Although reform aims and main principles are the same, there is

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<sup>1</sup> WORKING PAPER, WB Energy and Extractives Group “Charting the Diffusion of Power Sector Reform across the Developing World” by Vivien Foster, Samantha Witte, Sudeshna Banerjee and Alejandro Moreno.

no standard prescription applicable for all countries. The conditions at the starting point and priorities are different. Due to these differences, the root causes for the problems encountered should be carefully assessed. The road map for sequencing the reform, the transitional measures during implementation and implementation of different elements of reform should be carefully designed. Furthermore, TAG notes that, in some countries there have been reversals, distortions and market failures. There are a lot of lessons learned from past and ongoing reform implementation. In this context the ESMAP project "Rethinking Power Sector Reform" will be a valuable guide for countries and WB/ESMAP teams in their efforts in client countries.

35. In designing the institutional and regulatory framework, individual country characteristics should be taken into account. For example, it is questionable whether full vertical unbundling is necessary for a small country. Furthermore, it is also questionable whether wholesale competition is possible with only one or two generation entities within the sector.
36. The stages from monopolistic structure to full retail competition should be carefully planned. Attempts to open the market to private generation generally involve introduction of single buyer models as an intermediary step. In this model, a state owned single buyer purchases power from private generation companies and sells to the distribution /retail companies. However, there may be cases in which the power purchase and concession agreements between private party and the single buyer are badly designed. This leaves all the risks to single buyer, imposing take or pay obligations and inflexible power delivery conditions, with expensive purchasing price. It may have two implications:
  1. If the PPP model is not implemented carefully and with sound planning, and if the private companies are not selected through competitive tenders, the result would be worse. Instead of continuing the reform process, countries revert to a monopolistic structure due to political opposition and unexpected costs arising from the PPAs.
  2. Those assets will be stranded assets and may hinder competition in the market if the country tries to implement a competitive wholesale market structure.
37. Regarding Private Sector Participation in the distribution sector, there is sufficient evidence that, without clear and effective regulation, cost reflective tariff mechanisms and good sector governance which provides investor confidence, private capital cannot be attracted. Even if the distribution assets are privatized, there will be reversals and legal problems. On the other hand, if there are no performance standards, monitoring tools and mechanisms, the desired outcomes cannot be obtained.

### **3.5 MARKETS, PLANNING AND UNCERTAINTY**

38. Electricity generation from renewables will initiate many important changes in system operation rules and techniques. However, at the same time distributed renewable generation embedded in distribution and transmission system, smart grid operations, new market players, new electricity trading platforms etc. will necessitate new market rules and new market models. The current market designs may not support the shift to a disaggregated, flexible power system without significant adaptations.
39. The share of renewables is increasing. As part of the incentive mechanisms electricity generation from renewable sources is generally delivered to consumers without any constraints (must run generation-dispatch priority). However, this will have implications for power markets, especially on balancing markets and ancillary service procurement. The volume subject to competition in the wholesale markets will decrease. If renewable energy is dispatched automatically and delivered to the consumers directly, will it be a new single buyer model where suppliers are renewable generators and the single buyer is the

system or market operator? How can the interests of customers and distributors be reflected in centrally controlled and severely constrained markets? Utilities need to understand the transformation and position themselves according to the conditions of tomorrow's markets.

40. Even though the share of renewables will be increased, this increase will be gradual. At least for the medium term the need for conventional power generation technologies will not disappear. New investments in "baseload" and flexible (mid merit) generation will be needed for a reliable supply. Some countries are implementing "capacity mechanisms" to keep reliable and baseload generation alive. How will such administrative mechanisms be implemented without distorting wholesale electricity trading?
41. It is a general observation that modelling and planning capacity in most developing countries is weak. However, planning is necessary for the system expansion, security of supply, efficient use of resources, renewable integration and investment decisions. Strategic long-term planning is needed to direct the sector and ensure sustainable development. The contribution of ESMAP to this issue will be significant. For this reason, TAG welcomes the establishment of a planning group at ESMAP.
42. The purpose and expected outputs of planning is changing as the power sector environment changes. In monopolistic vertically integrated sector structures, optimum generation expansion plans are prepared and generation investments are programmed according to this plan and its results will be an input to transmission expansion plans. However, with the introduction of PSP and liberalization, it will be indicative for private Independent Power Producer (IPP) investments. Rather than aiming for compulsory generation expansion, it should provide information about future demand and possible use of primary sources of generation according to energy policy targets. It should analyze different scenarios and provide information about the risks and opportunities for investors. Demand projections provided by governments are generally optimistic and indicate the targets. Realistic demand projections are necessary in order to decrease risks. Furthermore, variable and intermittent renewable integration necessitates careful planning to ensure power system reliability and security. In order to achieve this, power system planning tools should also be capable of simulating the short-term generation dispatch, so that the influence of targeted renewable generation can be assessed.
43. In order to plan action plans for climate change mitigation and energy efficiency, integrated primary energy demand projection and supply planning is necessary. Such plans should not only cover the power system but also primary energy demand (gross or final energy consumption) for all sectors, and should enable the determination of CO<sub>2</sub> emissions. Implementation of plans should not be simply deterministic; there are substantial risks on both the supply and demand sides, with increasing disruption and also opportunities relating to demand and the role of customers in the market.

## 4 | FUNDING & PRIORITISATION

44. The 2017 to 2020 Business Plan is based on a funding level of \$215m, while committed funding to date stands at \$153m. Grant allocations have therefore been adjusted downwards across ESMAP programs taking account of earmarked funding and demand. Demand for ESMAP services exceeds the funded supply in all areas except Subsidy Reform and Efficient Buildings. In order to stay within budget, demand is being constrained by way of preliminary discussions with Bank Global Programs and by informal screening within ESMAP. It is recommended that ESMAP teams record instances where demand cannot be met and the reasoning behind prioritisation as information for both the Bank Global Programs and donors.
45. TAG recognizes the importance of the need for donors to continue the provision of support without earmarks to the extent possible, which gives management the flexibility to allocate funds where they are most needed in a given funding cycle. Donors are encouraged to make additional commitments as early as possible to support management in key resource allocation decision making, particularly regarding areas that are already experiencing funding pressure due to the level of demand for ESMAP services. In this report a case is made to ensure full funding for governance, markets and planning, renewable energy (solar in particular) and for energy access, with the latter especially focused on activities in Africa. But this is not intended to imply that other areas of ESMAP work are less deserving of full funding for this business cycle.
46. ESMAP could consider co-convening a roundtable on some key issue areas within energy access with existing and potential donors, working closely to convene a core prospective donor group of non-traditional donors (e.g., co-hosted by Rockefeller Foundation) and help to pitch ESMAP's capabilities and key issue areas to such a group. Having an existing donor like Rockefeller Foundation convene and explain their rationale around support to ESMAP's work on mini-grids could help to bring other donors to the table. It is not especially well understood in the broader philanthropic community why the Bank would need funding from foundations, or entry points. The potential for co-financing with private foundations can also be explored further on certain projects/issue areas. This would be intended to supplement rather than replace bilateral donor support, and to maximise engagement in key areas.

## 5| CONTROL PROCESSES (M&E)

47. A question raised for TAG is the extent to which ESMAP's work should be directly prioritized around proposals that lead to lending versus those that are clearly important/future oriented but may take several years for fruition. TAG's response would be to balance these needs where possible, especially when the latter are related to innovative areas of work or study that may become important lending opportunities in future. ESMAP cannot measure its success simply by stating exactly how much Bank funding has been "leveraged" and rightly focuses more on how it has "informed" Bank lending. At the same time, measurement of direct impact at ground level in terms of lives improved by a given Bank project is not a strong proxy for ESMAP contribution. It does not provide insights into the exact role ESMAP may have played in a given project's impact, unless it is clear that the project would not have happened at all but for ESMAP, given challenges around attribution.
48. It is the assessment of TAG that the existing approach, including the key metrics around informing Bank projects provides useful insights into the level of support and impact its work continues to have, when combined with other measures such as internal Bank feedback, feedback from donors and key stakeholders and external reviews such as those provided by TAG. TAG recognizes the additional work around transparency of operations which has been undertaken, including the development and launch of the [esmap.org/activities](http://esmap.org/activities) website database which provides summaries of activities and lending related to ESMAP work, useful both for donors and for the general public to gain a better understanding of ESMAP operations. TAG does note the importance for staff internal to ESMAP to be held accountable to complete Grant Reporting and Monitoring Reports (GRMs) appropriately and in a timely way in order to release funds, in accordance with the strengthened focus in this area. It was also reassuring to hear from the M&E team how they have been focused on enhanced monitoring and that submission of GRMs has been strengthened in the last year.
49. The TAG team reviewed the internal GRM reports for current and recently completed activities. These documents represent an improvement in the control and risk management process as they allow activity managers and reviewers in ESMAP to obtain clarity on progress against both expected outputs and deliverables. They also provide benchmarks for progress against impacts such as Bank lending and private sector leverage assumptions.
50. Given that this was the first year of operating this control process, it is not surprising that the quality of the reports varied, and ratings and definitions differed. TAG concluded that more detailed analysis in this report is not, however, warranted at this stage. TAG anticipates that the process will be refined so that ratings and definitions are standardised, and it should be possible to simplify the format.
51. The 2017 TAG report accepted that an improved control and risk management process could be seen as bureaucratic, but the reporting represents a significant step forward in aligning ESMAP controls to those existing in comparable public and private sector organisations. As the M&E team further develop the reporting, TAG members would be happy to provide more detailed suggestions.

### 5.1 ECONOMY, EFFICIENCY AND EFFECTIVENESS

52. TAG recognises that ESMAP is perhaps uniquely placed in being able to convert its advisory activities into products that can be utilised outside the multilateral and donor funding mechanisms to help countries and enterprises develop their own programmes and solutions. The development of these global products inevitably takes up resources, but it also represents significant efficiency in that it

prevents a situation in which there is simply an endless sequence of requests for the same support. This is especially important in areas such as energy efficiency where there can never be enough money to deal with every potential country and city. It also allows ESMAP to target a position when it can pull out of a programme even if demand is particularly high, because the product is generally available. Products that are reaching this point include the solar and wind atlases and the framework for off-grid solar. TAG therefore strongly supports ESMAP's approach to efficiency, and looks forward to seeing when ESMAP can move these products substantially outside donor funding. It is recognised that products such as the global wind and solar atlases may require limited ongoing support.

53. In terms of effectiveness the measure adopted for the current ESMAP business plan is the leverage of Bank funding, defined as the value of Bank projects informed by ESMAP. The leverage for FY2017 was reported to donors in the Portfolio Report. Leverage of other funds is identified where possible in internal reports, but the data is not used in overall reporting as it cannot be confirmed, especially when private sector investment is involved.
54. TAG reviewed a sample of internal GRM reports on activities and examined specific reports relating to leverage reported in the Portfolio Report and this analysis identified three forms of leverage:
1. The ESMAP activity was part of a specific Bank project and the full value of the project is treated as leverage. This can lead to high reported levels of leverage where ESMAP carries out a relatively minor part of the project, for example contributing a small \$60k study on cycle use to a \$625m urban transport project. In other cases, the linkage was much clearer while the level of leverage was of course lower.
  2. The ESMAP study provides the basis for the design of a World Bank project.
  3. The EMAP study is independent of any Bank project, but identifies the basis for a Bank project, or in the case of certain ESMAP products, a number of Bank projects.
55. It is anticipated that this inconsistency will be removed in future years.
56. TAG does not suggest making changes to the measure of effectiveness, but it is likely that the data used in the internal GRM reports is, as yet, somewhat inconsistent with the information in the Portfolio Report. In the longer term the M&E team may wish to look at clarifying the form of leverage reported in line with the analysis above.

