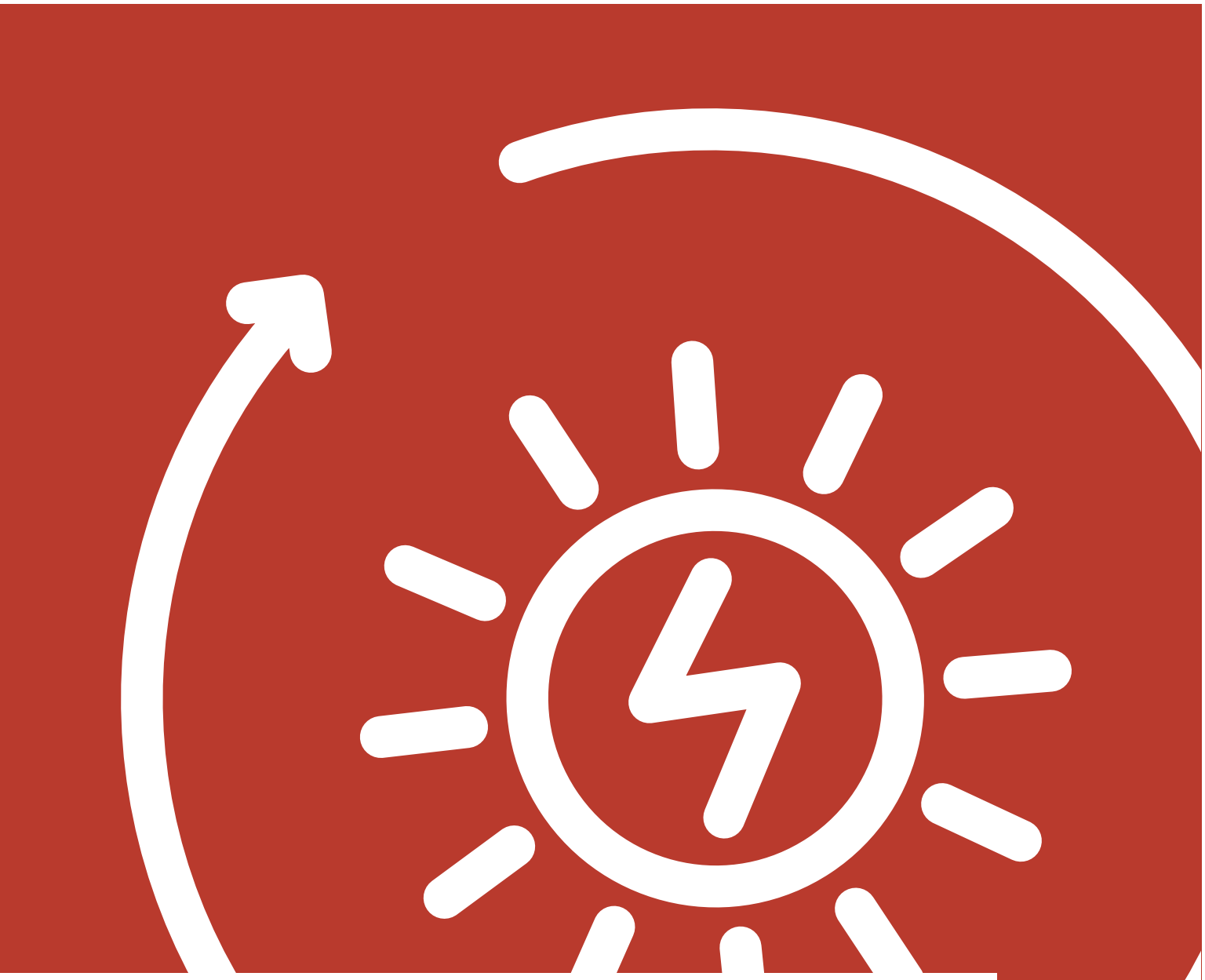

Rethinking energy sector planning in the Philippines

Policy Brief

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1. Energy planning for the future

Energy planning is a crucial task for policy-makers and other stakeholders in the Philippines to ensure energy security and affordable and sustainable supply in the long term.

Energy planning activities are diverse and differ from stakeholder to stakeholder. For government, they include assessing long-term demand and evaluating options for expanding generation capacity and transmission while ensuring that energy prices for consumers do not become prohibitive. Government energy planning is never a goal in itself; it is the mechanism with which a government translates energy policies into action to achieve its sector goals and targets. In a market-based system, such as that of the Philippines, government needs to influence the actions of private stakeholders by shaping appropriate economic incentives in line with its goals. Good planning helps in identifying optimal investment options by laying the foundations for key decisions, by exploring different options for achieving government objectives in an evolving energy system and by formulating appropriate strategies, programs and action plans. It also provides the public and private sectors with guidance to ensure better alignment with policy objectives and long-term goals.

The Philippines already has a comprehensive and well-structured set of energy plans and planning tools in place that were established under the Electric Power Industry Reform Act (EPIRA) – an act that particularly reflects the sector realities of the 1990s and 2000s. However, in view of the ongoing global energy and power system transition (see section 2), countries are well advised to consider adapting their planning regimes to the changes projected to result from this transition (see section 3).

To better understand the implications of this sector transition for the Philippines, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, on behalf of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and in close cooperation with the Department of Energy (DOE) of the Philippines, commissioned an assessment of energy planning in the country. The assessment was conducted by IP Consult / iiDevelopment. This paper contains a summary of this assessment. In addition, the current energy and power planning system in the Philippines was mapped, a list of possible issues and their respective solutions was developed, and final recommendations were formulated.

2. A changing sector – recent dynamics and new challenges

Disruptive changes in the global energy sector are fundamentally transforming the basic assumptions and methodological requirements of national energy planning.

Ongoing sector liberalization has led to a multiplication of power sector participants, changes in customer behavior and the creation of new business models.
Since 2001, the Philippine energy sector has undergone an impressive process of liberalization. Generation capacity has mostly been privatized, with only a few power plants remaining in public hands. Compared to the state utility model that existed prior to EPIRA, today's highly liberalized model involves many more stakeholders in the overall decision-making processes and shaping of the sector. These stakeholders also have very diverse roles, objectives, negotiating powers, budgets, data requirements and software tools. For example, the integrated Wholesale Electricity Spot Market (WESM) in Luzon and the Visayas now has 350 registered participants ranging from generating companies and private distribution utilities to electric cooperatives (ECs), bulk users and wholesale aggregators[1]. Further reforms, such as the planned implementation of retail competition and open access (RCOA), will further impact customer behavior and the business models of distribution utilities (DUs). If more customers can freely choose their energy source, their decisions will influence not only the DUs' actions and decision-making but also the evolution of the retail market[2], prompting the entry of new actors such as traders and aggregators. The option of net metering and low-cost distributed generation will significantly change stakeholders' roles in the sector by turning former electricity consumers into 'prosumers' – i.e. consumers of electricity who also generate their own supply, often using rooftop solar photovoltaic (PV) systems.

