

Universal energy access in Myanmar, challenges and opportunities

Daniel del Barrio Álvarez; Numata, M.; Yamaguchi, K.; Yoshikawa, H.

Policy Alternatives Research Institute, The University of Tokyo

Myanmar's evolving political context

Myanmar, formerly known as Burma, is the newest member of the club of world democracies. Coming after long years of a close military regime, the country and its steps towards consolidation of the new regime are of interest internationally. With the size of France, the largest in continental Southeast Asia, and with a population of fifty million people; Myanmar is located at the crossroads of China, India, and the rest of Southeast Asia. Increasing its geostrategic importance for regional and global affairs.

The country counts with 135 different recognized ethnic groups and it is administratively divided into 7 states, 7 regions, 1 union territory, 5 self-administered zones, and 1 self-administrative division. Burmese represents a 70% of the total population, whilst other large ethnic groups in-

clude Chin, Kachin, Karenni, Karen, Mon, Rakhine, Rohingya, and Shan. A long-time armed conflict between central government armed forces and minority groups have been continuing nearly since the independence from the British Empire. Achieving the national reconciliation is currently one of the top priorities in the government's agenda. Adding to this one the humanitarian crisis in the Rakhine State.

Myanmar is experiencing a double transformation politically from a military regime to an open democracy and from a closed economy to an open system. The change of government opened greater expectations for attracting international investment, particularly from Western countries. The traditional support to Aung San Suu Kyi and the lifting of the economic sanctions by the United States and the European Union were considered positive steps in that direction.

Alternatives for sustainable development in Myanmar

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In particular, we have been focusing on the analysis of the synergies between energy and sustainable development in Myanmar, under the framework of the Sustainable Development Goals (SDGs). We are also providing knowledge support in the development of strategies to facilitate a traditional vicious circle between energy and conflict in Myanmar^{1,2,3}, which has indeed attracted the local interest^{4,5}.

¹ Yoshikawa, Anbimozhi (2018) Electricity Futures in the Greater Mekong Subregion: Towards Sustainability, Inclusive Development, and Conflict Resolution. <http://www.eria.org/research/electricity-futures-in-the-greater-mekong-subregion-towards-sustainability-inclusive-development-and-conflict-resolution/>

² Del Barrio-Alvarez, D.; Sugiyama, M. (2018) Toward a sustainable electricity policy in Myanmar: Recommendations for policy makers and development partners. Policy Alternatives Research Institute - PARI Policy Brief. http://pari.u-tokyo.ac.jp/eng/publications/index_policy_briefs.html

³ See UTokyo Future Society Initiative https://www.u-tokyo.ac.jp/adm/fsi/en/sdgs_project067.html

⁴ Global New Light Volume V, Number 121, 17 Friday, August 2018. <http://www.moi.gov.mm/npe/nlm/?q=content/17-aug-18>

⁵ MyanmarTimes, June 18. Article in press (in Burmese)

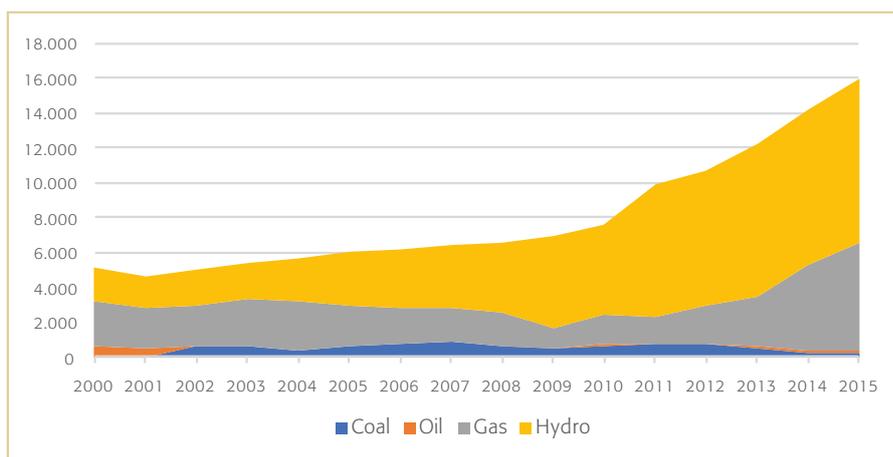
The two main goals of the power sector in Myanmar, secure stable supply in connected areas and expand the electricity service to rural areas, have traditionally been perceived as mutually exclusive, due to a perverse cycle explained in a next section. Contrary to that belief, our analyses show that appropriate energy policies and the national reconciliation process have positive spillovers to each other.