## 5.2 ESMAP'S ROLE IN MAXIMIZING FINANCE /CASCADE APPROACH

57. In order to achieve the ambitious goals for sustainable development, it is necessary to channel more private sources. To help generate the needed flows -domestic public resources and private finance; the necessary steps are:
- Explore increasing available financial resources
  - Expand policy guidance and technical assistance for domestic resource mobilization and spending
  - Promote and catalyze private investment
  - Support international action on global/regional development issues
  - Further improve coordination and alignment

58. The Cascade Approach first seeks to mobilize commercial finance, enabled by upstream reforms where necessary to address market failures and other constraints to private sector investment at the country and sector level. Where risks remain high, the priority will be to apply guarantees and risk-sharing instruments. Only where market solutions are not possible through sector reform and risk mitigation would official and public resources be applied
59. ESMAP's role in this approach starts from assessment of the actual needs and challenges in the counties and regions. Technical assistance, capacity building and knowledge dissemination activities are used to create enabling environment for attracting of private capital.
60. Furthermore, if there is not sufficient commercial financing, ESMAP TA helps the countries to use public sources effectively by correct determination of the problems and solutions and by enabling lending from multilateral development banks for the public investments.
61. Therefore, ESMAP have an important role in maximizing finance and implementation of Cascade approach. Especially the work on cross cutting issues such as Governance, Markets, Planning and Energy Access is useful for creation of enabling environment for domestic resource mobilization and promotion of private investment: It is proven that ESMAP's technical assistance work as a part of World Bank's operations leveraged substantial concessional lending. Furthermore, it has been used to leverage private capital in many countries.
62. When assessing the ESMAP's impact on leveraging private capital, it should be noted that, creation of enabling environment needs time and may not create immediate results. Furthermore, Due to rapid and big changes in technology and challenges in socio-political environment, there may be cases where the expected results cannot be achieved. Still, ESMAP should continue its effort and enhance its capacity to adopt itself to technological and political developments. This requires an integrated approach and continuous training for. Identifying and anticipating emerging energy issues, to be ahead of the curve; and. integrating cutting-edge knowledge into World Bank Group policy dialog and operations.
63. In terms of ESMAP programs, some will only succeed if they lead to commercial financing; examples are energy efficiency—where success is entirely dependent on developing country expertise linked to ESMAP products and ESMAP designed, Bank supported commercial financing—and renewables generation—supported by assistance on the enabling environment and products such as the global atlases. Within the energy sector the problem area remains the transmission and distribution sectors, and the latter represents the barrier to more rapid progress in sub Saharan Africa and some other countries. At this stage ESMAP services to the Bank in geospatial planning, subsidy/tariff reform, VRE integration (and as recommended by TAG more widely in system planning and operation and market design and operation) are significant contributors to the analysis, and therefore potentially to development of greater opportunities for private sector participation.

### 5.3 ESMAP INDEPENDENT REVIEW

64. TAG was asked for its view on the timing and content of the independent review, normally scheduled around the middle of the business period.
65. TAG's view is that the timing of the mid plan review should be such as to be completed by December 2019 at the latest, allowing at least 18 months for actions to revise the course of ESMAP. In terms of content the following is suggested:

- The process of moving from identified issues through demand from Global Practices to sustainable knowledge products that can be utilised to deliver impacts with reduced or minimal future donor intervention.
- The operational management process: cost management, delivery of outputs and activities to cost and time, risk management at both program and activity level.
- Alignment of Bank requests to ESMAP with ESMAP objective of influencing Bank activities.
- Review of progress on M&E systems and controls following the introduction of GRM reporting.

66. Given the improved reporting in ESMAP and the availability of internet communications now, it is not clear that the cost of country visits is justified.

## 6 | SEFORALL KNOWLEDGE HUB

67. The SEforALL Knowledge Hub continues to focus on several key reports related to SDG7 as well as Sustainable Energy for All, including the MTF, the GTF, RISE and SEAR (electrification). ESMAP are appropriately launching updated versions of these reports in various global fora, including the upcoming SEforALL conference in Lisbon.
68. TAG notes that one key area missing in the overall portfolio of these deliverables is a SEAR related to cooking access. While ESMAP together with the Global Alliance for Clean Cookstoves co-authored a state of clean cooking report in 2015, it has been three years since it was updated. TAG therefore recommends development of a SEAR for cooking and heating to complement the one on electrification. This would also complement the new iteration of RISE which will be released at the end of 2018 which will include a 15-country pilot on clean cooking. Given the continuing need to promote clean cooking and particularly given further research results providing more clarity in the evidence base in the last several years around those solutions that can drive the most impact at household level as well as ESMAP's own base of evidence and experience, it would make sense were this to be developed together with the WHO (since they have the lead for SDG7 measurement on cooking access). It could valuably include highlights related to issue areas pertaining to health outcomes as well as other related benefits. Suggested focus areas could also include model integrated national policies for clean cooking and heating, examples of fuel solutions that work and how they have been developed and financed across the national or local value chain given the recent renewed focus in that arena. These are outlined in the cooking sector of this report. Examples of what success looks like in the context of stove stacking (moving from utilization of several high emissions fuel solutions to the exclusive use of one or a combination of cleaner and/or clean fuel solutions) and community level solution adoption could also be included. Given the SEAR focus on case studies, this would also be a good way to highlight notable successes from within ESMAP's own portfolio, which may not yet be widely known within the broader development community.
69. Under SDG7 the World Bank is the designated custodian for electrification data and the World Health Organization for data on cooking access. As noted elsewhere in this report, there are some ongoing challenges for ESMAP in terms of full alignment of tracking modalities among different institutions, given the various attributes being tracked. TAG notes that the team seem to have a common sense approach to working within UN interagency mechanisms to address these challenges. It may be possible to refine approaches further, when tracking indicators come up for review in 2020.
70. One key consideration that is not yet being tracked systemically is the relative health impact/benefit of cooking access and the extent to which health improvements are being seen at household levels from the switch to various types of cleaner and clean cooking solutions, although MTF cooking data should help with this, at least in terms of quantitative aspects (e.g., stove type, fuel type, size of cooking area, ventilation etc.) even if perhaps not in terms of qualitative aspects of purchasing behaviour and rationale for certain choices (where they exist).
71. This has been a challenge in the cooking sector given the limited health benefits derived from certain cooking interventions. There has been extensive research conducted on this, with studies showing a range of challenges, especially for the contribution of biomass fuelled solutions. If there is a way for WHO to begin tracking this at household level—with the support of ESMAP (through MTF) especially in its own cooking interventions where such measurements are taking place—this will be a major step forward. This also requires a gendered response, particularly disaggregating health effects specifically

for women and children, since they generally suffer the most in terms of negative health impacts from lack of clean cooking access. It is understood that the MTF can do this, and the team are encouraged to ensure that such gender data analysis is also presented in such a way as to make it accessible to the broader energy access community and to policy makers.

72. TAG notes under SDG7 that while "reliable, affordable and modern" are good political objectives, they are subjective determinants, and lack clarity in how to measure them effectively. The ESMAP approach via the Multi-Tier Framework tracks seven attributes, providing a more holistic picture of the energy access at the household level and at community level. TAG also welcomes the new partnerships that ESMAP is undertaking to help overcome challenges with data accessibility in certain key countries that have not permitted extensive use of their data in the past.
73. TAG further notes, as in prior reports, residual shortcomings within existing global and national tracking systems (not specific to ESMAP) that do not provide sufficient insights into total community level electrification, given the primary focus on household level energy access within existing tracking systems. The MTF, being primarily focused on households, can do more to emphasize ongoing issues as well as capture insights gained through its measurement and analysis around partial lack of access, where the grid exists but still faces high levels of power outages that require the installation of backup systems, particularly in community facilities. It is understood that this will be presented in the next MTF report. The importance of this area is underscored in that high levels of intermittency often result in double costs for institutions that must have reliable power (e.g., hospitals) and require complex backup modalities. This can result in the worst-case scenario in avoidable deaths, when life- saving equipment cannot operate during frequent and prolonged outages.
74. In the experience of TAG members, certain developing countries still do not have sufficiently robust mechanisms to measure the level of electrification even within their own health and educational institutions. The ability to measure the reliability of supply in satellite imagery can be a valuable tool not only to measure reliability of supply, but also to help highlight the need for greater action for electrification especially for critical public sector institutions. ESMAP's continued role—even outside of formal tracking mechanisms—to support this holistic approach is encouraged, alongside approaches to deliver the energy that facilities, especially health care facilities, require.
75. The ongoing work of DFID, the UN Foundation and others on health care electrification could be useful in terms of ongoing engagement with WHO on tracking outcomes.

## 7 | GOVERNANCE, PLANNING, & MARKETS

### 7.1 APPLICATION OF ABGs

76. In order to strengthen sector regulatory and institutional framework, enhance accountability of institutions to deliver quality services, and foster private sector participation in infrastructure projects, ESMAP provides TA to client countries through ABGs. Good governance and fiscal management, sound planning, and well-designed market mechanisms can help countries improve the financial health of their utilities and attract the investment capital needed to develop their energy sectors sustainably.
77. The FY2017-20 business plan envisages using ABGs to:

- Provide advice to governments on appropriate governance mechanisms and performance incentives in legal and regulatory frameworks;
- Provide TA and training to power sector entities and government bodies on effective power system planning techniques, tools and methodologies;
- Provide advice to governments, regulators, and power sector entities on sector reform strategy, market design options, Private Sector Participation models, and regional integration options;
- Provide advice to governments, regulators, and power sector entities on regional integration options.

78. The ABGs are an integral part of regional work programs with allocation managed by the regions' energy sector managers. ABGs are demand driven with no ex-ante thematic allocations. Since use of ABGs is generally demand driven and used in WB lending operations, they have high operational lending impact and play a strong role in facilitating private and other non-Bank investment.

79. Annual Block Grants for Governance, Markets and Planning represented the largest share of the ESMAP portfolio, comprising over 30% of new approvals. From July 1, 2013 to December 31, 2017, a total of \$48.3 million was allocated and \$36.9 million was dispersed for 167 activities related to this area.<sup>2</sup> When the share of activities for the regions is analyzed it is observed that the share of the Africa region (AFR) is the largest, as shown in Figure 7.1. This is in line with the needs and priorities of this region:

**Figure 7.1: Annual Block Grants for Governance, Markets & Planning, July 201 - Dec 2017**



Source: [www.ESMAP.org/Activities](http://www.ESMAP.org/Activities)

80. As explained in FY2017 progress reports and the ESMAP Annual Report:

<sup>2</sup> [www.ESMAP.org/Activities](http://www.ESMAP.org/Activities)

- In FY2017, ESMAP allocated over \$9 million for 44 new activities to help countries improve governance, planning, and market structures in the energy sector. Approximately one third of new activations and nearly half of FY2017 funds are allocated for Africa, which is in line with regional demand and needs.
- Activities have resulted in significant policy shifts and informed \$2.9 billion in World Bank lending.

81. ESMAP is progressing satisfactorily towards the targets determined in the business plan for FY2017 as summarized in the following Table 7.1:

**Table 7.1. Results Achieved towards Business Plan FY2017-20 Targets**

TARGETS IN FY2017-20 BUSINESS PLAN	RESULTS ACHIEVED IN FY2017
10 countries confirm using the results of ESMAP-supported energy sector assessments in policy decisions	Two out of 10
Preparation of 10 new investment and lending operations, 10 existing operations informed	18 out of 20 new and existing operations informed
Mobilization of private sector investment and other non-Bank recourses facilitated in 10 countries	Five out of 10
Clients in 20 countries confirm enhanced institutional capacity to improve the performance of the power sector	Five out of 20
Knowledge exchange on energy sector facilitated with clients and other stakeholders in 20 countries	Two out of 20

82. According to the Regulatory Indicators for Sustainable Energy (RISE) 2017, reaching the SEforALL goals will require almost tripling the historical annual investment flows to about \$1 trillion. Countries will need to embrace an enabling environment that attracts all forms of investment—public and private. It is recognized that this funding level will call for an increase in private sector participation in the energy sector. The principal barrier to this lies in the grid sector, and especially with regard to the investment needed in transmission and distribution. Where possible ABG grants should be linked to projects that have a reasonable expectation of introducing private capital into these sub sectors.

83. In order to achieve the targets, ESMAP Activities in this cross-cutting field should be enhanced and funds allocated for this window should be increased if possible. The reason for this is that the success in ESMAP efforts in several thematic areas related to Energy Access, Energy Efficiency and Renewable Energy depends on good governance, correct market design and sound planning. Otherwise, the outcomes will not be satisfactory and the results cannot be sustainable. In many client countries mobilization of private sector financing remains constrained by unfinished or poorly designed market reform agendas and bad governance.

## 7.2 CURRENT AND PLANNED ABG ACTIVITIES

84. In reviewing ABG activities in the last year it was noted that they were primarily on governance and planning, and not markets.

85. The Regions are currently focusing on the following:

- Africa: sector viability (operational issues plus energy efficiency), hydropower, security of supply, energy access.
- Middle East and North Africa: regional trades, hydropower, sector reforms, gender, energy efficiency, utility benchmarking.
- East Asia Pacific: energy transition (reform and renewables), regional trades, natural gas, hydropower, access.
- South Asia: access, reforms, energy assessment and strategies, renewables, energy efficiency, regional integration and trades.
- Latin America and Caribbean: geothermal, security and resilience, access, small island states issues, upstream market reforms.
- Europe and Central Asia: market reforms, renewables, private finance and infrastructure renewal.

86. TAG notes in particular the increased interest in hydropower and as regional and country electricity markets develop the value of hydro with storage will increase because it can balance variable renewables. It can be difficult to realise this value in regional trades because interconnections are typically justified by bulk transfers of power. A second element of value in hydropower with storage is its contribution to country and regional resilience. Again, this is a value not readily acknowledged in country and regional planning and therefore not taken into account in interconnection planning.