Technological innovation will change the way power systems operate in the future.
Continuous innovation and reductions in the cost of renewable energy (RE) technologies and energy storage will inevitably make these technologies substantially more available and accessible. Most notably, the falling investment costs associated with solar photovoltaic (PV) power plants have already made grid-connected PV economically viable for several market segments in the Philippines[3]. Whether supported by policy instruments or not, the growth of variable RE[4] will most likely be driven mainly by the market force of cost reductions, and this growth will change the generation mix in the Philippines in ways that will necessitate changes to current operating practices.

Utility-size solar and wind farms as well as small rooftop solar systems will soon increase the amount of distributed generation significantly[5]. Grids will be affected by power injected at low- and medium-voltage levels, which in some cases will result in multidirectional power flows – i.e. power may sometimes flow from the distribution to the transmission level. The increased need for power plants to be sufficiently flexible to balance the variable output of solar and wind generation will render the concept of inflexible 'baseload' generation obsolete and make

[1] The participants include 105 generating companies as well as 171 customers comprising 16 private distribution utilities, 71 ECs, 79 bulk users and 5 wholesale aggregators (29th Status Report on EPIRA Implementation, 24 October 2016).

[2] DOE, Department Circular, Providing policies on the implementation of retail competition and open access (RCOA) for contestable customers in the Philippines electric power industry, 2017, available at https://www.doe.gov.ph/sites/default/files/pdf/announcements/draft_dc_rcoa_contestable_customer_0.pdf

[3] For details, see our forthcoming companion paper on the levelised cost of RE in the Philippines, to be published under the SupportCCC II Project. In off-grid remote areas of the Philippines, PV systems with or without batteries have for several years proved the cheapest option for many island applications.

[4] Some RE sources, such as wind and solar power, are referred to as 'variable RE', as they are non- dispatchable due to their reliance on the availability of wind or sun to produce electricity. Other RE sources, such as hydropower, biomass or geothermal power, are sometimes referred to as 'controllable RE'.

[5] 'Distributed generation' means the use of many small-scale power generation technologies located close to the consumers they serve.

new forms of ancillary services and flexible long-term capacity provision even more necessary. Generation and transmission planning as well as distribsiution planning need to take these factors into account.

Furthermore, technological innovation has improved information and communication technologies (ICT) and driven the 'internet of things' (IOT). Smart metering and smart grids will enable utilities, the National Grid Corporation of the Philippines (NGCP) and other power sector stakeholders to gather more and improved data relevant to the planning process and to control certain elements of the power system more directly and immediately (e.g. for demand-side management). Meralco, the Philippines' largest electric distribution company, has already set itself the goal of installing 3.3 million smart meters across its grid to better address network concerns, which include being able to isolate defective connections more quickly[6]. The introduction of electric vehicles (EVs) will add another dimension to the rapidly evolving energy system, linking the spheres of transport and power. The introduction of increasing numbers of EVs will generate additional demand for electricity and change load profiles. As the technology evolves, EV batteries may even be used to store excess electricity from the grid and to provide ancillary services, resulting in further changes to the way power systems operate. Similarly, "power-to-X" technologies, which take surplus electrical energy from the grid and transform and store it as different forms of energy (e.g. different types of gas), will further increase the flexibility of the system.

Increased uncertainty and volatility regarding fossil-energy-resource prices in tandem with low interest rates for equity and debt financing have made long-term policy and investment decisions riskier than in previous decades.

Today's relatively low global interest rates for equity and debt financing (capital costs) favor technologies with high upfront investment costs and low variable costs, such as variable RE[7]. At the same time, most models and decision tools used for energy planning determine economically optimal investments based on the net present values of future costs and benefits. Therefore, the presently lower global interest rates also increase the uncertainty of investment decisions, because the inherent error margin of assumptions about future prices is discounted at a lower discount rate, resulting in a higher present value of said error margin. Typical uncertain assumptions of national energy planning include: future fuel prices, the value of future carbon abatements, and uncertainties around new technologies.

For this reason, policy and investment decisions based on long-term planning are now riskier than they were in past decades. The longer the planning time span, the more this error margin in planning scenarios becomes apparent. Failing to consider these error margins and trusting in the results of a narrow set of assumptions for long term energy planning could result in misinformed decision making, and in technology lock-in effects[8] that may prove very costly to reverse.

Greenhouse gas emissions will become a more important parameter in the energy planning system.

In October 2015 the Philippines submitted an Intended Nationally Determined Contribution (INDC) to the United Nations that maps a 70% reduction of GHG emissions against the business-as-usual scenario[9].

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[6] Rivera, D., 'Meralco transforming network into smart grid', The Philippine Star, 16 March 2017, retrieved from: http://www.philstar.com/business/2017/03/16/1681468/meralco-transforming-network-smart-grid

[7] This is because the future 'cash flow' is discounted to present value at a discount rate equal to weighted average capital costs (WACC). The lower this discount factor goes, the higher will be the net benefits used to recover the initial investment (with a profit margin) and the lower will be the net value of the annually recurring costs (which, at less than 2% of investment, are very low for RE power plants – much less than the annually recurring costs for thermal power generation).

[8] i.e. significant investments in stationary technologies with long operating life time that cannot easily be stopped without major economic losses as soon as other technologies become more competitive

[9] Republic of the Philippines, Intended Nationally Determined Contributions, 2015, retrieved from http://www4.unfccc.int/submissions/INDC/Published%20Documents/Philippines/1/Philippines%20-%20Final%20INDC%20submission.pdf

The Government of the Philippines is still considering what specific GHG emission reductions and energy sector mitigation targets to set for its Nationally Determined Contributions (NDCs). However, given the role the energy sector plays in the Philippines' overall emissions, it is likely that clean energy sources such as RE will contribute to the achievement of these goals. GHG reduction targets, commitments and action plans therefore require new planning processes and/or the adaptation of existing planning processes at various levels to ensure overall coherence, which may require government intervention in power generation planning and decision-making. All available options relating to the planning of power sector development must be considered to ensure that costs and benefits can be balanced when determining an optimal national approach.

The changing dynamics in the Philippine energy sector will lead to increasing complexity and the need for faster decision-making to match the pace of changing boundary conditions.

