POWER AND CLIMATE CHANGE

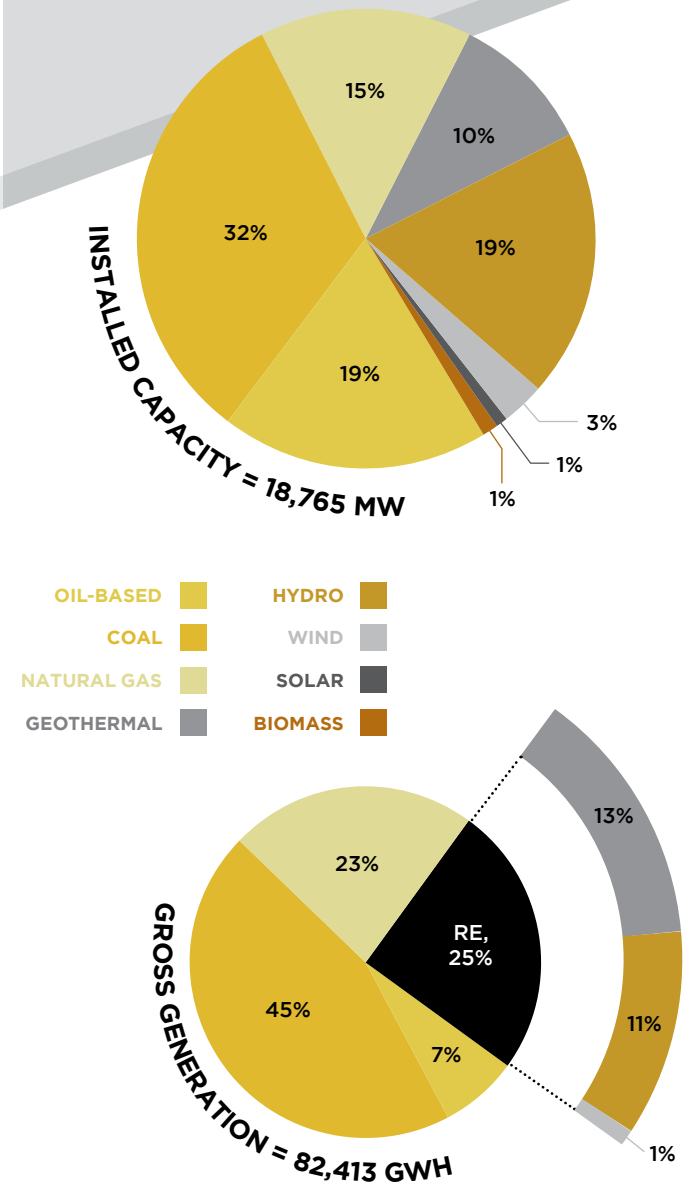


FIGURE 1: INSTALLED CAPACITY AND GROSS ELECTRICITY GENERATION IN 2015

OVERVIEW OF THE SECTOR

The Philippines' total installed electricity generating capacity continued to grow by 4.6% from 18 GW in 2014 to 19 GW in 2015. Coal-fired power plants constitute the largest share of the installed and dependable capacity in 2015 with 32% and 34% respectively. Among renewable energy (RE) technologies, hydro power maintains the highest share (19%), the majority of which is situated in Mindanao. With the implementation of the Feed-in Tariff (FIT) mechanism, wind and solar grew remarkably from 2014 to 2015 by 51% (144 MW increase) and 616% (142 MW increase), respectively. Despite their rapid rise, solar and wind power still represent only a minor share of total generated electricity, with less than 1% in 2015.

VARIABLE RENEWABLE ENERGY (SOLAR AND WIND) ACCOUNTS TO LESS THAN 1% OF TOTAL ELECTRICITY GENERATION IN 2015

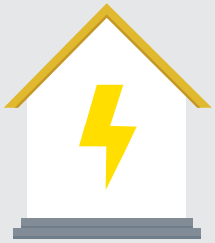
The Department of Energy (DOE) projects that by 2030 the country's peak demand for electricity will reach 30 GW or nearly 70% more than the current dependable capacity. The majority of capacity additions in the current pipeline are coal power plants. Out of the committed and indicative power plant projects 13,265 MW are coal plants, 2,500 MW natural gas plants, and 254 MW oil based technologies. In contrast, the combined total capacity of RE projects in the pipeline amounts to 5,435 MW (Wind 2,136 MW; Hydro 1,554 MW; Solar 1,314 MW; Geothermal 253 MW; Biomass 178 MW).