In this article, we first provide a quick overview of the energy system in Myanmar, with a special focus on electricity. This is followed by an explanation of the importance of energy as a pivotal instrument to contribute to the peace development in the country.

Energy to legitimize the political transition

The achievement of nation-wide peace between the government of Myanmar and the multitude of ethnic armed groups is a key priority for the consolidation, and a hope, of the democratic transition. A national reconciliation process was initiated with the 21st Century Panglong Conference, with a strong reference to the Panglong Conference held in 1947 under the leadership of Aung San (father of Aung San Suu Kyi and a national hero in Myanmar)⁶. National Ceasefire Agreements have been signed with several, but not all, the ethnic armed groups in the country^{7,8}. The negotiations are still on and cover a broad number of aspects.

Figure 1. Electricity production in Myanmar (GWh)



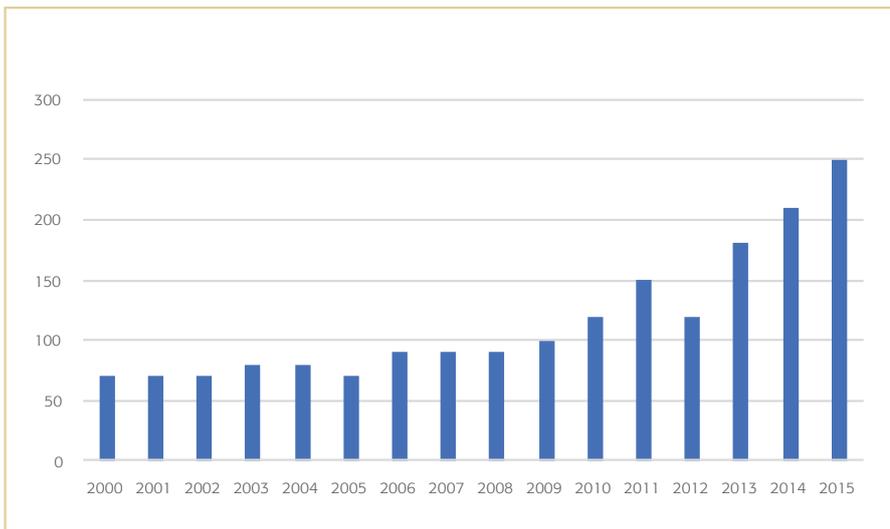
Source: International Energy Agency data

Energy is to play a pivotal role in the transition⁹, and the changes occurring need to be understood as a part of an overall process. The country is facing a lack of enough and adequate electricity supply. Less than half of the population have access to electricity, with very low levels of electrification in the peripheral areas of the country. Meanwhile, urban centers suffer from a lack of enough stable power supply, especially during the dry seasons, when dams are at their lower levels.

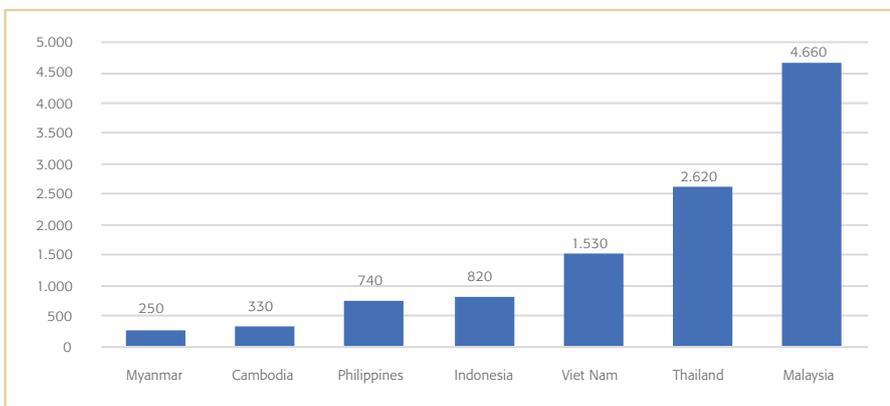
The promotion of sustainable development is also a key priority for the country. Myanmar is highly vulnerable to climate change effects. The rapid deforestation, third-worst in the world, reduces its natural protection.