87. It is noted that the MENA project on regional trade also seeks to define the power procurement needs of the individual countries, so that the role of regional trade can be defined to include the value of balancing supply and resilience at the country level. There is an opportunity for ESMAP to develop its planning and markets service to incorporate these aspects at country level and by doing so it can help develop a more robust framework for regional trading and provide impetus for that activity in areas where progress is stalled.

88. It is noted that the requirements of the Africa region on sector viability relate primarily to operational management and least cost planning. While these are important issues they represent only part of the viability problem of grid utilities and ESMAP clearly offers a wider level of service based around its expertise on tariffs and subsidies, system planning and operations, and now markets. In addition, ESMAP could help in moving country utilities from just least cost planning into risk orientated power procurement as a step in reducing the level of risk allocated to weak distribution utilities. TAG also reiterates the point made in the 2017 report that the viability of utilities may be better protected by increasing off-grid supplies relative to grid extensions, something not addressed in conventional least cost planning studies.

### 7.3 POWER SECTOR REFORM

89. The activity of “Rethinking Power Sector Reform “is financed by \$350k of ABG funds from each region plus \$70k from SEFORALL, totalling \$420k. A flagship report is being prepared dealing with a sample of countries, reflecting regions, successes and failures. Relatively few other current activities cover issues related to power sector reform. Examples are the Jharkhand 24x7 and the Review of the Power and Gas Sectors in Brazil. The latter started with a sector wide analysis (EAS) from which a set of priorities were highlighted as the new government sought to address problems that had not been tackled by the

previous administration for political reasons. It is noted that this activity covers a sector that had been successfully reformed, and, to judge from the GRM, the issues will be addressed within the context of the existing institutional structure.

90. The preliminary analysis seen by TAG would tend to confirm the view of TAG members that power sector reform based on institutional changes does not in itself overcome the challenges of power sectors in countries where there are political and economic barriers. In particular, private sector participation is not a solution in its own right if there are weaknesses in the total value chain and the energy system. Where individual processes in the value chain fail and there is no financial resilience within the sector to cover such failure, then the institutional structure has little impact, and changing that structure will simply delay progress and add to costs. Not surprisingly, those developed and middle-income countries that have effective processes are quickly moving further ahead of those who do not, and the leap required for problem power sectors to meet the latest standards is in fact increasing in terms of both investment and, human capability.

### 10.1.1 Where now for future interventions?

91. Inevitably the ongoing analysis of reforms in the energy sector is backward looking and seeks to determine what has not worked and why, compared with what has worked. However, if the standard power sector reform approach is not to be the reference point for Bank interventions, the question arises of how requests for support from countries with failing power sectors should be handled.
92. From the TAG experience it is suggested that an initial sector analysis would be a starting point wherever possible, even if there is a belief that the problems are understood. This would aim to identify the range of processes that have failed or are weak, and the impact of each failure on the performance, viability and sustainability of the sector. Tariffs are often cited as the problem, but the lack of sufficient revenues is generally the consequence of a range of failed processes, from financial planning through power procurement on to politicised demand targets and ineffective system and customer management. Behind all of this lies a lack of risk analysis, contingency planning and ongoing risk management.
93. A plan based around fixing the processes rather than reforming the sector may have a better chance of making progress – the understanding of the processes could lead on to institutional reform in due course.

## 7.4 UTILITY VIABILITY AND THE FUTURE OF THE UTILITY

94. Power sector reform is intrinsically linked to utility viability. The 2017 TAG report set out the issues relating to utility viability, and experience in the last year suggests that it is more important now to address this issue given the disruption in energy markets cause by the falling costs of renewables and the potential for energy storage.
95. In countries with problem power sectors the previous assumptions as to what the utility can deliver in terms of grid expansion, new connections and system reliability while remaining or becoming viable are inaccurate. The problem is that the major risks in the grid sector fall into the distribution utility directly or indirectly, and the utility may have no scope to manage or cover these risks.
96. Because each country will have different issues holding back the grid sector, it is only possible to set out the typical processes that would need to be addressed as causes of failure. However, it is understood from the Bank's Project Manager for the Energy for Rural Transformation project that the Government

of Uganda may seek advice on what to do with its distribution sector. Uganda is a country where institutional reform is advanced, and so it would be a good example where high-quality analysis could identify the key risks and the process failings that have caused a number of issues despite the success of institutional reform. It is understood from discussions with World Bank staff and others that the issues in Uganda may be as follows:

- The main distribution entity (Umeme) is managed under a franchise by a private sector company. Its objective has been primarily to reduce losses and improve collections. Umeme does not have responsibility for funding investment, and relies on government for capital. Losses are significantly reduced to below 20%, but clearly there is scope for further progress.
- The Umeme franchise is due to end in 2025 and uncertainty has already affected the share price. Government will need to decide what to do with the distribution sector, including whether to move from a franchise operation to a private sector ownership, with investment responsibility.
- There are 7 other distributors outside Kampala. Management and commercial capability in these entities is understood to be low, and demand is such that they are unlikely to be viable.
- There is a competent and independent regulator, but Government policy is to keep tariffs as low as possible. There is a published tariff methodology.
- None of the distributors undertakes its own power procurement which is in the hands of the transmission company as single buyer. Viability of the single buyer and the distributors depends on whether a bulk supply tariff covers all the upstream costs and risks, and whether the tariffs and current collection performance can meet the costs of the bulk tariff. The single buyer will be exposed to both these risks.
- The older distribution networks are likely to need attention by way of investment through upgrading and through improved operations as it would seem that reliability is a problem that will affect plans for economic development.
- Both the bulk supply tariff and the customer tariffs are time of use, but the underlying dynamics of supply, demand and marginal prices are not in the public domain. Changes in the demand profile and in the sales mix of the distributors will impact on both the single buyer and the distributors, and the scale of these risks is not known.
- There is an aggressive campaign for grid extension and new connections financed by multilaterals, donors and government. Capital investment funded by grants or concessional loans is not included in tariffs, and so there are hidden subsidies and asset replacement and renewal could not be financed by the companies.
- An aggressive expansion of generation capacity is in progress, primarily through PPAs with IPPs, while government owned generation operates on the basis of just recovering operating costs. If demand does not rise as quickly as supply, there is a risk of stranded costs from take or pay or equivalent contracts.
- It is understood that demand is not rising as quickly as planned despite the grid extensions and subsidised connections. It is also not known if any rise in demand exposes the distributors or the single buyer by increasing the peak relative to the other periods.

97. The above is indicative only but would suggest that Uganda would be a good example of analysis to establish the root causes of remaining problems in the sector, and to consider which processes contribute to those weaknesses, and how they may be resolved.
98. The outcome could be a re-definition of what existing institutions do, especially in distribution and in power procurement and related risk management. Who funds the investment? How will the cost be recovered? How will power procurement risks be managed, and by whom and for whom? What can a distributor reasonably be expected to deliver in terms of investment and performance improvement? How can loss making supplies be paid for? What is the economic interface between grid, off-grid and any mini-grid solutions, and how do they interrelate? How can the utility respond to competition from distributed solar over which it has little control? How can markets be developed that enable risk management by suppliers and distributors, and also enable basic forms of demand side participation in order to improve efficiency?

## 7.5 THE MARKET PROBLEM

99. TAG notes that there were no activities in ESMAP relating to wholesale power markets under the Governance, Planning and Markets heading (ABGs). There are activities on upstream energy markets, but these would guide planning rather than power markets.
100. At the Knowledge Exchange Forum in London the Bank reported that wholesale power markets existed in only 30% of developing countries. In many of those the market represents little more than a means of sharing out the inadequate cash flows, with little progress on transparent economic despatch or the trading of imbalances between supply and demand. In reality the “market” is a set of PPAs plus a number of government owned generators who have no protection by way of contract. Inefficiencies or stranded costs that are not covered through customer tariffs simply leave the utilities short of cash and needing subsidies just to pay the generators, with nothing ever available for investment in reliability or growth. Investment to increase supply, backed by long term PPAs, may increase the problem if demand does not rise as expected, or if it only increases at times not covered by PPAs.
101. The competitiveness of variable renewables will place more pressures on these feeble markets as the level of renewables goes above a level that can be handled through system operations. Indeed, in developed countries obligations to meet renewable targets through government policies has constrained market activities as more of the market is blocked out. Where renewables have despatch rights but no obligation to supply at specified times in the demand profile, then other costs in system operations and balancing arise that may be hidden.
102. One factor here is that market operations are complex and expensive to implement and run in developing countries and in small electrical systems. Even where countries have adopted the institutional reform approach to the grid sector, the system operations process and any related market operations have little status and there is little or no transparency on how despatch is done, and on how ancillary services are managed and what they cost.
103. So, are wholesale power markets no longer worth developing? In fact, other trends are likely to see renewed interest in wholesale markets. Pressures on end tariffs and on system operations and reliability, combined with the competitive prices of renewables, will mean that renewables suppliers will be asked to take on obligations to supply specific parts of the market in the same way that hydro and other forms of generation have to, as has happened in Chile. There may be interim stages where regulations introduce caps on despatch rights or other administrative rules. The implication of this trend

is that the renewables generators will need to be able to trade both through the balancing market and short-term deals. Any supplier of storage will want to trade in order to optimise its position.

104. In addition, the Knowledge Exchange Forum highlighted the potential role of demand side participation in the UK, an activity founded on the creation of the wholesale balancing market. This activity complements more traditional demand side management and energy efficiency measures, and distributed renewables. It helps reduce consumption and peak demand.
105. The above analysis suggests that it is time to consider how some form of market can be introduced in developing countries so that there are incentives for better system operations, more efficient despatch and ancillary service provision, better power procurement, some form of demand side participation, and reductions in peak demand. TAG therefore strongly supports the appointment of a markets specialist into ESMAP.
106. The question, however, arises as to how some form of market can be developed in the appropriate countries, and how Bank country managers can be informed of the benefits. It is suggested that countries that could benefit would be those where there is a high risk of imbalances between supply and demand, with over supply at night while still having problems in meeting peaks.
107. In terms of the approach, there would seem to be little value in moving directly to an institutional reform and a complex form of market. The approach would need to be creative and to look at steps that could make improvements and that would be consistent with a long-term market structure with increasing complexity. A possible line is:
  - Use analysis to identify the current hidden market risks, what impact they are already having and which entity carries the risks initially.
  - Seek transparency on economic despatch and the interfaces with PPAs: how would the short-term market marry with the long-term contract market? At what periods does the buyer look to be over covered, and when will the buyer be short? How risky are these positions?
  - Identify how ancillary services are provided, who carries the cost, and whether the party carrying the cost is rewarded.
  - Review how variable and intermittent renewables are or will be despatched, and what the commercial implications are with the technical integration of renewables.
  - Consider what opportunities may exist for trading to improve efficiency, and for some form of demand side participation.
  - Review how to make market data regularly available for current and future market participants.
  - Review the implications for power procurement and existing PPAs.
  - Consider what level of market operation could be introduced, perhaps on a simplified basis, and how demand side participation might operate.
108. TAG noted that there is significant demand for ESMAP services on the technical integration of variable renewables, and that this demand in reality is moving into a general requirement for support on system planning and operations where advances in developed countries have been slow to filter through to developing countries. In line with last year's TAG report this is considered to be an area where ESMAP

can make a greater contribution, and a linkage with market expertise is critical in ensuring a more efficient and commercial outcome for client countries of the Bank.

## 7.6 REGIONAL POWER MARKETS

109. International energy exchange through interconnection is a method applied to many parts of the world since a long time. This practice, which has become widespread due to its benefits such as more efficient use of regional resources and the need to reduce investment needs in countries, has evolved into a regional integration from simple energy exchange between the two countries through a regional network.
110. In addition to its classical benefits, regional integration also provides a solution for the widespread utilization of renewable energy and enables investment which would not be feasible due to small domestic demand. Regional integration of the networks also enables for the creation of efficient energy markets. It is not possible to create a wholesale market where there are not enough generators, traders and demand. In such a situation a regional market can be established covering many countries in the region.
111. Regional electricity and power transmission market cooperation and integration is a long-term process that involves the combined and coordinated operation and control of various power networks; a common grid-code, performance standards, interconnectivity and the harmonized management and delivery of infrastructure development. This requires a common strategy around policy harmonization<sup>3</sup>
112. ESMAP, together with the regional teams is working on this subject in different regions, including Africa, Balkans, Southeast Asia and Latin America. This work covers a wide spectrum of activities from simple network interconnection to establishment of competitive energy markets. Naturally in such a large spectrum nature of ESMAP's contribution differs. It covers technical assistance on purely technical issues such as planning and creation of interconnection systems and their operation; as well as assistance on the transformation of simple pools to regional markets by preparation of regulatory framework under which the regional markets operate.
113. ESMAP's work on this area helps address problems related to security of security, climate resilience, the development of renewable energy and the efficient use of limited resources a basis for financing network and generation investments and an upgrade in systems and markets capability at both regional and country levels.
114. In a regional pool, the networks can be operated synchronously through direct connection, or if this is not possible due to technical reasons, High Voltage Direct Current (HVDC) can be used for inter-country energy exchange. The operational problems can be handled through common grid operational rules. However, without solving market related issues such as allocation of interconnection capacity to users-traders through competitive methodologies, commercial consequences of imbalances and ancillary services, differences between energy pricing principles; the regional power exchanges cannot be operated efficiently.
115. Market structures may be different from fully competitive wholesale markets to monopoly integrated utilities acting as single buyers. In some countries private participation may be enabled whereas while in other countries the private sector role remains limited. The retail markets have been opened in some

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<sup>3</sup> Transforming the West African regional electricity market — Lessons and experiences IEEE.

countries but remain tightly regulated in others. There may be energy subsidies in some countries while some already implemented cost recovery tariff mechanisms and competitively determined wholesale pricing. As an example, there may be cases where a generator producing electricity with a heavily subsidized gas in one country and trade this in the neighbouring country where local producers are struggling for marketing their products in a competitive wholesale market.