In terms of household electrification, as of 2015, the level is estimated at 88%. This corresponds to over 18 million energized households out of the estimated total number of households of 21 million. The Government aims to increase the household electrification level to 90% by 2017. Luzon has the highest level of household electrification at around 94.6% while Mindanao has a rate of 74%. To reach 90%, a total of 800,000 households are targeted for energization. It is estimated that 300,000 can be connected to the grid, the balance of 500,000 will be served by off-grid systems such as stand-alone systems (e.g. household-level solar systems) and micro-grids which at this moment are mainly powered by diesel generators. Most of the un-energized households are located in far flung off-grid areas and in conflict affected areas in Mindanao. Due

to its archipelagic characteristics, the Philippines still has a significant share of off-grid areas. Off-grid supply is currently mainly provided by expensive diesel generators. The subsidies for these generators pose a burden on all electricity consumers.

TABLE 1: HOUSEHOLD ELECTRIFICATION LEVEL AS OF JUNE 2015

DISTRIBUTION UTILITY	TOTAL HOUSEHOLD	TOTAL ELECTRIFIED	% HH ELECTRIFIED
Electric Cooperatives	13,081,400	10,901,416	83.3
MERALCO	6,383,307	6,207,371	97.2
Other Private Utilities	2,110,783	1,887,841	89.4
Total	21,575,490	18,996,628	88



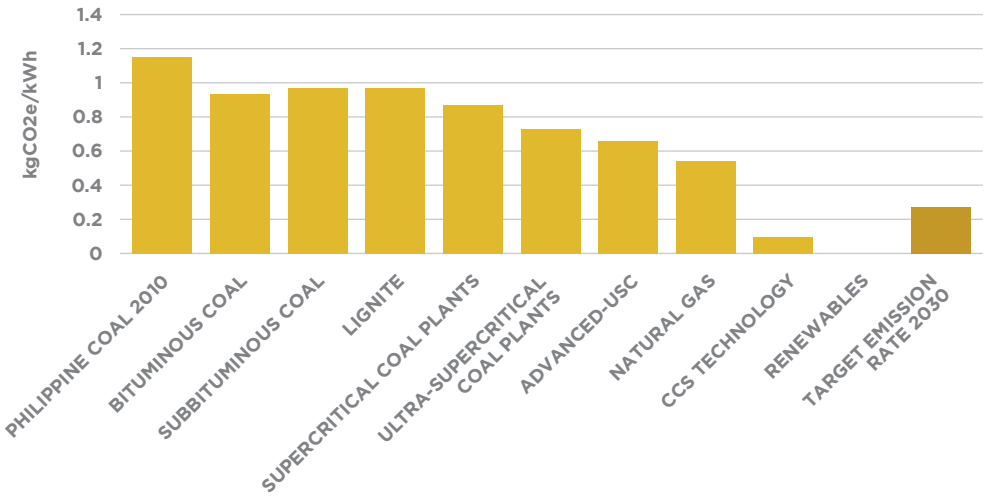
THE HOUSEHOLD ELECTRIFICATION TARGET IS TO ATTAIN 90% BY 2017

RELEVANCE OF THE SECTOR

36% OF THE TOTAL NATIONAL GHG EMISSIONS CAN BE ATTRIBUTED TO THE ELECTRICITY SECTOR

The power sector is not only of pronounced importance for the economy, it also comes with significant externalities. Beyond the end product of electricity, the sector produces large amounts of greenhouse gases (GHG) and pollutants. The current Philippine Energy Plan 2012-2030 envisions that coal will continue to be a leading contributor to the country's electricity supply. As such, this will have considerable impact on the aspiration to attain clean electricity supply and reduce GHG emissions. The figure below shows that even the most efficient coal technology has an emission rate far above the target emission rate in 2030 (without CCS). Under these considerations, the absolute maximum share of coal generation in 2030 can be calculated with a very simplified methodology. Assuming that coal plants are complemented exclusively by emission free technologies in 2030 so that all electricity sector emissions can be attributed to coal generation, a maximum share of approximately 40% results if only Advanced-USC plants are operating. However, such a scenario is highly unlikely due to the already existing coal plants with far lower efficiencies. Assuming that existing coal plants are used in 2030 a maximum share of about 20% results. Furthermore, in a realistic scenario - even with the cleanest and most efficient technology - the share would have to be lower due to operational limits of coal power plants.