Myanmar does have signed the Paris Agreement and has committed in its Intended Nationally Determined Contributions (INDC) to continue as a net GHG sink by 2030¹⁰. The devastating effect of the cyclone Nargis in 2008, which followed an unusual path is representative of Myanmar’s vulnerability to climate change. This killed 140,000 people in 2008, making of it one the deadliest in Asia¹¹. The large number of victims and casualties was partly due to its path across the lowest part of the Irrawaddy Delta, the most populated area of the country. The country is regularly hit by floods during the monsoon season. Last August, a breach in a dam created severed floods and inundated nearly 100 villages and forced evacuation of about 150,000 people¹².

⁶ Weiss (2017) Did Aung San Lead at Panglong – or Follow? .The Diplomat <https://thediplomat.com/2017/07/did-aung-san-lead-at-panglong-or-follow/>
⁷ Reuters (2018, January 24) Myanmar to sign ceasefire with two rebel groups amid decades of conflict. <https://www.reuters.com/article/us-myanmar-military/myanmar-to-sign-ceasefire-with-two-rebel-groups-amid-decades-of-conflict-idUSKBN1FD0HH?il=0>
⁸ See Myanmar Peace Monitor: <http://www.mmpeacemonitor.org/peace-process/ceasefires>
⁹ Posner Ross, R. (2015). Myanmar’s Path to Electrification: The Role of Distributed Energy Systems. Washington D.C. Retrieved from <https://www.csis.org/analysis/myanmars-path-electrification>
¹⁰ <http://www.burmalibrary.org/docs24/Myanmars-INDC.pdf>
¹¹ Gottlieb (2018) 10 years after, Cyclone Nargis still holds lessons for Myanmar.The Conversation. <https://theconversation.com/10-years-after-cyclone-nargis-still-holds-lessons-for-myanmar-95039>
¹² The Guardian (2018, August 29) Myanmar dam breach forces thousands to evacuate their homes. <https://www.theguardian.com/world/2018/aug/29/myanmar-dam-breach-people-evacuate-homes-officials-say>

Figure 2. Electricity consumption per capita in Myanmar (kWh/capita)


Source: International Energy Agency data

Figure 3. Electricity consumption in selected ASEAN countries (kWh/capita, 2015)


Source: International Energy Agency data

Energy in Myanmar

Myanmar's electricity production was near 16,000 GWh in 2015. This is a two-fold increase since 2010. The generation mix is dominated by hydropower and followed by

gas. Hydropower constitutes between 60 and 70%, whilst natural gas makes about the remaining 30%. Other sources are a minority in the mix. Figure 1 shows the rise in electricity production. This has gone in parallel with a rapid increase in electrici-

ty consumption per capita (see Figure 2). Nevertheless, this remains the lowest level of electricity consumption per capita when compared with other Southeast Asian countries (see Figure 3).

Access to electricity is at world-low levels. Although different figures exist about that, there is a basic agreement that at least half of the population lack access to modern electricity. Furthermore, the majority of the rural population electrified relies either on diesel generators, which are economically and environmentally costly or from solar home systems, which do not provide enough power for productive uses (Table 1).