All these changes require those involved in energy planning to consider a much larger and more flexible set of scenarios, to take into account the increasing uncertainties related to factors such as fossil fuel price developments, future carbon abatements, uncertainties around new technologies and their cost, and the future effective operations of technologies with very different variable costs and restrictions. Also, in view of these changes and to ensure the reliability of energy supply, system operators need to adopt new operating and dispatch modes, and regulators need to put in place the rules and guidelines governing these new modes. The energy planning regime will therefore have to adapt in a number of ways over the coming years to ensure it can achieve its planning objectives and avoid unnecessary economic losses. For instance, short-term planning will become increasingly relevant and a more frequent task on all planning levels.

With regard to power generation, the focus will shift away from traditional base, intermediate and peak loads towards a focus on the 'residual load' concept – i.e. meeting the part of the demand that cannot be supplied by variable RE. This part of demand must be supplied by dispatchable plants, making the flexibility afforded by fast ramping capabilities and short start-up times an even more important factor in power plant operations. New 'virtual' power plants, namely cloud-based distributed power plants that aggregate the capacities of heterogeneous distributed generation sources as well as demand side management, will also come on stream and compete with these flexible power plants. In addition, new inverter concepts and distributed storage may play a role in providing this flexibility.

The demand profile for services from the distribution system will change as more consumers produce their own electricity, which will, in turn, change the requirements for system operations. The power flows in grids will, for example, become multidirectional, with power moving upwards from the distribution level and across (i.e. between prosumers) rather than just being supplied top-down by major power generating companies. Different ancillary services will therefore be required to ensure stable and smooth operations. In the long run, the development of local grids of prosumers and mutual suppliers will require the higher-level regional distribution grid to provide entirely different kinds of services. Power markets and related markets will also be affected in various ways. Competition will play out between generators with very low operating costs in the wholesale market and impact margins and dispatch of fossil fired power suppliers. Long term contracts will need to be flexible. New ancillary service markets (in which variable RE will participate) as well as new short-term forecasting methods will further affect dispatch.

3. Steering the transformation process through appropriate planning

The Government of the Philippines will have to take an even more active role in energy and power planning to ensure future challenges are met. Planning needs to be swift, evidence-based and far-sighted.

The Philippines has set itself the goal of ensuring secure, reliable and affordable access to energy for its citizens. While the profound changes expected in the system do not alter these objectives and priorities, they do change the options and approaches for meeting these objectives and, in particular, change the trade-offs impacting future decision-making. It is vital that these new options be reflected in energy and power planning. The Government of the Philippines has a window of opportunity to adapt the current planning regime at an early stage. If this opportunity is missed, adjustments made at a later stage may come at a much higher price to the overall system and consumers.

The current Philippine energy planning architecture is well organized and certainly met the requirements of the liberalized electricity sector of the 1990s and 2000s. However, as it stands, it is no longer adequate for addressing the new opportunities and implications arising from variable RE, distributed generation and other innovations.

When it comes to 'classic' power sector reform, the Philippines has made impressive advances, boasting a power sector that is, by international standards, well organized and operated. The Philippine energy sector has had a comprehensive planning arrangement in place for more than a decade, making the country an early adopter of such arrangements (Figure 1). The core electricity-sector-related parts of this arrangement were designed[10] according to the 2001 Electric Power Industry Reform Act (EPIRA). The country's well-structured overall framework of plans includes the Power Development Plan (PDP), the Transmission Development Plan (TDP), the Distribution Development Plan (DDP), and the Missionary Electrification Development Plan (MEDP) and its respective interlinkages and planning processes. Thanks to this framework's links with the broader Philippine Energy Plan

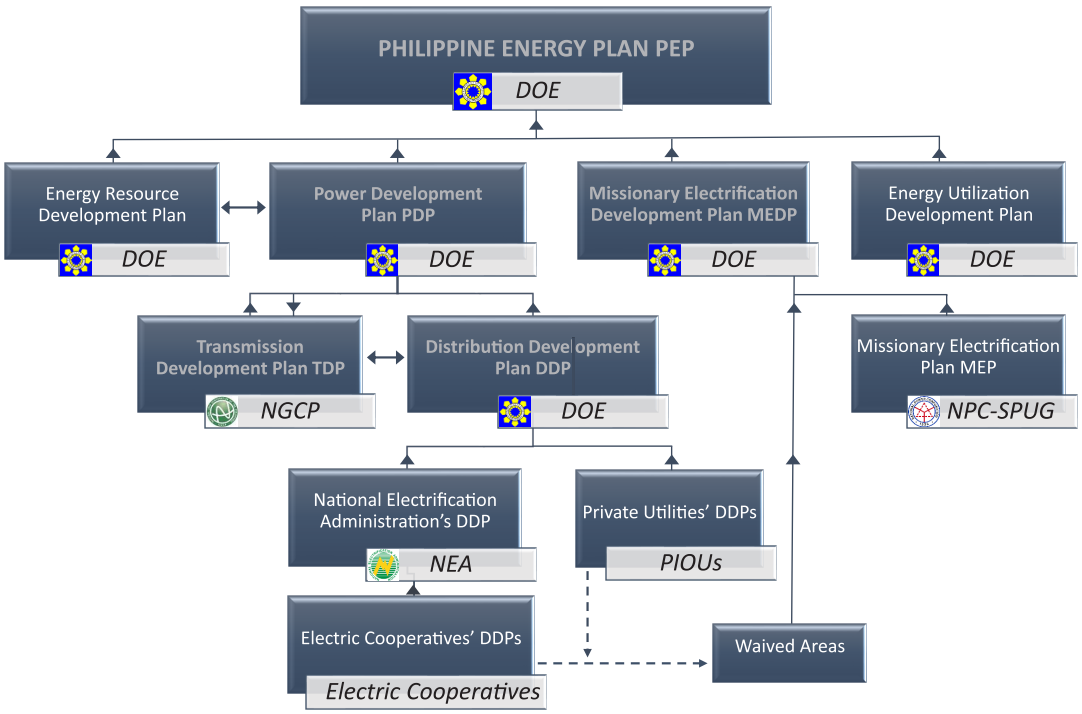

Figure 1: The Philippines' energy sector planning system (adapted from DOE)

[10] Japan International Cooperation Agency and Philippines' Department of Energy, The *Study on the Institutional Capacity Buildingfor the DOE under a Restructured Philippine Electric Power Industry in the Republic of the Philippines. Final Report (Main Report)*, February 2004, Chubu Electric Power Co. Inc. and Mitsubishi Research Institute Inc.