FIGURE 2: TECHNOLOGY EMISSION RATES AND TARGET EMISSION RATE 2030 (70% EMISSION REDUCTION VS. BAU)



Aside from GHG emissions, coal-fired power plants produce large quantities of pollutants. Conventional coal-fired power plants sulfur dioxide (SO2) and nitrogen oxide (NOX), the key pollutants in the formation of acid rain Acid rain acidifies water bodies, and harms forest and coastal ecosystems. NOX helps form of ozone (smog) and nitrates. Ozone impairs lung function and reduces the yields of many economically important agricultural crops. Nitrate deposition over-enriches water bodies, causing algal blooms that kill fish and reduce biodiversity.

ASIDE FROM GHGS, COAL-FIRED POWER PLANTS PRODUCE LARGE QUANTITIES OF SULFUR DIOXIDE (SO2) AND NITROGEN OXIDE (NOX), THE KEY POLLUTANTS IN THE FORMATION OF ACID RAIN

Conventional coal-fired power plants are also a major source of particulate pollution. Scientific studies have shown that raised levels of particulates result in increased illness and premature death from heart and lung disorders, such as asthma and bronchitis.

Coal contains numerous persistent, bioaccumulative trace elements that are released during combustion and end up in the atmosphere and water bodies. These include mercury, dioxins, arsenic, radionucleotides, cadmium and lead. Many of these trace elements are known human carcinogens and have many other negative effects on human health.

Coal combustion waste (CCW) such as fly and bottom ash, and 'captured' pollutants, is normally disposed of in landfill sites or sold for industrial use. Regardless of how CCW is disposed of, there is a risk of toxic metals leaching into nearby surface and ground water. People who drink, over a period of years, water contaminated with CCW have a higher risk of cancer.

To reduce the negative impacts of the power sector and reap additional benefits, many countries are going through major changes of their power systems. The global 'energy transition' is a shift from large and central, mainly fossil-fuel based power systems towards more decentralized, mainly renewables-based power systems with smarter energy grids and more sophisticated energy markets. The Philippines has a vast reserve of RE potential (please see figuwre to the left) that can be tapped for electricity production. A study by the IRENA conducted this year concluded that "accelerating the deployment of renewable energy will fuel economic growth, create new employment opportunities, enhance human welfare, and contribute to a climate-safe future". The study provides empirical evidence that economic growth and sustainability are fully compatible and that the "conventional consideration of trade-offs between the two is outdated and erroneous."

To facilitate the transition of the electricity system the country needs to implement several measures. Some of these measures may include:

- Developing a long-term energy vision and planning framework based on a set of possible scenarios for future developments in the sector.
- Institutionalizing spatial planning of future RE projects and their timely integration into the Transmission Development Plan (TDP)
- Conducting RE grid integration studies
- Studying appropriate deployment models in particular for decentralized RE technologies for on-grid and off-grid applications
- Studying the costs related to technically integrating variable RE into the electricity grid

GEOTHERMAL >4,000 MW

WIND RESOURCE >76,000 MW

HYDROPOWER >10,000 MW

SOLAR >5KWH/M2/DAY

OCEAN >170,000 MW

BIOMASS >500 MW
(BAGASSE & RICE HULLS ONLY

TABLE 2: EXEMPLARY BENEFITS OF RENEWABLE ENERGY DEVELOPMENT

BENEFITS OF RENEWABLE ENERGY DEVELOPMENT	
1	Locally-available renewable energy sources can increase energy self-sufficiency and reduce dependence on fuel price fluctuations and diplomatic relations.
2	Cost for renewable energy projects around the world are often on par with coal power. Prices for renewable energy are projected to continue their rapid decrease, while coal price developments beyond a 3-5 years' time frame remain highly unpredictable
3	Clean energy sources contribute to clean air and a healthy environment, while reducing the financial burden to the Philippine economy associated with air pollution and environmental degradation from conventional power generation.
4	Reducing diesel consumption through the utilization of renewable energy in off-grid areas can significantly reduce the requirements of the subsidy borne by the electricity consumers through the Universal Charge for Missionary Electrification (UCME) factored in their electric bills.
5	Decentralized renewable energy plants provide access to energy in rural areas.