116. Each regional trading bloc has different issues, and in general inter country trading is easier to establish where there are clear economic reasons for bulk trading and the issues are more political than economic. Examples are the potential for trading between hydro with storage and natural gas generation in West Africa, both of which can compensate for the variable nature of other renewables. Similarly, there will be logical bulk trades in the MENA region. One major barrier to regional trading in electricity is the lack of capability in individual countries with no operating markets of their own in determining what they actually wish to buy or sell through regional platforms. TAG therefore welcomes the approach in the MENA region in seeking to support individual country trading strategies alongside the regional market.
117. Where bulk trading may be difficult to justify, as in East Africa, there may well be value in a regional market for the trading of flexible and balancing power in order to minimise the cost of managing variable renewables and to reduce balancing costs. In addition, in regions such as East Africa the long-standing problem of periodic sub regional drought—predicted to increase with climate change—could be mitigated by regional interconnections. Resilience has a value not reflected in trading arrangements, and of course it has a cost, but the insurance premium of regional cooperation may be less than each country taking (or not taking) its own measures.
118. In conclusion TAG believes that ESMAP expertise in system planning and markets can contribute to a better understanding of the opportunities and benefits of regional power trading beyond bulk power transfers as these projects are developed through the Bank.

## 7.7 UTILITY BENCHMARKING

119. TAG notes the activity in MENA on utility benchmarking. Utility benchmarking specialists have generally not ventured into developing countries, although they have begun to consider middle income countries. Effective benchmarking was the key driver in the rapid improvement in utility service and cost performance following the sector reforms in developed countries, and it is a driver that is missing in developing countries, although ad hoc comparisons are made. While benchmarking starts from high level performance measures it has to go down to the process level to deliver major improvements
120. A Bank led initiative to develop utility benchmarking in each region could become an ESMAP product as a means of addressing the endemic problem of non-viable utilities in some regions. As a product it would have the advantage of being readily transferred to the private sector in due course. It is suggested that a standardised benchmarking process would be more durable than repeated interventions.
121. While most benchmarking focuses on operational performance and costs, the more advanced providers of benchmarking services also venture into commercial issues such as regulation, tariffs and power procurement and trading, and consider financing options (how utility owners perform).

## 8| ENERGY SUBSIDY REFORM

### 8.1 FOSSIL FUELS

122. Historically the subsidy reform program has focused on the identification and removal of subsidies relating to fossil fuels, and the success of ESMAP can be seen in examples such as Ukraine and Egypt. Demand has been primarily from middle income countries with a history of shielding the population from fossil fuel price volatility, but subsidies become ingrained in the system and difficult to remove. However, the energy sector in general is subject to political interference, in particular because of the political sensitivity of energy sources and also through policies that provide “incentives” to certain energy sources. TAG welcomes the fact that the subsidy reform team moved into this arena in the last business plan, and that it increasingly offers a product that will be valuable to a wider range of countries and Bank projects. It also notes that demand is increasing from low income countries where utilities are dependent on grants and subsidies from Government.
123. Countries that use commodity subsidies to help support the purchasing power of the poor turn to the Bank generally for fiscal reasons, because they can no longer afford the subsidies regime. The political sensitivity surrounds all energy prices, not just electricity tariffs. In fact, LPG is generally far more important for the poorest in the population.

### 8.2 POWER SECTOR

124. The Subsidy Reform team can contribute more widely whenever there is a dysfunctional energy or electricity sector—the entry point in low income countries is typically the electricity sector. Outcomes of an effective analysis of subsidies and tariffs, going back into hidden subsidies and covering cross subsidies—can be wide ranging:
- Identification of funding gaps caused by low tariffs;
  - Identification of inefficiencies, often maintained by managers seeking subsidies ahead of efficiency;
  - Capital costs hidden in Government grants and concessional loans, paid for by taxpayers—resulting in poor investment decisions and no provision for future asset replacement and enhancement;
  - Wasted investment in grid extensions and connections that cannot be economically sustainable, and may lead to increases in costs at peak times while providing minimal revenue to the sector;
  - Mismatches between assumed generation costs based on high capacity factors and actual costs based on the matching of supply and demand: stranded capacity costs in PPAs, hidden ancillary services costs to maintain reliability and quality of supply (increased through the expansion of variable renewables);
  - Persistent and increasing problems of reliability in networks arising from the lack of funds for investment, leading to constraints on economic development and competitiveness—diesel standby generation, lack of inward investment;

- Hidden fiscal subsidies through the above, plus unexpected calls on the fiscus as hidden problems emerge in sector failings—unpaid IPPs, blackouts;
- Poor power procurement strategies, resulting in inflexible markets and unexpected costs, with a lack of risk management by the buyer, and costs falling unexpectedly on the distributor;
- Distortions in private sector investment, say between alternative fuels or forms of cooking.

125. The developing ESMAP product (ESRAF) has been designed to make a significant contribution both as an analytical and diagnostic tool but also as a means of determining a plan for the sector and for a regulator and utility. However, it is recognized that the subject will be sensitive for governments, and for developers who may have benefited from incentives and from favoured market positions thanks to their PPAs. The analysis may reveal distortions previous and ongoing multilateral and donor projects. One advantage of the ESMAP product is that it can be used to address the different issues of subsidy in middle income and low-income countries
126. The above is a catalogue of points that be used as evidence that effective analysis by the team using the methodologies of ESMAP can lead to the identification of a range of issues where Governments can address the dysfunctional nature of their energy/electricity sectors through targeted decisions and more integrated planning. Each area of decision—tariff policy, subsidy policy, cross-subsidy policy, investment programme, power procurement strategy, utility strategy, utility performance improvement, off-grid policy and competition in the sector – will typically require a plan of action covering a lengthy period. From a number of analyses a set of principles may emerge, for example, how best to subsidise the sectors without introducing shocks and distortions, how to minimize cross subsidies and their impact on economic development, how to link reliability to tariffs, how to manage power procurement risks, how to define what a utility should do, how to introduce energy efficiency into the market – especially if and when tariffs have to rise. Potentially a preferred approach to subsidies and their relationship with tariffs can emerge as a best practice—subsidy at the point of delivery, not at production.
127. The message emerging from this for Bank officials and other stakeholders is that the ESMAP program is moving on from handling fossil fuel subsidies alone, or even just tariffs, but to focus on the contribution that this form of analysis can make to energy, power and fiscal policy and planning. One outcome of a plan may be that tariff changes are deferred or introduced in a phased manner, but this would need to be coordinated with a subsidy policy that handles ongoing shortfalls and any risks carried by the Government as owner of the sector rather than by customers. Tariff and subsidy reform is one of those critical elements that will sit at the heart of any effective integrated planning of the electricity and energy sectors.
128. TAG welcomes the fact that the reduction of energy subsidies is often embedded as a trigger for funding within Development Policy Lending (DPL) operations on power sector reform. For this reason, the ESRF team has started to monitor these operations when they are in their preparation phase and contribute inputs on how to design sustainable subsidy reforms. Such early monitoring allows the ESRF team to inform DPL teams of the financing and technical resources available from the Facility that can be used to prepare their operation with some Technical Assistance on subsidy reform, and thereby encouraging them to make more wide-reaching recommendations for reform.
129. In summary TAG notes that subsidy reform is an area which is currently fully funded and where the expertise can play a larger role in Bank projects. It supports the progress made in the methodology.

Wherever utility viability is an issue impeding progress in a country the expertise in this team can assist in identifying many of the steps required to improve the sector's performance.

## 9 | ENERGY ACCESS

130. ESMAP continues to prioritize the importance of energy access within its planning, operations and resource allocation. This remains an appropriately important priority work area for the Bank, especially in view of ongoing international community support for universal energy access as outlined in SDG7 and other related goals. The focus on both grid extension and increased focus on off-grid and mini-grid activities reflects the recognition of the role of off-grid energy services in provision of initial energy access to households and communities that do not have access to the grid and are unlikely to gain access in the near term. Additionally, in view of the viability challenges faced by many utilities across Africa, combined with the low energy demand and capacity to pay (despite willingness to pay) of many consumers, this is a make sense strategy informed by the latest geospatial studies that outline "lowest cost" approaches to electrification. ESMAP's work has evolved and has continued to be informed by the evolution in the energy access sector of what energy access truly means—while initially focused on the tiers outlined in the early versions of the Global Tracking Framework, the Multi-Tier Framework which includes additional dimensions of energy access has been well received, even if its parameters are not at present a complete match with the tracking requirements enshrined within SDG7. One of the key issue areas has been to move beyond a simple MW installed or Watts installed approach and really tying in to household and community levels of economic productivity enhanced through the provision of various types of energy services, recognizing that these are what consumers really want. Additionally, there has been much work conducted around the gendered effects of energy access, which is increasingly being incorporated into ESMAP's work as well as more broadly in the sector. This is welcome.
131. Much of the work of ESMAP is already well established in this area. In particular, TAG notes the longstanding cooperation with the IFC in the Lighting Africa and Lighting Global Programs and congratulates the team on the recent highly regarded Off-Grid Electrification Forum in Hong Kong in January 2018, sponsored by ESMAP. This drew hundreds of entrepreneurial off-grid companies and players, hosted by the Global Off-Grid Lighting Association (GOGLA), itself a spin-out from the Lighting Africa program and focused on many of the rapid innovations happening in the sector. TAG recognizes nonetheless that market-led approaches will not reach all households, particularly those in very remote areas (where a private sector company will never see sufficient margins to be profitable absent some type of incentive) as well as among the very poor. While some PAYG companies have marketed themselves as enabling access for very low-income households, it remains unclear to what extent they are truly reaching the very poor and in which markets. TAG notes ESMAP's ongoing work with governments and the private sector to develop approaches that do not undermine the development of the commercial market. TAG also notes some recent challenges (e.g., complaints by PAYG companies in Myanmar that were trying to operate in villages where subsidy programs were also active, resulting in them exiting that market at a loss) While this was a client country issue, it emphasizes the need for clarity in ensuring that subsidized approaches do not undermine existing market efforts.
132. TAG recognizes ESMAP's ongoing work in the development of results based financing approaches, targeted working capital facility development and linking off-grid subsidies to social protection programs. TAG recommends continuing with such efforts, even as there are calls from some companies in the off-grid sector to avoid any type of subsidy. TAG recognizes that virtually every off-grid company, including current GOGLA members, has benefited from some type of subsidy over the last decade. It is more important to focus on subsidies that support market development, market quality, provide for lifetime maintenance and quality service and avoid market distortion.

133. TAG notes the many positive rapid developments in the sector in the last five years, as outlined in last year's report and in particular in the rapid development of the Pay-As-You-Go (PAYG) approach to off-grid solar power delivery. This includes ESMAP's role, primarily through Lighting Africa/Lighting Global, in the rapid evolution of this subsector. For the first time in the sector companies have attracted a number of commercial investors providing significant levels of both debt and equity investment. Although much of the sector remains focused on East Africa, increasingly companies are looking at the opportunities in West Africa as well. Several companies have recently set up operations in countries that were previously considered more difficult to serve (from a private sector standpoint). It further notes the increased emphasis by a number of off-grid companies now in differentiation of products and services, including providing larger systems which focus on "productive uses" and in particular the linkages with agricultural productivity. These include by way of example, the use of solar powered threshing machines, rice huskers and solar water pumping for irrigation. This is an important area that can be effectively utilized by ESMAP to engage productively with other Bank areas, particularly the agricultural practice and TAG recommends extending this work. It is also very relevant in the context of the gender work of ESMAP, given that many of these solar powered agricultural machines in a rural village context essentially provide huge time savings to rural women who in the past may have had to have conducted much of this work manually. TAG also recommends this as an area for further work by the gender and energy access teams—particularly given the focus on women's time (also for clean cooking) and the extent to which these solutions can free up additional time for rural women for other purposes.
134. TAG notes the intention to address the “poorest of the poor” for energy access, an approach that accepts that this will require subsidy in some form. To put this in perspective, in 1981, the World Bank estimated that 42.2% of humanity lived on less than \$1.90 per person per day (adjusted for purchasing power). In 2013 that figure stood at 10.7%. That is a reduction of 75%. According to the Bank's more recent estimates, absolute poverty fell to less than 10% in 2015.
135. Clearly the best solution here is to continue to support the macroeconomic standards that have enabled this progress. Any form of subsidy should not prevent those who have moved out of that level of absolute poverty from then benefitting from access to modern energy. Any subsidy arrangement based on cross subsidies between customers through off-grid or mini grid franchises may—arguably—slow down overall progress and restrict the level of competition in the emerging off-grid market.