(PEP) and its sub-plans, the Energy Resources Development Plan and Energy Utilization Development Plan, it has the basic characteristics of an integrated national energy planning arrangement.

While the EPIRA takes into account the particularities of the Philippines, it is quite close to the 'ideal model' planning arrangement for a liberalized, unbundled and partly privatized electricity sector that was envisioned during the great global wave of sector reforms in the late 20th century[11]. In the Philippines' case, however, the Government and regulator play a somewhat stronger role in overseeing the system's grid, in particular the DUs activities, as well as bilateral long-term contracts for power supply.

The arrangements of and competences and procedures in these plans were designed 15 years ago for a then novel institutional set-up for the energy sector (EPIRA). More recently, updated versions of these plans have been drawn up through very comprehensive and sometimes cumbersome processes. The planning and decision support currently in place cannot adequately address the new features and implications of variable RE, distributed generation and other innovations. It is therefore of limited use in providing appropriate responses to the new issues that the Government of the Philippines must grapple with in its decision-making process.

Most of the planning problems identified in the Philippines are not isolated to that country. The fundamental changes mentioned in section 2 (which incidentally could not have been foreseen when the EPIRA was drawn up) will affect power sectors across the world in similar ways, and sector actors and processes are largely unprepared for them. Neither textbooks nor scientific papers have prepared emerging market agents for these fundamental changes, leaving many feeling out on a limb. To find appropriate solutions, it is therefore important to truly understand these interlinked fundamental changes, rather than just their symptoms, and consider new experiences from other emerging markets that face similar challenges.

While planning must be careful and well-advised, a number of 'no-regret' options are already available and can be implemented without much further delay.

The guiding role of the Government will become increasingly important in ensuring that planning prioritizes benefits for the overall power system over individual project interests. After formulating its goals and targets, the Government will need to review the market design elements, regulations, incentives and other policy mechanisms needed to achieve them. However, in view of the above-mentioned sector uncertainties, it is advisable to act with caution (see Box 1 for Seven General Principles of Adjusting Policies ideation by co-author K. Reiche).

By quickly implementing no-regret options (e.g. investment incentives and reforms that carry low risks but provide high overall benefits at a high probability and low cost), the Government gets to roll out initial quick-win measures while taking more time to plan for other, more uncertain medium to long-term decisions. For example, while planning the overall long-term transmission requirements for sites with the best RE resources (i.e. sites with low RE generation costs and/or high RE system benefits), it may be beneficial to invest in installing smaller and more distributed RE in cases where they can provide significant benefits to both the existing and the likely future transmission systems. This could, for instance, involve installing solar PV systems close to urban centers where the period of peak demand coincides with peak solar power generation. To take such decisions based on a transparent

[11] Readers interested in theory and practice of these power sector reforms in developing countries may refer to various publications by World Bank:

Besant-Jones, J. E., Reforming the Policies for Electric Power in Developing Countries. Washington, D.C.: World Bank 1993.
Bacon, R. W., and J. E. Besant-Jones., Global Electric Power Reform, Privatization and Liberalization of the Electric Power Industry in Developing Countries. Annual Reviews of Energy and the Environment. 26: 331–59. 2001
Teplitz-Sembitzky, W., Regulation, Deregulation or reregulation—what is needed in the LDCs power sector. Industry and Energy Department Working Paper No. 30. World Bank, Washington, DC, 1990. http://documents.worldbank.org/curated/en/521881468739783393/Regulation-deregulation-or-reregulation-what-is-needed-in-the-LDCs-power-sector
Vagliasindi, M. Besant-Jones, J., Power Market Structure, Revisiting Policy Options, World Bank 2013. http://documents.worldbank.org/curated/en/795791468314701057/Power-market-structure-revisiting-policy-options

comparison of the costs and benefits of additional generation and transmission investments, a solid grasp of the actual system-level benefits (i.e. fuel savings that can be achieved after factoring in line losses) of added RE at different substations will be necessary. A forthcoming companion paper to this report discusses this important issue in more detail.

The Philippines is at a crossroads: the decisions taken today have the potential to shape the sector for decades to come.

Some of the changes described above have already occurred in the Philippines. Since lead times for many generation and transmission expansion projects can be long, and a preference for long-term supply contracts persists in the sector, the decisions taken today will shape the energy sector for several decades. Given the scale and speed of current change as well as the associated technological and market forces underpinning these dynamics, the new era will come whether or not the Philippines decides to actively support this transition. An active engagement with these issues and a thorough evaluation of the associated risks and opportunities is therefore essential to avoid unnecessary costs to society, some of which may simply result from inaction. To become active and successful stakeholders in the energy transition, governments urgently need to develop well-informed, goal-oriented policy, with appropriate decision tools.

The development of the Philippines' energy sector has arrived at a decisive crossroads that offers numerous potential paths. Some head towards a centralized, fossil-fuel-based, largely interconnected national power system that, through flexibilization and integration, provides some room for further RE and distributed generation, while others lead on towards greater decentralization. Given the restrictions inherent in a developing economy, the Philippines may not wish to take a leading role in or serve as a laboratory for testing new solutions that address more complex structures and operations in the power sector. However, by closely observing changing trends in other countries and markets, such as Brazil and especially highly influential countries in the region such as China, the Philippines can pre-empt larger regional developments and adapt to upcoming challenges. To minimize the risk of costly and ultimately undesirable developments, it is advisable to avoid locking the country into a single pre-set path (e.g. that of centralization). For those locked in, late adjustments may engender significant costs in the form of stranded costs and overall welfare losses, which can diminish gains made through economic progress.

Box 1 – GENERAL PRINCIPLES FOR ADJUSTING POWER PLANNING TO THE NEW GLOBAL FRAMEWORK CONDITIONS

In the present phase of transition to national power systems comprising large shares of variable RE, successful national power planning will need to be:

i. **Informed** – It must as far as possible be based on analysis, facts and data, even when the exact details of the future new energy era are still difficult to predict.

ii. **Immediate** – It must focus on practical methods that can address short- and medium-term planning problems, while looking for better methods to define long-term visions.

iii. **Incremental** - In view of the present uncertainties, small steps should be taken towards targets and directions should be re-evaluated more frequently. If relatively robust no-regret options can be identified that would be beneficial under most of the many future scenarios possible, they should be favored.

iv. **Iterative** – Short, medium and long-term planning methods need to be repeated on an ongoing basis and mutually guide each other by sharing input data and results.

v. **Integrated** – (i) Much closer interaction is needed between the presently separate planning entities for RE, overall power, the energy sector and climate policy. (ii) A system-level view of costs and benefits should be adopted alongside the present singular focus on private sector project-level costs. (iii) All options should be judged according to their potential for achieving the multiple and weighted objectives (economic and social, environmental and climate-related) in a way that ensures sufficient, secure and safe supply.

vi. **Inclusive or participatory** – The planning must be based on a transparent societal discussion of the trade-offs between multiple objectives and of the solutions available for those who will potentially lose out as a result of the predicted changes.

vii. **Ideology-free** – It is important that RE be neither promoted nor impeded out of hand on the basis of unexplained principles or for ideological reasons. Instead, the focus should be on ensuring an optimal transition (in terms of net economic benefits to the country) to the inevitable new era ahead of high RE share and other innovations. This might also include a more conscious effort to inform the public about the relative pace of investments in specific RE technologies.