Energy Efficiency (EE) is the easiest and often cheapest way to reduce the need for expansion of power generation and can thus contribute to the achievement of the energy transition. Increased energy efficiency is achieved by reducing energy losses and energy consumption without compromising economic output. It is often called the "invisible fuel", as savings in power demand or the reduction of electricity generation losses, will reduce the overall need for utilization of fuels to achieve the same economic outcome. These reductions can be achieved in two ways: through supply-side energy efficiency (SSEE) which aims to decrease energy losses in the supply chain and through demand-side energy efficiency (DSEE) which aims to consume less energy for the same level of service, for example, when operating buildings, tools, products, and machinery.

The successful implementation of an EE program can result in reductions in peak demand and consequently energy imports. The country has a national DSEE program since 1996 which includes end-use EE measures pursued at the national level through programs for energy management and audits, building award recognition, standards and labeling for residential appliances, voluntary arrangements, and peak demand reductions. An EE roadmap was formulated which is aptly titled Energy Efficiency Roadmap for the Philippines 2014-30. The over-all objectives of the Roadmap are to attain the following by 2030:

- 40% reduction in energy intensity compared to 2010 baselines
- Decreased energy consumption of 1.6% per year against baseline forecasts
- Savings of approximately 10,665 KTOE p.a. (one-third of current demand)
- 21 MtCO2 emission reductions by 2030 compared to BAU

LEGAL AND POLICY FRAMEWORK GOVERNING THE SECTOR

Two fundamental laws currently govern the power sector: Republic Act (RA) 9136 or the Electric Power Industry Reform Act (EPIRA) of 2001 and RA 9513 or the Renewable Energy Act of 2008. Both laws present a framework to achieve energy security, affordability and sustainability in the country.

ELECTRIC POWER INDUSTRY REFORM ACT (EPIRA) OF 2001

EPIRA brought about major reforms in the power sector, most notably the privatization of government-owned generation assets and transmission network operation. EPIRA initiated an unbundling process and divided the electricity industry into four distinct sectors: generation, transmission, distribution and supply.

RENEWABLE ENERGY ACT (RE ACT) OF 2008

The primary goal of the Act is to achieve energy self-reliance through the accelerated exploration and development of renewable energy resources. To attain this, the RE Act offers various fiscal and non-fiscal incentives to private sector investors, RE equipment manufacturers and suppliers, and RE project developers.

The non-fiscal incentives in the RE Act include the Renewable Portfolio Standard (RPS) that mandates a minimum percentage of RE generation for on-grid systems; Feed-in-Tariff (FIT) that guarantees a fixed price for RE electricity generation for 20 years; Net Metering mechanism enables RE installations at the end-user level (now capped at 100 kilowatts capacity) to sell back to their utility any unconsumed RE generation at an approved rate. Current rules place this rate at the blended generation rate of the distribution utility which is significantly lower than the rate paid by consumers; The Green Energy Option Program (GEOP) recognizes that some customers may choose to have RE despite a potentially higher price. This policy mechanism mandates distribution utilities to ensure that their non-contestable customers have the option to buy RE. The contestable customers already have their power of choice, hence their non-inclusion into this mechanism. As of this writing, only the FIT and Net Metering policies have been fully implemented.

NATIONAL POLICY RESPONSES AND ACTIONS

The Philippines has formulated quantitative energy policy targets that directly and indirectly affect the development of clean energy sources. These include the desired national RE capacity target of at least 30% (Department Circular DC2015-07-0014), the tripling of RE capacities from 2010 until 2030 (National Renewable Energy Program, NREP), and a 70% reduction of GHG emissions compared to the BAU scenario (Intended Nationally Determined Contribution, INDC). The translation of these policy targets into concrete plans is realized through different agencies such as NEDA, DOE, NEA, NPC, ERC, NGCP, and others. However, the new Government Administration is presently reviewing these policies and there are changes to be expected from this initiative. Likewise, EPIRA mandates that actual realization of new power plants is undertaken by the private sector, which proposes technologies, size and locations of new power plants based on economic rationale. Actual steering of these developments through the government is achieved through regulations and the provision of economic incentive schemes.

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