## 9.1 MINI-GRIDS

136. TAG notes the robust ongoing work on mini-grids and the ongoing strong demand shown for support in this area. This is reflected in the achievement of 7 (out of 5 per the target) countries supported with project identification and preparation services in FY2017. At the same time TAG notes continued challenges with mini-grids around regulatory frameworks, tariff setting and financing structures. Thanks to the work of the ESMAP Global Facility on Mini-Grids, combined with the work of DFID and other donors in this arena, mini-grids can now be seen to work, and emerging examples of success are now extending beyond Kenya (an early focus country) and Tanzania into Nigeria and several other countries in East and West Africa.
137. Since mini-grids are appropriately more heavily regulated than off-grid solar PV system installations there remains an ongoing need for extensive TA across the sector. Knowledge development workshops such as the one successfully held in December 2017 in Abuja, Nigeria together with DFID and other partners are also especially valuable and should be continued. Such Action Learning and Exchange events are extremely helpful to a range of stakeholders in the sector, not only informing ongoing work,

but by bringing together policy makers and practitioners from existing focus countries as well as those exploring opportunities. This facilitates important discussions on key issue areas such as cost, tariffs, policy frameworks and mapping (especially now using GIS). Given the existence of an estimated more than one million existing diesel mini-grids in Nigeria as well as the large number of people still living without electricity there (it being one of the 20 high energy access deficit countries under SEforALL parlance) the focus on Nigeria in particular seems appropriate at this time.

138. ESMAP focuses on "low cost and timely" mini-grids, and TAG recognizes the challenges in varying contexts around tariff setting and the challenges of delivering energy via a mini-grid at the same cost as the national grid. There are varying approaches taken to addressing this and/or accommodate different tariff regimes. Regulators will need to accept that mini-grid solutions will have higher costs per kWh than grid solutions, and there will be a need to move away from the political focus on the kWh price and move towards a value based regulatory approach. Mini grid operators recognize the need to move well beyond the proposition of grid utilities in terms of the range of services that have to be provided to make the investment worthwhile. In progressing mini-grids towards a sustainable product there will be a need to address the value proposition beyond energy access or the electricity price. Further work should also be undertaken to look at a make sense set of incentives for mini-grid operators in settings where eventual grid integration may be desirable.
139. At the same time, in embracing a "least-cost" approach, it is important to ensure that needed services are being provided in a holistic way. For example, for a community mini-grid where a health clinic is being electrified, it is important that gender aspects are informed and accommodated in the solution design and installation such that in order to save money, they are not designed out of the process. Examples of this would be inclusion of external lighting so that women feel safe to attend a health clinic in the evening, and lighting latrines and staff quarters, as well as the clinic itself. This type of holistic approach may not constitute "least initial cost" but the "most value" or lowest lifetime cost (when factoring in externalities) to the community. Dividends, in terms of potential health and safety outcomes, are another part of the value proposition. TAG encourages further engagement between the mini-grids and gender teams to explore these aspects in more depth across the various services that a mini-grid may enable (health, education, agriculture, small business as well as household energy services). In particular, they can draw on the emerging examples now available in the sector across many different countries in sub-Saharan Africa.
140. ESMAP co-hosted a one-day conference in 2014 on mini-grids for electrification in Washington, DC which was very well received at the time. Resources permitting, a similar event could be organized in FY2018 (or 19), either as a standalone or alongside off-grid solutions, that showcases progress made over the last years, as well as emerging opportunity areas. For example, it is now time to include a focus on improved energy storage solutions—which would be relevant for both under-electrified countries as well as those assessing the relative contribution of micro-grids in urban and rural areas and Small Island Developing States (SIDS). While ESMAP and other donor focus is rightly at country level, as evidenced by the Nigeria conference, such a follow-on event could be a complement to ongoing in-country work. It would allow emerging success stories to be better understood both within the Bank as well as the broader international development community and also provide opportunities to invite investors (including IFC) to participate to explore potential deal flow opportunities. Consideration could be given to scheduling such an event with partners (such as Rockefeller Foundation and DFID, for example) alongside the planned exhibition showcasing off-grid energy solutions which the Energy Access team plan to host in the Bank's atrium later in the year. The latter is planned as a follow on to the Off-grid conference in Hong Kong, to showcase a full suite of off-grid solutions for energy access, and inform

Bank colleagues in particular around the level of innovation and sophistication now seen in the off-grid sector.

141. Another emerging area where ESMAP engagement in the energy access arena should continue is in the area of super-efficient appliances (explicitly designed for load-constrained environments) and their relationship to the Internet of Things (IOT). In particular, TAG recommends a focus that begins to explore the full range of services enabled by electrification and the extent to which electrical appliances may be able to provide at least partial solutions including more explicitly for aspects of clean cooking. TAG notes that the clean cooking and the electrification sectors have largely been operating on separate, parallel tracks. Could a larger mini-grid at times provide a cost-effective contribution for clean cooking purposes in Africa? For example, as in some mini-grids in Asia where rice cookers are powered by hydropower, can the increased use of induction stoves be supported in areas with grid power? If so, under what circumstances? What other services can best be supported—how can a small mini-grid also help to increase agricultural value in a village setting e.g., through solar powered milling? What are the trade-offs in terms of price and value for the community? What are the gender implications? This is an area where some donors such as DFID are already active alongside World Bank partner NGOs like CLASP. Consideration can be given to exploring how to integrate the two areas more and leverage the experience with a range of super-efficient appliances by emphasizing some of the cooking appliances (perhaps holding a competition with Global LEAP for the most efficient and safe electric cooking appliance for certain uses, such as a pressure cooker—recognizing that these will vary by region and cultural context etc.).
142. While it is recognized by TAG that a primary constraint is the cost of electricity, exploring load optimization and cost optimization in a holistic manner that includes expected cooking functions as well as other household appliances, to determine viability in a given context, is encouraged. This is an area where e.g., a working group of clean cooking and off-grid companies (including private sector companies) could explore further.
143. As a complement to the proposed cooking health analysis, ESMAP may consider—through its Mini-grids team together with the knowledge and communications team—updating elements of previous reports that focused on delivering energy access to health facilities in constrained settings (a highly valuable earlier report co-authored with WHO). These would reflect its ongoing work on mini-grids and emerging models for incorporating health centers into mini-grid planning and particularly focusing on holistic design elements, and emerging business/sustainability models, as well as the need for continued advocacy around this issue. Issues of medical appliance efficiency have also not been taken up within the energy access community and this is something that can be explored within the energy access team. Perhaps this could be taken up together with CLASP. Attention to this issue of health care access appears to TAG members to be somewhat lagging in the sector—it is no longer a high impact opportunity area for SEforALL, although there is much still that can be usefully done in this arena, including by ESMAP. TAG welcomes ESMAP's ongoing engagement in this area. Health system strengthening is invaluable for supporting modern healthcare service delivery and could be an area for renewed joint engagement with the Global Health GP.

## 9.2 URBAN POOR AND DISPLACED

144. TAG notes with interest the work underway around energy access for the urban poor as well as the emerging focus on displaced persons and the energy access related challenges surrounding humanitarian needs, especially pertaining to refugee camp settings. TAG notes that there is an existing body of work already underway conducted by UNHCR and other UN agencies, through the Safe Access

to Fuel and Energy Initiative (SAFE) which is already looking at the issues relating to both electrification and clean cooking fuels and technologies in refugee settings. TAG would recommend, if this is intended to be a focus area of growth for ESMAP, early engagement with this initiative and with UNHCR in particular. This is both to avoid duplication and also to leverage their expertise around protection matters and their intersection with energy service delivery, which would strengthen planned engagements. Clearly gender considerations are also especially important in refugee and other displacement contexts, notably in challenges relating to e.g., the safety of woodfuel gathering and the alternative fuel options that may be—or could be made—available. Again, there is much already underway in this arena and ESMAP should not try to duplicate what others are already doing, but to explore where its core competences can add value. This could include, for example, work on solar mini-grids in camp settings, various types of off-grid solutions and clean cooking solutions experience, to add to the emerging body of work and projects already underway.

### 9.3 CLEAN COOKING AND HEATING

145. While the SDG7 goal on energy access includes clean cooking and heating as well as electrification, TAG notes that, despite a robust portfolio within the Bank, the continued limited financing allocated across the international community for clean cooking. This was outlined, for example, in the Sustainable Energy for All Report in 2017 (in which ESMAP was a partner and funder) "Understanding the Landscape."<sup>4</sup>
146. This report highlighted levels of funding specifically allocated to support clean cooking in the 2013-14 two-year period, across 20 identified high access deficit countries in Asia and Africa. In those countries, the report noted that clean cooking averaged only \$32 million in tracked funding per year, 80% of which was provided by international public funding. With the exception of one gas project, these funds were predominantly geared towards biogas and lower tier improved cookstoves.
147. An estimate cited by SEforALL CEO Rachel Kyte states that at least \$4.4 billion per year will be needed to reach SDG7 by 2030. Clearly across the international development system there is a significant funding shortfall and it is unclear to what degree private sector funding can provide significant additional funding (except for certain fuels). The international community is not on track to deliver SDG7 targets in clean cooking under the business as usual scenario.
148. A lack of funding and in parallel a comparative lack of political will are two of the realities facing the work of ESMAP and other stakeholders in the clean cooking sector. There has, however, been strong engagement by ESMAP in the last years in development of an active portfolio of cooking and heating sector focused projects, totalling \$317 million at the World Bank, spanning 14 countries. In the cooking sector, these largely comprise a mix of biogas, improved cookstoves, ethanol (Madagascar) and advanced biomass cookstoves projects.
149. It is unclear to TAG—principally due to a lack of time to do a more detailed examination with the team—exactly how those choices in terms of solution set were chosen by client countries and the level of ESMAP guidance in choice of solution set. This is not a criticism of ESMAP's approach, but is referenced because in TAG's experience, many countries still do not yet have a clear nationally integrated planning approach to clean cooking. Many, therefore, can benefit from planning interventions/projects in a more integrated, holistic way through a fully integrated plan (the NDC may not provide this).