4. Assessment of the Philippines' energy planning regime

Overall assessment

The scope, structural arrangement and procedures of the Philippines' core energy plans (PEP, PDP, TDP, DDP and MEDP) have several notable strengths:

- They cover the energy supply and demand sectors in their entirety.
- They are coherent in structure: subsectors at the lower levels conform to the power sector plan, and the power sector plans and other sector plans conform to the overall energy plan.
- In principle, their interrelation with information input and feedback loops is logical.
- They provide more detail for the lower levels (DDP and MEDP) and are increasingly aggregated as one moves higher through the upper levels.
- They provide short and medium-term planning for the lower levels and long-term planning for the higher levels.
- As plans are prepared for each of the three major regions (Luzon, the Visayas and Mindanao), they reflect the specific situation of the Philippines.
- The plans, in particular DDP and MEDP, provide a basis for regulation and oversight.

However, there are also some minor weaknesses in the process regarding current needs, which creates some room for improvement:

- For various reasons, certain elements are not always being updated according to the time frame set in the ambitious EPIRA schedule. An example is the DDP, the compilation of which requires inputs from many actors, especially from the distribution utilities and electric cooperatives.
- While the plans are drawn up to be interrelated, their interconnections are not as finely tuned as they could be. Due to their different purposes and cycles, the plans are not prepared sequentially from the bottom up. So, in practice, even though the results of one level are reported to the higher level, these results will only become inputs for planning at the higher level if the timings of the two levels' reporting cycles coincide.
- Also, there is too little interregional exchange between Luzon, the Visayas and Mindanao regarding their respective plans. Promoting more options for interregional exchange and grid balancing may therefore be useful.
- Electricity demand projections do not take into account the potential differences arising from self-generation, demand-side management and new electricity uses (e.g. e-mobility). Yet doing so is important for the DDP and will become increasingly important for the TDP.
- The coordination of stakeholders and their participation in core planning is beneficial, in particular for the TDP, for which a regional stakeholder process is currently underway. However, at the higher level, the participation of stakeholders from outside the energy sector in the PDP and PEP appears to be lacking, which carries risks for coherence.
- The information and coordination of the executive branch's planning with the legislative branch is organized but could be improved. Although policy design and strategy are prerogatives of the elected government, the legislators and even the opposition could be more involved in the information flows, analyses and forecasting.
- Coordination and participative planning within the DOE could be improved. The strategies developed by the recently installed competent body for RE have been reconciled with the overall DOE strategy, but they are not the result of an integrated planning process.
- Coordination between the different competent bodies within the executive arm of government (departments) and between their plans (e.g. energy and climate, energy and transport) could be improved.

Some of these weaknesses are already being addressed. Working groups set up by, among others, the DOE, the National Renewable Energy Board and the Energy Regulatory Commission have focused on specific issues within power planning.

The following two sections discuss two additional challenges of the current planning regime. Since these challenges have broad-ranging implications for the whole planning system, they deserve more in-depth discussion.

Key challenge I - the need for more comprehensive decision-support

Despite having put in place the above-mentioned complex energy planning arrangement, the Government of the Philippines' support for certain strategic decisions seems insufficient for developing comprehensive ways to address the new opportunities and risks arising in the sector. These strategic decisions may include opting to expand the traditional central power system, integrating new technologies, or even deciding for or against a fundamental transformation of the power and energy sector (see Box 2 for the categories, time horizons and approaches for planning and decision-support).

The appropriate tools and necessary capacities for providing hands-on decision support to those making high-level policy decisions are still lacking. Without adequate decision tools and institutional capacities, the impacts of different policy options cannot be properly assessed. Examples of specific questions that quantitative decision-support tools can help to answer include the following:

- What types and sizes of power generation facilities should be built next? Which existing facility should be retired and when? Where in the territory should the facility be installed, taking into account the capacity and expansion of the transmission system?
- What are the costs, rate impacts, economic benefits and other welfare implications of integrating different types and amounts of RE into power sector developments? Would a cost-effective and low-carbon generation and grid system be adequate in terms of security and quality of supply? What would be the most efficient low-carbon investment path from a cost–benefit perspective?
- What would a policy to actively promote distributed generation and a smart grid mean in terms of costs and benefits and of the security, stability and quality of supply?
- Having factored in the system benefits and other costs resulting from the integration of a new RE or fossil-fuel power plant, what would be the fair value-based price of this plant? How can flexibility[12] be best assured and at a low cost?
- How should a power capacity mechanism[13] be designed? What other adjustments are needed to the fundamental design of the power market and its price signals?
- When envisaging and simulating investors' behavioral reactions to incentives, which policy and regulation designs seem to be conducive?

The Government of the Philippines has already begun to take a more proactive role with regard to expanding generation, promoting investments and bilateral contracts, and completing the set-up of wholesale markets (e.g. that of Mindanao). However, situations may emerge in which the Government is forced to choose between continuing its hands-off approach for power generation (and leave many decisions to the private sector) and actively steering the sector towards long-term political goals. This may, for example, occur when private sector investors submit unsolicited proposals for large power plants or when bilateral long-term contracts and deliveries are agreed.

[12] Here, 'flexibility' refers to a power system's ability to respond to changes in supply and demand. The system's flexibility is deemed higher if it is able to respond quickly and at a low cost.

[13] A 'capacity mechanism' is an administrative measure for remunerating generators for the power they make available, even though they may not be actively feeding this available electricity into the grid. These mechanisms exist to ensure that the desired level of supply can be maintained. In energy-only markets, such as WESM, generators are remunerated for the electric energy they generate, but not for their generation capacity.

Beyond reviewing the planning arrangement, a new integrated legal framework may be needed to integrate RE and other innovations into the power sector's regulatory system and to better prepare the sector for the profound changes and new energy era ahead.