Development partners' re-engagement with Myanmar in the power sector

The democratic transition brought new opportunities from the lifting of economic sanctions and a rapid and powerful re-engagement of development partners. Table 2 summarizes some of the most relevant programs being carried out by development partners. The three major policy documents prepared have been so far the Energy Master Plan with support from the Asian Development Bank (ADB)¹⁴, the National Electrification Plan (NEP)¹⁵ by the World Bank, and the National Electricity Master Plan (NEMP) by the Japan International Cooperation Agency (JICA)¹⁶. A brief overview of the three of them is provided below. (Table 2).

The ADB initiated its re-engagement in Myanmar in 2012 with the publication of an Initial Assessment of the power sector. The initial contribution from ADB in the energy sector consisted on the support to

¹³ See Myanmar Information Management Unit (MIMU): <http://themimu.info/census-data>

¹⁴ Emmerton, M., Thomcraft, S., Oksanen, S., Soe, M., Hlaing, K. K., Thein, Y.Y., & Khin, M. (2015). Myanmar Energy Master Plan. National Energy Management Committee (NEMC)

¹⁵ Castalia (2014). Myanmar National Electrification Program (NEP), Roadmap and Investment prospectus. Final Road Map and Investment Prospectus.

¹⁶ http://open_jicareport.jica.go.jp/pdf/12238754.pdf

Table 1. Population using electricity as the main source for lighting in Myanmar (2015)

	Total population	Pop. using electricity for lighting	Share of population (%)
Kachin	269,365	81,590	30%
Kayah	57,274	27,831	49%
Kayin	308,041	82,805	27%
Chin	91,121	14,074	15%
Sagaing	1,096,857	265,131	24%
Tanintharyi	283,099	22,754	8%
Bago	1,142,974	316,091	28%
Magway	919,777	208,473	23%
Mandalay	1,323,191	520,838	39%
Mon	422,612	150,876	36%
Rakhine	459,772	59,039	13%
Yangon	1,582,944	1,097,146	69%
Shan	1,169,569	390,581	33%
Ayeyawady	1,488,983	178,810	12%
Nay Pyi Taw	262,253	111,678	43%
Union	10,877,832	3,527,717	32%

 Source: Myanmar National Census (2015)¹³
Table 2. Energy sector related development partners' programs in Myanmar

Institution	Plan / Programme
World Bank	National Electrification Plan (NEP), to achieve universal energy access by 2030 ¹⁷
Asian Development Bank	Energy Master Plan 2014 Electricity Law of 2014 ¹⁸ (with funding from Norway) ¹⁹
International Financial Corporation (IFC)	Strategic Environmental Assessment of the Myanmar Hydropower Sector ²⁰
Japan International Cooperation Agency (JICA)	National Electricity Master Plan (NEMP), to support the development of a capacity expansion plan by the Ministry of Energy and Electricity
GIZ	Promoting Rural Electrification in Myanmar Programme ²¹
Norway	Sustainable hydropower Karen National Union (KNU) ²²

Source: Elaborated by authors

¹⁷ <http://projects.worldbank.org/PI52936?lang=en>
¹⁸ For an English version, see <http://pwplegal.com/documents/documents/2efb6-Newsletter-50-9-November-2014.pdf>
¹⁹ <https://www.adb.org/news/adb-norway-help-update-myanmar-electricity-law>
²⁰ https://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/hydro+advisory/resources/sea+of+the+hydropower+sector+in+myanmar+resources+page
²¹ <https://www.giz.de/en/worldwide/42922.html>
²² <http://www.dvb.no/news/norwegian-support-for-hydropower-peacebuilding-through-best-practice/45265>

Table 3. Scenarios considered at the current version of the NEMP

Scenario	Description	Installed capacity in MW (2030)				
		Hydro (large)	Hydro (Middle-small)	Gas	Coal	Renewables
Domestic energy consumption	Maximization of use of national resources. Hydropower and gas-fired plants fully developed	12147	6891	4986	2760	2000
Least cost	Minimization of overall generation cost. Increase of coal-fired and reduction of gas-fired	12147	6891	2482	5030	2000
Power resources balance scenario	Only hydropower plants with shorter lead time developed. Gas-fired limited to known gas supplies.	1412	7405	4986	7715	2000

Source: JICA

the National Energy Management Committee (NEMC), created in 2013 for the coordination of the numerous ministries with responsibilities in the energy sector and abolished by the current government. The ADB approved two technical assistance, the TA-8244 to draft a National Energy Policy adopted in 2015, and the TA-8356, under the Japan Fund for Poverty Reduction, to prepare the Energy Master Plan (EMP).