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<sup>4</sup> [http://www.SEforALL.org/sites/default/files/2017\\_SEforALL\\_FR2.pdf](http://www.SEforALL.org/sites/default/files/2017_SEforALL_FR2.pdf)

150. In addition to the question of funding, TAG notes Sustainable Energy for All have provided a recent advocacy re-set, with CEO Rachel Kyte in several recent fora reminding stakeholders that in fact "over 95% of the cost of meeting these (clean cooking) targets is found not in the stoves but in the fuels."<sup>5</sup>
151. This is a needed—and in the view of TAG—overdue steer to the sector writ large, along with the needed sea change in funding for the sector. ESMAP clean cooking team can continue to provide support to this orientation. TAG notes that an ESMAP supported study, titled "Scalable Business Models for Alternative Biomass Cooking Fuels and their Potential in Sub-Saharan Africa" was published in 2017. To supplement this work, ESMAP could perhaps additionally sponsor studies focused on:
- Where there are international norms, what is needed for a successful e.g., ethanol or LPG supply chain and intervention- where are the conditions ripe for this, and what are the necessary enabling environment supports to make this feasible?
  - How can and should policy makers choose among different options that may have quite different characteristics, for an optimal public sector strategy.
152. This will need to accommodate the mix of urban, peri-urban and rural demographics as well as different levels of low income populations comprising the 2.8 billion people lacking clean cooking access—a very heterogeneous set of consumers.
153. While eventually it is hoped that at least a portion of the cost could and should be taken up by the private sector (delivery agents and consumers), public sector financing certainly has a role to play for the foreseeable future. This may include public sector investments and guarantees (together with private sector where feasible) into the assets required for developing the infrastructure required for import (e.g., import terminal expansion) and safe storage of fuels (e.g., LPG), and for other infrastructure related to the safe manufacture and distribution for other fuels such as ethanol and methanol at scale. It is recognized that fuel cost subsidies in many countries (unlike the Indian example) are not sustainable over the longer term. For LPG, emerging experience in countries such as Cameroon is worth tracking, to determine how they navigate their planned transition from 20% to 60% adoption of LPG by 2030, without consumer subsidies, and in that regard, how successful they are over time in expanding markets beyond existing urban centers. Ghana is also undertaking a transition to the cylinder re-circulation model for LPG, which is the internationally accepted safe model for LPG that when adopted can help to increase Kg per capita use of LPG significantly. It has been adopted across much of the ECOWAS region (apart from Nigeria) although in a number of countries, significant investment is still needed to support full national capacity for LPG.
154. Public sector financing is also required to help develop the enabling environment necessary for LPG expansion. While some countries have undertaken their own reform process, many have not been able to do this without significant support to help them develop the plans and policies needed to determine how to develop their sector further to accommodate potential increased demand. This is best provided by international development finance institutions and bilateral agencies, since it is not attractive to private sector foundation funders, and most international LPG private sector companies do not see market expansion as a priority in areas where demand is likely to remain relatively low.
155. While integrated geospatial planning for electrification has become a key tool for planners in the electrification sector, at country level clean cooking planning often remains fragmented, in part due to

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<sup>5</sup> Rachel Kyte, Keynote "LPG for Development" Summit, Marrakech, Morocco October 3, 2017

silos within government Ministries. For example, the decision to outlaw charcoal burning may be taken by the Ministry of the Environment; biomass and biogas (and perhaps ethanol) cooking interventions may be the purview of the Ministry of Energy, while LPG fuel options may be the purview of the Ministry of Oil and Gas or the National Petroleum Authority. Women's Ministries and the Ministry of Health also of course have roles to play—and the Ministry of Finance of course.

156. The question of what is an exemplary planning process for clean cooking therefore still remains. Various solutions may be required that utilize very different value chains, have their own set of market structures, regulations and in some cases, safety protocols. There are also at times tensions between optimization of outcomes among different solution sets and trade-offs among them—e.g., affordability, gender (supporting local entrepreneurship), level of emissions reductions, contribution to mitigation of forest degradation and health.
157. There is a need for a high level of political leadership in client countries to address clean cooking issues comprehensively. For ESMAP, a challenge comes when that high level of political support is not already there in a country, or is not there across the full needed array of stakeholders and that may constrain the Bank's options in terms of how it operates. TAG notes that the African Development Bank is beginning to assess opportunities for more integrated high-level policy planning in certain target countries, and is considering taking the approach of embedding staff to help drive these processes. It recommends where possible, in the context of African operations, that ESMAP/the Bank should work closely together with the AfDB in helping countries to support integrated national planning and implementation strategies for clean cooking.
158. The development of additional planning and solution optimization tools that help to reinforce both the utility of and support for an integrated high level inter-ministerial planning approach to cooking solutions that takes into account the various options and their respective contributions to the solution are needed. Country targets are useful, but often aspirational. They need to have solid analysis and solutions options modelling and planning behind them to be able to support a make sense strategy that addresses urban and rural settings alike and optimizes solutions choices given local conditions.
159. It is the sense of TAG that outside of the World Bank context there remains room for more clarity in terms of preferred solutions, despite efforts in this regard. This is not only needed by client countries, but also within the cooking sector as a whole to provide more clarity about the optimal future direction of the sector. Tiers of solutions are helpful, but often pertain to idealized lab conditions and do not necessarily provide policy makers with in depth insights regarding the various options and trade-offs among solution sets. Policy makers also should consider costing, short and long-term impacts in terms of reduced deforestation and forest mitigation, climate and health impacts, cost per outcome, and optimization of recommendations at both national and community level.
160. TAG understands that ESMAP is undertaking work on a simulation study with Dalberg related to the issue of monetization of co-benefits. Initial results from the simulation appear to show potential benefits in terms of averted disability adjusted life years (ADALYs) even in the lower cooking tiers (e.g., in moving from Tier 2 to 3.) Reported findings include that it may be relatively more cost effective (in terms of ADALYs) to intervene there, compared to supporting clean solutions. TAG however, recommends peer review and recognizes that depends on the tool used for the simulation, notes the limitations of e.g., the Household Air Pollution Intervention Tool (HAPIT) 2.0 (which has now been superseded) since pricing did not necessarily reflect market conditions. Clearly there is more work to be done to establish the extent to which such findings may be validated in real life contexts.

161. Work is currently being undertaken by PBL Netherlands Environmental Assessment Agency on a new modelling effort to try and integrate more of these components. TAG notes that ESMAP has had some interactions with PBL to strengthen the quality of modelling solutions for use by the sector.
162. TAG further recommends the need to consider—where possible, while recognizing issues around affordability and the need to provide solutions for the very poor—a more explicitly aspirational "clean fuels first" approach, to help reset the focus that it is not the stove alone that is important (while recognizing that other factors such as ventilation and behaviour are also factors.). This is needed to push for the greatest health benefits where feasible, while recognizing that internal Bank traction around the issue of clean cooking by the Health global practice could be enhanced. It does so, recognizing that while advanced biomass solutions are certainly an improvement on earlier improved cookstoves in terms of increased efficiency, no biomass cooking solution at present in regular field use, has yet been shown to deliver the emission reductions needed to meet the WHO guidelines for health. While continuing to support research and field studies and trials to enhance the cleanliness of biomass fuels, an enhanced ESMAP focus on clean fuels can do this, especially when they are adopted at a whole community level (rather than going household by household). Stove stacking, to the extent it continues, becomes stacking among clean fuel options. Supporting an array of solutions to provide more consumer choice among clean options is also preferred where possible, to drive uptake and sustained use.
163. For this purpose, clean fuels are understood to mean clean at point of use, and include biogas and biofuels (ethanol), electricity, LPG and natural gas ("BLEN" fuels), although the latter is not yet a factor under consideration for cooking in most of developing Africa. It also includes solar cooking solutions, although their utility for many cooking purposes remains quite limited. TAG notes that ESMAP already works on a range of "clean fuels" options, notably biogas and ethanol, as well as cleaner advanced biomass/pellet solutions and in the last year ESMAP supported a knowledge note on LPG and facilitated a workshop on LPG in September 2017. While other aspects related to cooking, including kitchen size and ventilation may play a role, switching to exclusive use of a clean fuel
164. It has not to date engaged in any LPG project, despite broader World Bank engagement (and IFC) on this widely used solution. The IEA has identified LPG as potentially comprising 50% of the solution for clean cooking (1.4 billion people). In Kenya, for example, the Bank has a longstanding project underway in the oil and gas sector which includes a component to support the rollout of LPG to some 4.8 million households in the coming several years. India is at present in the middle of a massive national transition to bring LPG to 150 million of its people, including the poor and countries like Morocco have shown that LPG can be adopted nationally even in rural and low-income areas. Despite being a fossil fuel, LPG is a low carbon fuel and in certain contexts has been shown to be climate neutral. It is anticipated that despite fossil LPG already being abundant, more renewable and bio-LPG will become more widely available on global markets in the coming years (although the economics do not yet work for low income applications), and this would use existing infrastructure.
165. While ESMAP may not countenance the use of new fossil fuel subsidies, the Indian Ujjwala scheme has provided many useful insights into how existing subsidies can be re-oriented more towards the poor, and streamlined to address leakage. It is also showing challenges around sustained use, which highlight not only the affordability of the fuel per se, but challenges within households around cash flow, savings and prioritization—all areas where the World Bank has a tremendous body of existing work, housed for example in CGAP. TAG suggests that ESMAP can usefully work together with CGAP on some studies and reporting to highlight how affordability constraints can be managed in the context of household savings and what are some of the mechanisms (such as microfinance and a range of savings tools, particularly now digital savings) that can be used to help address them in the cooking sector. TAG further notes that,

as it pertains to LPG, adoption of the cylinder re-circulation model, when combined with enabling policies and related investment can lead to increased per capita utilization of LPG in a country, without necessarily requiring a correspondingly high level of subsidies.

166. There has also not, to TAG's understanding, been a comprehensive study around evaluation of cooking fuel costs in urban and rural markets for different types of consumer across key SDG7 target countries (high access deficit countries). This could offer valuable insights into comparative costs as well as relative utility of various options. For example, there is no existing study that shows the cost of equipment acquisition and of LPG refills for cylinders of different sizes across all markets in Africa, nor of comparable costs of e.g., charcoal or ethanol and monthly usage. It may be that the PBL work referenced above may provide such insights.
167. Similar to in the off-grid sector, there is some interesting innovative work underway on Pay-As-You-Go options for certain clean fuels which ESMAP could also continue to study (this was referenced in the report on alternative biomass cooking fuels released in 2017). TAG also recommends it can evaluate some of these innovations in cooperation with CGAP and others. This can help the sector continue to evaluate the business models and circumstances under which these, or other innovative financing mechanisms, such as various types of microfinance for initial equipment purchase, may be helpful in extending their adoption beyond traditionally accessible market areas and in reaching lower income consumers.
168. At the same time, it is important not to sacrifice affordability. A solution that provides some benefits in terms of increased efficiency is better than none as long as it is not adopted and then discarded. For this reason, it is recognized that advanced biomass solutions—particularly when it can be verified that the biomass is sustainably harvested (which is not yet the case—perhaps a third-party verification system could be established) will continue to have an important role to play in certain countries for the foreseeable future. This is particularly true for those very poor households that cannot afford to pay for their fuel and continue to depend on foraging for fuel in one way or another. Some new social enterprise models focused on recurring sales of biomass pellets, with the stove costs factored in over time, are showing some early promise, although not yet achieving in field use full level of emissions reductions needed to deliver all the health benefits of a truly 'clean' fuel.
169. TAG supports the Bank's focus on utilization of advanced biomass solutions (such as in Lao PDR) rather than improved stoves where possible, when looking at biomass solutions. In cases of extreme poverty, the question of subsidy (underwriting the stove acquisition in full or in part, and ongoing fuel costs) comes into play.
170. One of the additional challenges remains a lack of full consensus across the cooking sector on what actually constitutes clean cooking in a given context. Indicators vary between the ESMAP work on the Multi-Tier framework and the existing SDG7 indicators and measurement managed by WHO, as well as tiers of cooking established by third parties such as the Global Alliance for Clean Cookstoves. While ESMAP staff are in ongoing discussions with WHO via UN inter-agency processes to try to harmonize approaches, it is recognized that there may not be a universal tracking mechanism for clean cooking under SDG7, at least not before 2020 when the indicators will be reviewed. ESMAP is encouraged to continue to work closely with WHO in this area, not only on metrics, but also on mechanisms to optimize health benefits. In this regard, the WHO focus on addressing air pollution, and the late October 2018 first WHO conference on Air Pollution and Health may provide opportunities for strong ESMAP engagement. There is potential for a joint publication of a key paper focused on optimizing health outcomes of clean cooking interventions through improved air quality and reduction of NCDs. Since the

World Bank's Health practice has not yet strongly taken up the issue of clean cooking, this may also present an opportunity to draw them in more closely.

171. TAG welcomes the recent opportunity for ESMAP to take a cleaner cookstove project to the Green Climate Fund for approval, while noting the challenge of high transaction costs as outlined by ESMAP staff. Consideration by Bank management should be given to explore with the GCF at a high-level ways to reduce transaction costs and to streamline the process for approval (while recognizing that they have already reduced approval times), given that the GCF can be a highly valuable funding mechanism for clean cooking. Noting the increased focus by Sustainable Energy for All on cooking fuels, it is also worth ESMAP exploring whether in future an LPG project would be eligible to take to the GCF for approval, given that it is a fossil fuel, albeit one with a benign environmental profile that is recognized by the IEA as a major clean cooking fuel for achievement of SDG7, especially in urban and peri-urban areas.
172. TAG finally notes the recommendation around the development of a clean cooking report under the SEAR series, as mentioned already in the SEforALL knowledge section of the report.

## 10 | RENEWABLE ENERGY

173. Sustainable Development Goal 7 aims for a substantial increase in renewable energy's share in the energy mix by 2030. The latest 2017 Global Tracking Framework data shows that there have been rapid increases in renewable energy consumption; yet the overall share of renewable energy has been growing more slowly due to continued rapid growth in overall energy consumption globally, especially in emerging markets. Increasing the share of renewable in the power sector will have an important contribution.
174. In addition, renewables create an important opportunity for energy access through off-grid and mini-grid solutions based on renewable energy, especially solar.
175. As costs of renewables technologies are rapidly falling, renewables are becoming less costly than fossil fuels in many parts of the world. This provides an important opportunity to increase the share of renewables. However, it also requires time and investment, as well as improvement in technical and institutional capacity.
176. In order to contribute to countries' efforts in this respect, ESMAP carries out its activities in the field of renewable energy under 4 different thematic windows:
- Global Geothermal Development Planning (GGDP)
  - Renewable Energy Resource Mapping
  - VRE Grid Integration Support
  - Solar Technologies TA Program
177. From July 1, 2013 to 31 December 2017 a total of \$42.6 Million was allocated and \$25 Million was dispersed for 75 activities related to renewable energy.<sup>6</sup> This accounts for 25% of total ESMAP grants and 22.3 % of total disbursements in the same period.
178. When the share of activities for the regions is analyzed it is observed that the share of the Africa region (AFR) is the largest, as shown in the following graph. This is in line with the needs and priorities of this region (Figure 10.1).