In any case, the current situation calls for a broadened and modified arrangement of energy planning. Aware of this need, the DOE has set up a taskforce (with the National Renewable Energy Laboratory and USAID)[14] to study the implications and options of this new era, and has approved some first technical studies in collaboration with GIZ that discuss vRE costs and system benefits in the Philippines under a broad range of scenarios, and discuss implications of these quantitative results for vRE policies. The results will be published as companion papers to this report.

For any policy decision, the relevant timing and planning horizons have to be aligned. Non-deferrable short-term decisions must be distinguished from medium-term plans for the transition phase, long-term strategy and the very long-term vision. Plans therefore need to factor in their specific timing needs. This requires reviewing the current planning system, plans, procedures, methodologies and models employed, and choosing practical and appropriate methods for short-term decision-making, medium-term activity plans, long-term strategy and very long-term visions. New and forthcoming planning methods and tools can be employed at any level to increase the accuracy and thus the value of the information contained in the plans.

Box 2 – PLANNING FOR DIFFERENT TIME FRAMES

The very long-term vision: imagining potential energy futures and scenarios

In countries with developing economies and rapidly increasing energy demand, it is important to visualize how, in light of the expected global systemic and technology-related changes, the energy system of the country might look in the long run. For this, explorative scenarios describing the energy system **30 to 40 years** from now should be developed. However, due to the significant uncertainties associated with such long-term planning, this vision of the future needs to be based on many different scenarios, taking into account possible future climatic, demographic, industrial, economic and social situations. These scenarios may include, among others:

- a business-as-usual scenario, which features a high share of individual transport powered mainly by combustion engines, and complete access to electricity supplied mainly by centralized power generation facilities via a fully interconnected grid;
- strongly contrasting scenarios, such as a decentralized zero-carbon scenario with local grids and distributed RE-based power supply and e-mobility and with high sector coupling;
- mixed scenarios and transition scenarios.

Using these kinds of scenarios, the Philippine Government and civil society can formulate a vision. However, given the high number of uncertainties involved, this vision should not be very detailed. Instead it could, for example, include some general targets on shares of low-carbon energy or outlines of long-term grid development. Most importantly, all publications related to these scenarios should always be accompanied by an explicit and detailed cautionary note on assumptions, uncertainties and their implication.

[14] The Greening the Grid Technical Advisory Committee and the Modelling Working Group have been established for this purpose.

[15] As an example, some economists looking at the security and cost of power supply provided an extrapolation of the future of fossil-fuel-based power generation that failed to consider any of the upcoming trends and changes. See: Energy Policy and Development Program, Filipino 2040 Energy: Power Security and Competitiveness, UPECON Working Paper, 2017.

The long-term strategy: setting objectives and priorities

With a long-term impact horizon of **20 to 25 years**, the Government needs a strategy that sets out its general objectives and priorities for its time in power. To translate objectives into targets, the Government

can include clearly formulated indicators and milestones, which it can use as the basis for incorporating different action plans and active measures in the strategy. For the current term of the government and legislature (i.e. for around five years), the indicators and milestones can be more specific, while mid-term adjustments (10 to 15 years and beyond) can remain more open. Assumptions regarding market developments should be as realistic as possible. Preferably, a long-term strategy is based on a broad consensus between policy-makers, sector stakeholders and the general public.

The analysis undertaken to develop the strategy can be based on projections that consider variations of the business-as-usual scenario. These variations include differing assumptions on prices and technology development and variations of defined vigorous policy assumptions. The analysis should use advanced system models that have the ability to represent both decentralized and centralized options as well as distributed, non-dispatchable and dispatchable plants, and it should have the ability to integrate the spatial and temporal dimensions of supply and demand. The analysis will also need to reflect the longer-term scenarios and vision mentioned above. Special caution must be taken to ascertain whether the examined approach leads down a pathway that may turn out to be disadvantageous in the longer run. Again, the full range of possibly relevant future scenarios needs to be covered and explained.

Medium-term development: formulating concrete plans for system development

In the medium term (i.e. a time frame of **5 to 10 years**), the expansion of main parts of the electricity system needs to be planned. Note that the regulated parts of the system are key not only for the grid's functioning, but also for facilitating the transition to a more decentralized structure.

The planning will in particular need to include expansion plans for power transmission systems that cover the medium-voltage level, because solar parks and wind farms are connected to this level, and distributed generation feeds into this level from below. When developing such plans, it is essential to optimize the configuration of spatial and temporal factors to find technically and economically optimal solutions. Detailed geographical and technical grid plans must be drawn up and considered, taking into account the changing supply patterns and directions of flows in the distribution system. Analyses will have to be conducted to check the operation patterns of the projected systems as well as grid adequacy and the ability to assure energy, voltage and frequency. To ensure that long-term objectives can be met, these plans must cohere with the overall energy strategy. As the marginal costs and benefits of additional transmission as well as generation in different locations have to be weighed against each other, generation, transmission and distribution planning need to be re-integrated to some extent, to find economically optimal national investment paths.

The short-term: current policy and decision-making support

Short-term planning requires identifying and addressing decision needs inside the framework of the existing medium to long term plans. Decisions that cannot be deferred must be identified and prioritized. Where they have to be taken based on incomplete information, the no-regret decisions discussed in this report come into play. Good information, data and analysis are required as they constitute an essential basis for any decision-support.

To do all the above requires very agile planning support. Models must adequately represent not only the current systems but also the possible choices and the impacts of decisions. Simulation models that allow operations to be tested play an important role in short-term planning. Concrete investment needs should be indicated and other cost-benefits related to specific decisions should be identified. Again, models incorporating the spatial and temporal dimensions of load and generation should be used.

Key challenge II – methodological inadequacies: accounting for future system characteristics

During the assessment, a number of methodological inadequacies were noted, which, if remedied, could significantly improve planning. They are as follows:

- Long-term planning in PEP and PDP uses only a few narrowly defined scenarios, leaving many of the potential fundamental changes and options unstudied. When considering the energy future beyond 2025, more diverse scenarios need to be included in the analysis. Producing and analyzing scenarios for 2040 using only a model of the current system cannot produce the information needed to anticipate possible profound changes. As a result, important omissions and gaps may appear in any future strategy developed.
- The Government of the Philippines currently refrains from formulating very long-term scenarios and visions. This leaves a void that other actors and interested parties can fill and, in so doing, influence public opinion.[15]
- There is a basic methodological bias against new technology options, because the models used fail to properly represent the characteristics of future energy systems. A key deficit in the Philippine power sector lies in the insufficient representation of the spatial and temporal properties of supply options and demand. Yet these factors are increasingly determining the shape and operations of those systems growing their share of variable renewable energy and thus, in turn, have significant implications for the costs and benefits, emissions and other criteria that people consider when working to develop an optimal power sector. If these spatial and temporal properties are not represented correctly in the analysis, the relative results for the options considered will be incorrect.

  Information contained in a forthcoming GIZ study shows that the DOE's planned spatial guidance (on auctions and feed-in tariffs that drive RE investments towards the nodes where they provide the highest value to the system) can indeed save money, avoid overcapacities like that occurring on Negros Island, and ensure RE is beneficial for rather than detrimental to the power system. This upcoming study also provides the DOE with concrete guidance on how such spatial auctions and feed-in tariffs can be calculated and implemented, essentially following a nodal approach. The basic method employed for this involves

  1. defining the price cap for each substation, which is calculated by considering the economic operational benefit ('nodal value') of each marginal MWh injected at that substation, all other things being equal; then,
  2. not only accepting no bids above that cap, but also awarding the contract to offers with the highest 'public net benefit' (difference between the nodal value and offer price).

- Another methodological inadequacy is the solution algorithm derived from annual load curves, and the selective optimization for base load, mid-merit load and peak load, which fail to reflect the frequent fluctuations in the merit order or wholesale market.
- At the outset, neither the costs and benefits nor the adequacy of future generation and transmission capacity for higher shares of variable RE and new modes of operation were analyzed. This deficit is now being addressed (see Box 3).

Box 3 - RE project cost vs system cost and benefits

Looking to the new energy era, it is still not possible to determine with any clarity what the final market rules and successful private sector business models will be, which makes long-term planning difficult. That said, a number of new, evidence-based methods and instruments do exist for optimising public and private sector RE investments during the transition period. These methods and instruments share a technology-neutral approach and seek to maximise public welfare by shifting from an approach that considers the planning of energy and variable RE as totally separate to one that mainstreams RE planning into standard energy planning and thus ensures decision-making is more integrated. These methods and instruments also afford a more complete view of RE economics by minimising net costs to the system rather than just the local RE generation cost of each individual project. Concrete examples of such pragmatic vRE optimization methods have been applied by GIZ in Ghana, Morocco and Kenya, and by the World Bank in Haiti.

5. Recommendations

The existing energy planning system and methods used should be adjusted and streamlined.
The long-term energy and power sector plans will need to be modified and streamlined to reflect changes both within and outside the sector, all the while keeping inside the framework provided by EPIRA. The content and revision cycle of existing key plans must respond to the need for support on decision-making in the political process and regulatory process, and to the information needs of stakeholders and the public regarding the Government's intentions. For example, the PDP is currently a limited mechanism for determining the optimal siting of generation facilities and expansion of transmission, because this plan lacks a spatial dimension that would enable transmission costs and nodal system benefits to be considered. Nowadays, applied methods and tools should incorporate a detailed temporal and spatial analysis of demand and supply as well as their balancing. Interim modelling exercises should be carried out more frequently to guide adjustments and detect changes in boundary conditions, such as technology and fuel prices. A broader mix of non-binding short-, medium- and longer-term scenarios for the energy sector will have to be considered. The new and pragmatic mix of sector planning models and methods should consider the changing decision rules and changing merit order in dispatch and reflect them in their solutions and optimization methods, which will result from higher variable RE shares, the option of distributed generation and their consequences for investment decisions.

Nonetheless, existing key plans – notably the Philippine Energy Plan (PEP), Power Development Plans (PDP), Transmission Development Plan (TDP) and Distribution Development Plan (DDP) – remain relevant and important. They explicitly express and communicate the strategy and the programming of intended policies and activities, and therefore form the basis of agreements and information on future system development.

It is, however, recommended to revise, modify and complement the existing energy and power planning system. Addressing issues which need a regular updating involving many stakeholders in the sector should be kept in the routine of recurrent plans, whereas the various issues coming up as needed in energy policy and decision-support in the political and regulatory process should be addressed by a more versatile planning. The content and revision cycles should reflect the need for decision-support in the political process and regulatory process and the need to inform stakeholders and the public about the government's intentions. This does not mean abandoning the existing process but, rather, streamlining it. In particular, the revision cycle of formal plans could be reduced to a feasible level in order to free up planning capacities for new tasks. Even the key TDP may not be needed annually. In contrast, informal interim planning and modelling exercises should be performed more frequently to guide adjustments and detect changes in boundary conditions.

The PDP and TDP should no longer incorporate the annual load curve and layer-wise (base, mid-merit, peak) optimization methodology, as they disregard the characteristics of variable RE and neglect the opportunities offered by it. Instead, a new generation of system expansion and operation modelling software tools will need to be used.

Another methodological suggestion is that consumers' self-generation be considered in the demand projections included in the DDPs and that distributed generation be considered in the TDP.

The regionalization of the PDP and TDP on the basis of the demand projections in the DDP should be extended further. The specific demand and supply situations of increasing numbers of islands or island groups – including their interconnections with neighboring islands – will need thorough analysis. Solutions for islands with relatively fast variable RE and distributed generation developments should be studied first.

Although easy-to-understand policy targets are important both for the public and politically, quantitative targets should be based on well-informed analysis and be compatible with different scenarios. In order to avoid

unnecessarily restrictive targets, fixing shares based on extrapolations of past or rough calculations should be avoided whenever better data is available. If this is not the case, the limitations should be stated clearly.

Planning should be enhanced by a mix of new methods and state-of-the-art software tools.
The DOE will require a versatile analysis and planning capacity with access to various data and modelling instruments for use in supporting policy decisions and program design. The data system and decision-support tools suited to this task are diverse. The mix of tools should include short-, medium- and long-term analysis as well as low-cost models with few data requirements that can be used widely alongside models that require more time, data or budget and are therefore less used.

Planning methods and tools should incorporate the detailed temporal and spatial analysis of demand and supply as well as approaches for balancing demand and supply to tackle the challenges posed by distributed generation. New tools can easily model many facets of the recent changes in the energy sector, especially those involving the behavior of variable RE or storage. The rise of distributed generation also increases the need to model generation and network expansion together. Traditional power sector planning models using internal optimization (cost minimization) functions, such as WASP, lack some essential features but can be complemented by newer and more suitable tools, such as the PLEXOS tool used for a recent NREL study under the above-mentioned task force, or the RECD method used for the above-mentioned technical companion papers to be prepared by GIZ.