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<sup>6</sup> <http://www.esmap.org/activities>

Figure 10.1: ESMAP Grant Allocations, by Region (Jul 203-Dec 2017)



Source: [www.ESMAP.org/Activities/renewable](http://www.ESMAP.org/Activities/renewable)

179. ESMAP activities in this area are critical to mobilizing investment needed to help countries transition to a low carbon, climate resilient development which is in the order of trillions of dollars. In order to achieve the Sustainable Development goals and to implement Climate Change mitigation measures, it is necessary at least in the short-term (duration of this business plan) to keep the share of renewable energy related ESMAP work at least at the same level.
180. For the 2017-20 business plan the total budget is \$22.2 Million. Some \$7.57 million (34 %) is already used for 26 activities in FY2017. In order to continue with the same pace in FY2018-19 and 20, and in order to close the funding gap, total budget for this area should be increased to the level proposed by ESMAP BP 2017-20, i.e. \$42 million
181. In the following sections, ESMAP activities in four thematic windows within renewable energy are assessed and recommendations are provided.

## 10.2 GLOBAL GEOTHERMAL DEVELOPMENT PLAN

182. Geothermal energy is an underutilized resource with the potential to deliver renewable and reliable electricity and heat for many low-and middle-income countries. Since its launch, the GDDP played a crucial fundraising role for exploration drilling, which is the riskiest phase of geothermal development.
183. ESMAP has helped to mobilize new concessional financing for the risky and capital intensive upstream phases of geothermal development and maximize the potential to leverage private capital in low-and middle-income countries. Results prove that ESMAP is successful in this field. Since its launch in 2013, GGDP has helped inform projects leading to mobilization of \$250 million of concessional financing for geothermal exploration activities. This is expected to leverage at least \$1.5 billion in private capital.
184. In FY2017 ESMAP's Global Geothermal Development Plan (GGDP) informed three new World Bank geothermal projects in Chile, Indonesia, and Turkey, totalling almost \$460 million, fulfilling the first target in the BP. This was achieved with a modest budget (according to ESMAP financial data only \$0.7 million was used from a total of \$2.2 million budgeted.)

185. It is expected that ESMAP will continue its activities to achieve other targets stated in the Business Plan, namely to mobilize new concessional funds in other countries and finalize its work related to needs assessment for data management in geothermal exploration projects.
186. ESMAP's Global Geothermal Development Plan informed a \$350 million project in Turkey to scale up private sector investment for geothermal development by reducing investors' risks during early-stage drilling. Further analysis in this case indicates that:
- There is demand from the Government and private developers
  - A regulatory framework, including incentives for renewable energy, was in place
187. This case is a good example for being successful in ESMAP's work informing projects that also in turn leverage private capital.
188. ESMAP has helped to create a positive environment for geothermal development, and has published a range of knowledge products that are widely used in the sector. In the last report TAG recommended "preparation of a standard document package for geothermal projects financed by the World Bank given the project implementation requirements by the Bank. This would include templates or standard documents for areas such as safeguards, procurement and supervision. It may include recommended Terms of Reference for consultant services, Bills of Quantity for works, specifications for goods and services, etc." This recommendation is reiterated, although it will be important to liaise with the International Renewable Energy Agency (IRENA) and its linked International Geothermal Association (IGA) who are undertaking similar activities.
189. Given the changing power markets as set out in the context section of this report, it will be increasingly important that geothermal activities in any country are supported as necessary by experts on governance, markets and planning.
190. Given the IRENA initiative and the number of other bodies promoting geothermal energy the question arises as to when ESMAP has fulfilled its role in developing the global framework for geothermal development, allowing the numerous other bodies to take up the promotion and facilitation of geothermal development. ESMAP's Geothermal Handbook,<sup>7</sup> a US Energy information Agency report from 2014<sup>8</sup> and a Lazard's report<sup>9</sup> all suggest that geothermal power is competitive for baseload generation and development is supported by risk mitigation facilities in East Africa and Latin America, as well as a number of technical assistance programs. IRENA is also proposing some form of risk mitigation. This raises the question of when ESMAP's global role is fulfilled and the individual developments are picked up by the trade associations such as the IGA, but it is recognised that the trade bodies are not yet sufficiently strong and that the sector will continue to depend on multilateral finance for test and production drilling,

### 10.3 RENEWABLE ENERGY RESOURCE MAPPING:

191. Through the Renewable Energy Resource Assessment and Mapping program ESMAP helps countries to map their renewable energy resource potential using the latest methodologies, and then incorporate

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<sup>7</sup> Geothermal Handbook: Planning and Financing Power Generation, June 2012

<sup>8</sup> *Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2014*

<sup>9</sup> *Levelized Cost of Energy 2017*

this data into national planning. TAG welcomes ESMAP's approach and development of products which have wider value outside the Bank and donor supported interventions, and sees these as good examples of where ESMAP adds specific value.

192. In this context, the new Global Solar Atlas was developed and launched in January 2017, with high resolution solar maps issued for all 146 developing countries. This work will continue to extend in scope. The Global Wind Atlas was launched in November 2017 following a substantial upgrade of the original DTU product in collaboration between ESMAP the DTU—the product remains in the ownership of DTU.
193. Resource mapping activities provide reliable information on the localization of renewable sources and their technical characteristics. There may be not much immediate impact on the investments. However, its impact in the long run will be significant, since it is a practical and valuable tool for policy makers, planners and increasingly for investors. Therefore, TAG recommends continuing communication of the products over the next two years and TAG supports the relatively small cost of maintaining the atlases. It is noted that a decision will be necessary in due course on the ownership of the Global Solar Atlas, with one option being ownership continuing with the World Bank.
194. Furthermore, TAG supports ESMAP's plans to explore new global tools, including the enhancement of the geospatial planning tool with Lawrence Berkeley National Laboratory, an assessment and mapping of global floating solar potential, and a tool to support rooftop solar identification. A web based version of the geospatial planning tool is under consideration and would again represent specific added value from ESMAP.
195. In addition to global atlas ESMAP continued to provide financial and technical support to 16 country/regional projects. Furthermore, while Results Targeted in the Business Plan 17 aim for more than 12 countries; 4 new countries applied innovative geospatial, GIS, open data and analytics to decision making n FY2017 alone and so the program is on track.

ESMAP proposes the following revision in the Business Plan:

196. "As a result of the new focus on the Global Solar Atlas and Global Wind Atlas, and corporate pressures to shift solar and wind measurement campaigns to client execution, the result target of ">\$15m in additional funding leveraged" is no longer relevant, because ESMAP is likely to downscale the budget allocated to this window.
197. The team instead proposes to combine this target with ">5 external projects informed/support" into a more concise target focusing on utilization of the expertise that ESMAP has developed in this area, as follows: ">8 non-ESMAP solar/wind measurement projects adopt ESMAP-developed standards/guidelines."
198. TAG supports this proposal.
199. In addition to solar and wind resource mapping, ESMAP worked on hydro mapping in some countries. Hydrological sources, especially small run of river type, can make a contribution to increase the share of renewables in the energy mix. Also, small hydropower mapping can provide valuable input to government plans for mini grids and grid expansion by identification of unknown sites. Unlike solar and wind assessment, determination of hydro sources and their characteristics is more time consuming and expensive. Individual countries have shown that they can, with donor support, identify mini hydro resources. While a hydro resources atlas is attractive as a concept, the cost under current funding constraints, the capacity building required and uncertainty as to its value are such that it is not a priority.

However, it is noted that hydropower is a major theme for Bank regions, and TAG considers that ESMAP's best contribution at this stage would be in supporting the analysis of hydro projects based on their role and value within current and future wholesale electricity markets at both country and regional level. This would go beyond the initial evaluation of bulk movement of electricity and cover also how hydropower with storage can fill the gap in the market for flexible generation that can meet the challenges of intermittency in other renewables.

## 10.4 VRE GRID INTEGRATION

200. Widespread use of renewables for power generation will require transmission and distribution grid investments and also will initiate many important changes in system operation rules and techniques. For an extensive VRE grid Integration:

- Power systems should be planned, designed and expanded such that the grid can reliably evacuate and transmit power from renewable energy plants which are generally dispersed. Technical and economic issues for grid integration should be resolved such that the need for VRE curtailment is minimized.
- Technical Measures and arrangements should be developed to ensure system stability and reliability against the variable nature of renewables.
- A regulatory framework should be designed such that, on the one hand there should be an enabling environment for renewable investment and, on the other hand, there is a need to address issues such as balancing requirements, their influence on costs, energy pricing, market operations and competition.

201. In order to address the challenges, ESMAP has developed the VRE Grid Integration Support Program to offer support to utilities, operators, regulators and other public organizations. The program covers capacity development for long-term grid planning, market design, revision of VRE support mechanisms, development of rules of access to electricity grids for VRE, and efforts aimed at strengthening the electricity dispatch and transmission infrastructure.

202. An ESMAP-Public-Private Infrastructure Advisory Facility (PPIAF) Partnership on Climate Change was established to help countries transition to climate-resilient energy infrastructure. The joint support will leverage \$2.5 million of co-funding from PPIAF over five years to build enabling environments that facilitate deployment of variable renewable energy. In this respect, partnerships with the Global Sustainable Electricity Partnership (GSEP), Public-Private Infrastructure Advisory Facility (PPIAF), NREL, Clean Energy Ministerial (CEM), and the Children's Investment Fund Foundation (CIFF) should continue.

203. When compared with the targets in the Results Framework in BP17-20, it can be seen that ESMAP is on track and considerable progress has been achieved (Table 10.1).

**Table 10.1: VRE Grid Integration Program Progress**

TARGET	RESULT
At least 8 new World Bank operations informed	2 out of 8: India and Mongolia
At least 10 country planning strategies informed	5 out of 10: Sri Lanka, India, Guatemala, Costa Rica, and Uzbekistan

204. TAG also welcomes ESMAP’s efforts to prepare VRE Guidance Notes, which is a package of 4 documents. The work has been started in FY2017 and would be finalized in 2018. This is an essential part of the VRE Grid Integration Program which gives guidance to the Energy Global Practice on what the essential considerations, requirements and recommendations are for the sustainable development of VRE generation in the client countries
205. As a result of the technical assistance of ESMAP, competence in transmission and distribution system operators can be increased and it will be possible to integrate more VRE in the grid. Eventually new investments for transmission and distribution investments will be realized. In this respect these activities will inform and help support substantial leverage in the form of WB lending and private investments.
206. Due to their variable output and intermittency, renewable generation sources cannot provide continuous and stable power generation. In order to regulate the power and frequency other sources should be available as spinning reserve. Keeping the spinning reserve has a cost and if not allocated correctly may cause unnecessarily high cost to the system and consumers. TAG was informed that ESMAP developed a methodology for spinning reserve allocation in Guatemala.
207. This is indicative of the high potential value of ESMAP’s work on grid integration. With renewables now becoming mainstream at grid, mini grid and off-grid levels the value of expertise on system planning, system operation and market development and operations is increasing, and at the same time this expertise can address some of the fundamental process problems that impact on utility viability. It is not surprising that demand in this area of expertise is high, and that demand will not just be related to variable or intermittent renewables. This activity, alongside geospatial planning, tariff/subsidy strategies and off-grid market development, sits at the heart of an integrated approach to the electricity sector, and the increasing involvement of the VRE Grid Integration team in wider system planning activities is welcomed.
208. ESMAP provides valuable technical assistance to many client countries. Assistance provided covers a wide spectrum of needs, from geospatial planning for mini-grids to least cost planning for generation and transmission system expansion and integrated planning for regional markets. ESMAP's capacity building activities (training on power system modelling, demand estimation and supply planning) are greatly appreciated since they will provide necessary capacity needed for system expansion, renewable integration and energy efficiency activities in the client countries.
209. Given this context TAG recommends that ESMAP considers a change in the focus of VRE Integration from Renewables to a more general planning and markets capability within the next year, and would encourage donors to consider support to this activity as an enabler of greater reliability, risk management and efficiency within the energy sector. The program should consistently expand to consider wider markets, planning and regulatory issues in a holistic fashion.