Simulation tools such as LEAP can facilitate the integration of many stakeholders and the consideration of their ideas in varying scenarios in the long-term energy planning process. In this way, civil society can be involved in discussions on the trade-offs between objectives in different scenarios, which makes the planning process more inclusive and transparent.

When designing and revising specific policies, rather than running an unwieldy system or consulting existing plans that may not yield relevant answers, what is needed is agile decision-support tools.

Obtaining answers rapidly and at short notice is of particular use in policy design (e.g. RE policy design) and in the assessment of its impact on, for example, the preparation of competitive bidding for capacity (e.g. purchase agreements or contracts including and preferring low-carbon generation options), the zoning or nodal auctioning of generation in a manner consistent with transmission optimization, the analysis of proposed large power stations and their long-term fit with the system, etc.

The DOE should have permanent access to a versatile analysis and planning capacity endowed with various data and modelling instruments. This can be used for ad hoc policy decision support as well as for programming, quick regional and other partial system analyses, fast analyses of policies and significant measures, and key projects.

The decision-support should facilitate the identification of incremental policies and of specific measures under consideration. The tools should be able to quickly simulate numerous possible future scenarios, and should present choices and steps for sector targets that could be considered to be relatively robust 'no-regret' options.

A diverse range of appropriate data-system and decision-support tools are available[16]. Geospatial data on resources and demand and on distributed generation should be readily available. In addition, appropriate generation and transmission system expansion models, whether custom-made or commercially available (e.g. Plexos LT), should quickly be considered and adapted for the specific needs of analysis in the national Philippine system and for application in regional and other sub-systems. It is a very good development that Plexos has already been introduced at DOE recently. Annual production cost models should be provided to enable the simulation of

[16] For a recent overview of modelling and tools see IRENA, Planning for the Renewable Energy Future: Long term modelling and tools to expand variable renewable energy power in emerging economies, International Renewable Energy Agency, Abu Dhabi 2017

detailed annual system operations. Dynamic grid models such as the Power System Simulator for Engineering (PSS/E) or Power Factory, as well as advanced stochastic modelling software tools are required for grid stability analysis. In sum, the Philippine energy sector's actors and stakeholders now need access to a much broader mix of tools including a wider choice of databases and decision-support and planning instruments.

This required tool mix should include: options for performing short-, medium- and long-term analyses; low-cost models with few data requirements that can be frequently used; and processes and models that require more time, data or budget and are therefore used less often. The planning process, in addition to including stakeholders (i.e. engaging all energy sector institutions in joint planning), should aim to be comprehensive. In practice, this means it should be based on a transparent societal discussion of trade-offs, which itself requires tools to facilitate the discussion. The DOE's organization of goal-oriented taskforces or commissions is appropriate and should be further developed.

The depth and detail of the decision-support capacity can be developed incrementally, which means it can be built quickly even if certain aspects of the desired long-term sector development path are still unknown. This capacity should also build on the early-stage work undertaken so far by the Philippines to develop proactive temporal and spatial guidance for variable RE planning.

Planning capacities should be systematically strengthened.
Coping with current and future challenges will mean investing in new staff as well as training and developing the skills and competencies required for the new roles and tools. Existing, well-developed competences within government agencies, academia, research institutes, civil society organizations and private consultancies will need to be enhanced. Public access to relevant data on the Philippine power system must also be ensured to enable a transparent process and broad participation by all relevant stakeholders in the planning process.

The planning capacity created should also be versatile enough to provide support on other upcoming issues affecting the largely diversified power system of the Philippines. In this way, the interest-driven proposals that abound in the Philippines, as in many emerging markets, could be evaluated and countermeasures taken.

The Philippine energy sector is a huge system and the benefits of good planning and faster decision-support processes easily outweigh the costs of a larger, more focused and diversified planning capacity and thus justify the planning efforts. This future planning capacity must be able to develop custom-made national tools, use remote tools with user interfaces and apply existing software. Highly specialized technical planning work can be contracted out to suitable organizations or agencies with the relevant expertise.

6. Final remarks: tackling the challenges of transformation

Most of the planning problems identified are in no way Philippines-specific or home-grown: a set of fundamental changes is affecting power sectors across the world in similar ways, and sector players and processes are globally largely unprepared for it. Neither textbooks nor scientific papers prepare actors in emerging markets for these fundamental changes, and many feel like they have been left out on a limb.[17] To find appropriate and well-balanced solutions, it is therefore important to fully understand these interlinked fundamental changes rather than just recognize their symptoms.

Variable RE technologies are arguably the most 'viral' of these changes as they have recently gained significant shares in many markets around the world; and this development is expected to speed up further due to ongoing cost declines. The results of two forthcoming GIZ/DOE studies, to be published in early 2018, clearly show that both the supporters and opponents of variable RE are wrong to discuss whether high RE shares in generation should be supported or not; this is yesterday's question. The real question is not **whether**, but **when** RE shares will 'take off' in a country and enable that country to reap optimal benefits from well-placed annual additions of RE, and **how** this can be achieved within the sector planning structure. This then poses a new set of questions, because planning now also entails proposing when and where to invest in RE. Whether private stakeholders do invest accordingly is then left to their assessment of associated profits and risks. At this point, changes in other fundamentals, including storage and information technology, climate policy and low cost of capital, also come into play. The effect of all this is that today's planning processes, while close to ideal under 20th century energy sector standards, are not appropriate to tackle the new challenges.

The good news is that many emerging market utilities and independent power producers, including several in the Philippines, have recognized this fundamental shift and begun forming subsidiaries to invest in PV. Meralco, for instance, launched its own solar subsidiary, Spectrum, in January 2017. Those who move early are better placed to avoid the fate of the German utilities, which, having neglected the trend towards RE for too long, ended up losing more than two-thirds of their value and, as a consequence, had to shed many of their staff. The bad news is that, if this process is to be guided efficiently, public sector planning processes in the Philippines – and, indeed, around the world – need to be updated.

The Philippines should therefore not hesitate to revise and update any energy and power planning processes that require adjustment. Even if ready-made templates do not exist due to the fast pace of recent and future changes, iteratively applying the best available methods will help to ensure energy security and the affordability and sustainability of supply in the long term.

[17] GIZ vRE Discussion Series: Towards Adequate National Renewable Energy Planning for Dynamic Energy Sectors, Gesellschaft für Internationale Zusammenarbeit, Heising et al. Eschborn, 2015; European Union Energy Initiative. National Energy and Power Planning: Challenges for a Sector in Transition to a New Era EUEI, Eschborn, forthcoming; and Besant-Jones, J. Reforming Power Markets in Developing Countries: What Have We Learned, The World Bank, Washington, D.C. September 2006.

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