### 10.4.1 Energy Storage

210. Storage technologies are developing and their cost is declining. Utility sized storage technologies will have an important contribution to solve balancing and congestion problems and enable smooth integration of renewables in transmission and distribution grids. Smaller storage facilities will be useful for continuity of supply for mini grid and off-grid solutions.
211. In coordination with the IFC, ESMAP also produced and launched the Energy Storage Market Report which shows that energy storage technology will become more accessible in emerging markets in the coming decade, enabling a significant scale-up of renewable energy. ESMAP also collaborated with the KOREA Clean Growth Trust Fund with support in the amount of \$2.5 million for activities in 5 countries.
212. Therefore, TAG recommends ESMAP to enhance its efforts on this subject, together with the IFC and in its own operations. In the short-term storage may merit its own activity until its cost and value are clear in the market and the activity could then be absorbed into planning and markets

## 10.5 SOLAR SCALE-UP PROGRAM

213. Despite a sharp decline in the cost of solar technologies (especially solar PV), solar deployment in many developing countries with good solar resources is slow. The main reasons are: an inadequate enabling environment, insufficient regulatory framework, limited capacity for designing and implementing business models for procurement of solar generated electricity.
214. ESMAP aims to catalyse increased investment in grid-connected solar technologies. ESMAP work mainly targets:
- Provision of support to the enabling environment: market assessments and deployment roadmaps; assessment of the legal, regulatory, and institutional frameworks; assessment of needs for enabling infrastructure;
  - Preparation of pre-feasibility studies and other preliminary site-specific work in urgent/fragile cases;
  - Global engagement, including mobilization of climate financing targeted to solar; analysis and dissemination of lessons learned and development of knowledge products; and building partnerships with relevant partners.
215. This will also be achieved by leveraging the resources and data generated under ESMAP's parallel work on resource assessment and mapping, and the integration of variable renewables, to provide a complete package of support to client countries.
216. In FY2017, ESMAP initiated nine new activities to support the World Bank's efforts and is starting to develop core expertise and knowledge on key issues, such as the transition to solar auctions, and deployment of rooftop solar.
217. The business plan's targets and results are:
- At least 7 new grid-connected solar investment projects financed by WBG and/or other donors and private sponsors. Only 1 project is informed in FY2017 (Haiti)

- At least 8 country assessments, feasibility studies and project structuring completed. One project completed, others are ongoing.

218. Because of high investment costs, large scale deployment of solar resources for power generation remained limited in IDA-eligible countries and other developing countries in the past years. The sharp decline of the costs of solar technologies in recent years created new opportunities for the utilization of solar sources in developing countries also. It is observed that, countries have started to demand TA and project support from ESMAP/WB. The potential is huge, the willingness is there. Projects have started in many countries and the development will gain pace. However, it requires time for preparation of regulations, business plans, enabling environment and most importantly technical and institutional capacity. ESMAP work in these issues will accelerate the development. It is already a major growth area in the WB lending portfolio. Private sector interest is also increasing. Therefore, it is expected that the demand for ESMAP support will be increased in the following years. The Impact of ESMAP work can be significant in terms of new public and private investments.
219. The work in this area is closely related to VRE Grid Integration and to some extent with resource mapping. The measures for large scale deployment of renewables and the issues related to grid integration are similar, if not the same. Therefore, the work related with solar and VRE grid integration should continue to be carried out in coordination. An example is ESMAP's support to the WB West Africa Large Scale Solar Development Project with pre-feasibility studies and institutional off-take arrangements for solar PV connected to existing hydro power.
220. Since large capacity solar installations require wide areas (which are sometimes limited due to geography, agricultural use etc.), floating solar installations will create new opportunities. Therefore, it is recommended that ESMAP should continue its studies on this subject and for the implementation of this model in other countries where feasible.
221. Storage will play an important role in solar development. Similarly, hybrid hydro + solar and wind + solar solutions applications may enable the flexible operation and can be useful for a stable generation without causing imbalances in the market. ESMAP studies on these applications will help smooth development.
222. One of the important opportunities for large scale solar deployment is roof-top PV application. However due to conventional distribution system design and operation, it is not easily implemented. In addition to creation of the regulatory framework, a number of technical, commercial and operational issues need to be resolved. Where opportunities arise, ESMAP can look at developing a sustainable product, starting with the preparation of guidelines and relevant training programs in close coordination with the VRE grid integration group.
223. CSP technologies may also become a factor in markets in future, and where possible ESMAP should contribute to the development of CSP. The MENA region is a good candidate in this respect.

## 10.6 GENERAL

224. Electricity generation from renewables will initiate many important changes in system operation rules and techniques. The challenges and solutions will be studied under VRE Grid Integration topic. However, at the same time distributed renewable generation embedded in distribution and transmission system, smart grid operations, new market players, new electricity trading platforms etc. will necessitate new market rules and new market models. Utilities will be influenced greatly by technology disruption.

225. Renewables are supported through various mechanisms such as dispatch priority, FIT arrangements, and exemption from balancing responsibilities. However, all of those have implications in energy prices, utilities' financial viability, competition in the markets, additional costs for ancillary services and balancing operations. Since the cost of renewables has declined to such levels that they can compete with other technologies, these supporting mechanisms should be reconsidered and re-designed. Some examples are, introducing balancing responsibility, shifting from FIT to competitive auction.
226. The renewable energy element of Sustainable Development Goal 7 (SDG7) aims to support a significant increase in the share of renewable energy in the global energy mix by 2030.
227. ESMAP activities in renewable energy are generally related to the power sector. Although this sector is the most important area for increasing the share of renewables in the energy mix, in order to increase the share in final energy consumption, ESMAP work on renewable energy use in other energy consuming sectors such as heating, transportation and industry is also important.
228. Geothermal and solar energy can also be used in heating. In fact, only around a quarter of geothermal resources are suitable for power production. The remaining potential can be used for heating and other fields. Development of solar and geothermal heating will have a positive effect in increasing the share of renewables in final energy consumption. Direct use has local economic benefit and can help rural development and slow down urbanisation. Therefore, ESMAP may consider developing its expertise in these areas.

# 11| ENERGY EFFICIENCY: EFFICIENT BUILDINGS & ENERGY EFFICIENT CITIES

229. TAG notes the contribution made by the ESMAP energy efficiency program to the development of sustainable development plans for cities in World Bank projects. The review of specific activities demonstrated how closely the team is involved in planning Bank projects. The team is well aware that demand for its services (and for Bank projects) will be more than it (or the Bank) can conceivably fund. It has made good progress in defining products that can be of wider use, and an important next step will be to reinforce the capability of client countries through knowledge products.
230. The critical issue going forward will be to build on and replicate the success of projects where ESMAP has helped build the financing capability of an energy services sector, enabling significant leverage of Bank funds through commercial lending. The mechanisms established in Brazil are noted in particular. If comparable mechanisms can be established in Vietnam, where the program includes linked energy efficiency in the industrial sector, then there would seem to be the basis for a replicable Bank and ESMAP product that can eventually move into the private sector. TAG recognizes that any product will need to be supported by technical assistance in many countries if energy efficiency programs are to be initiated in lower income countries, and where country specific adaptations are necessary.
231. It is understandable that energy efficiency activities have so far been concentrated in middle income countries as that is where there is the biggest impact and the greater capability with regard to commercial funding. Most cities in middle income countries still have difficulty accessing affordable financing sources but they tend to have more scope to consider energy efficiency and often have stronger institutions than in IDA countries, which is a key foundation to structure a program or lending operation.
232. As the ESMAP product is honed it would be good to see if the current activities in Abidjan, for example, can be transferred to rapidly growing cities in other sub-Saharan countries, especially where there is growing capacity in the banking system. It is accepted that improving the performance on energy efficiency in lower income countries is a slow process. A key source of increased demand has arisen from ESMAP reaching out to task teams outside of the Bank's Energy and Extractives Global Practice and helping them identify opportunities that also help advance other transport, urban, water, etc. goals. The ESMAP team believes that there are many more untapped opportunities in those sectors that have not been aggressively pursued due to limited financial and human capacity.
233. It was reported that demand in reality exceeds supply with regard to the ESMAP energy efficiency program, and in effect projects are screened and prioritised at Bank level. The potential for energy efficiency is of course enormous and is especially valuable where there are energy and electricity supply constraints and where there are issues of affordability. This is an area where leverage of both ESMAP expertise and Bank and other multilateral funding can be substantial, but that funding is still essential in poorer municipalities (as in Brazil) and lower income countries. This may be an area where a separate fund specifically for energy efficiency, including targets for leverage of the funding from both other multilateral sources and the private sector would make sense.
234. On the operation of the energy efficiency program TAG noted that it operates in at least one country where there is a wholesale market in electricity. As yet the program has not ventured into demand side participation which has become a major driver of improved energy efficiency in developed countries.

There is a trend for demand side participation to merge with more conventional energy services and energy efficiency activities. Some form of demand side participation can be considered wherever there is sufficient transparency regarding marginal power prices, and TAG recommends that ESMAP considers the opportunities that are available through cooperation between the energy efficiency team and the expertise in markets and planning.

## 12| GENDER EQUALITY

235. Given the still relatively new ESMAP specific focus area on gender, it is promising to see the continued level of dynamic engagement in this arena. TAG notes the leadership of ESMAP team members in this regard.
236. TAG welcomes the upcoming report "Getting to Gender Equality in Energy infrastructure" (Gender and energy module within the Multi-Tier Framework) and recommends also utilizing it for opportunities for ESMAP to support women policy makers. ESMAP can also explore gender aspects within regulatory agencies, drawing on existing research that shows that board level decision making improves when women are included on boards. There are also opportunities to work closely with IFC support for women CEOs, women on boards (public as well as private sector), women on investment committees (private sector financing)—all play into ESMAP's gender related energy work in a range of ways.
237. TAG made several recommendations directly to the gender team in the discussion during the briefings with ESMAP staff. It recommends analyzing energy supply chains to determine the level of gender parity both upstream as well as downstream and exploring any ways to connect into the Bank's new fund for Women's Entrepreneurship. This could include, for example, through the provision of relevant project preparation services, perhaps together with colleagues at the IFC.
238. The team can work with country colleagues to evaluate the possibility to help support gender equality across a specific energy supply chain, for example by creation or inclusion of opportunities specifically for women-led energy enterprises. This could be within a larger Bank lending or combined public and private sector project focusing on the various points in the supply chain where they are underrepresented. This would replace a more typical gender focus on more downstream aspects in the energy sector that tend to stress women's entrepreneurship at community level and women as beneficiaries, leaving upstream opportunities unaddressed. The ESMAP team have begun to do this in specific contexts already, so it is not a full departure from its ongoing work.
239. To facilitate this, a gender audit of a particular supply chain or sector can be conducted at national and/or regional level to determine where there is underrepresentation. Consideration should then be given to the types of programmatic response to address that, whether through highlighting through communications and knowledge pieces the lack of diversity and the need to address it, through targeted sessions to e.g., inform women CEOs about opportunities around a particular project, through targeted financial instruments, or other specific mechanisms. ESMAP have begun to do this and TAG welcomes this focus.
240. Across West Africa (ECOWAS) for example, this could also be a valuable operational component to complement the ECOWAS Gender and Energy Policy prepared and adopted across the region recently, in what is understood to be the first regional gender and energy policy globally (others are now underway). Additionally, a gender audit of national Ministries and regulatory agencies can be conducted, and gender disaggregated statistics can be collected where possible, to measure the level of gender parity in a given entity—for example in utility leadership and in regulatory agencies.
241. TAG also recommends where feasible connecting with other existing bodies of work that look at gender and energy and continuing to partner to share best practices.

242. TAG notes that the recommendations made may have implications for core funding, and recommends therefore that Bank management continues to support the importance of gender within its ongoing operations both in ESMAP and within its Global Practices broadly, to help secure the resources needed to undertake such work.

## 13| COMMUNICATIONS & KNOWLEDGE

243. TAG welcomes the increased clarity in the ESMAP brand and its use in seeking to influence the global energy agenda and Bank decision makers across the Global Practices. This is an important element in helping ESMAP move its expertise from country and Bank project specific support through to a product that can be utilised globally.
244. TAG welcomes the commitment by donor countries to hosting knowledge management fora, such as the one jointly convened between DFID and ESMAP in London in November 2017. While recognizing the significant organization required to host such a meeting, it encourages other donors to consider convening similar events with a specific focus on key emerging topics of relevance to the ESMAP agenda. Focusing on several key areas of challenge, opportunity and innovation helps to ensure that the dialog is productive and current. For future fora, a potential opportunity to co-host with the IFC to maximize engagement with both public and private sectors should be given due consideration, depending on the subject matter.
245. Since communications were not a primary focus area for TAG this year, comments in this regard are limited in this report. It is recommended that they are reviewed in more depth in next year's report.