The National Energy Policy²³ highlighted nine salient points:

- (i) To explore and exploit all energy resources available in Myanmar
- (ii) To reform the organizational set-up of energy related State entities in accordance with the State's economic reform policy
- (iii) To compile systematic statistics on domestic demand and supply of various different kinds of energy resources of Myanmar
- (iv) To implement rural energy supply programmes in order to narrow the gap between urban and rural energy consumption

- (v) To implement measure for sustainable energy development
- (vi) To promote Energy Efficiency and Energy Conservation
- (vii) Establish Research & Development institutions in order to keep abreast with international practices in energy resources exploration and development works and to produce international quality products
- (viii) To promote international collaboration in energy matters
- (ix) To formulate appropriate policy for energy product pricing meeting the economic security of energy producer, energy supplier and energy consumer and also to reduce the subsidy in pricing of energy products

The National Electrification Plan (NEP) constitutes the most relevant involvement of the World Bank in Myanmar. The NEP aims to achieve full electrification by 2030, requiring 7.2 million new households' connections. The total cost of the electrification is estimated to be

US\$5.9 billion, to initiate the works, the World Bank approved a US\$400 million in 2012²⁴. By 2030 it is expected that most of the country will be connected to the national grid, while only 11,000 households will be connected to permanent mini-grids. In the meantime, particularly during the initial years, Castalia study looks at a pre-electrification strategy based on diesel and solar hybrid mini-grids for ¼ million households²⁵.

Finally, the Japan International Cooperation Agency (JICA) supported the development of the National Electrification Master Plan (NEMP). Two levels of demand growth were estimated, being the demand in 2030 triple fold than current levels for the low case, and five times larger in the high case. The high case of demand considers a 13% growth rate, based on calculations from the Myanmar Electric Power Enterprise (MEPE). Table 3 summarizes the three scenarios considered. The Power resources balance scenario was confirmed to be the one to proceed on 27 May 2014²⁶.

²³ EEP, Myanmar National Energy Policy 2014 <http://www.eepmekong.org/index.php/resources/country-reports/myanmar/224-myanmar-national-energy-policy-2014>

²⁴ Posner Ross, R. (2015). Myanmar's Path to Electrification: The Role of Distributed Energy Systems. Washington D.C. Retrieved from <https://www.csis.org/analysis/myanmars-path-electrification>

²⁵ Castalia (2014). Myanmar National Electrification Program (NEP), Roadmap and Investment prospectus. Final Road Map and Investment Prospectus.

²⁶ http://open_jicareport.jica.go.jp/pdf/12238754.pdf

Breaking down the perverse cycle between energy and peace

All the programs in the energy sector share the goal of achieving a universal and sustainable energy access across the country. This is as well a top priority in the democratic transition and a clear demand of the people, both in rural and urban areas. Nevertheless, under a sensitive context of still conflicts between the central government and ethnic armed groups in the peripheral areas, the process towards that shared goal must be mutually reinforcing a peacebuilding strategy.

In the past, the development of very large-scale hydropower dams has been promoted as part of the energy plans but have had a negative impact on exacerbating conflicts. Myanmar is rich in hydropower resources, but this solution could lead to new conflicts. Hydropower technical potential has been estimated to be around 50,000 MW, and 266 sites were identified to install up to nearly 40,000 MW²⁷. Majority of this potential would be developed through large-scale dams. This would be way over the country's needs. Indeed, a large percentage of the electricity generated would be committed through export contracts to China and Thailand. Whilst this would bring foreign currencies to the country, little

positive local impacts in terms of energy access were expected.

The Myitsone dam in the northern Kachin state has become the most salient case of this. The project, proposed as a joint venture between Burmese and Chinese investors with the Ministry of Energy of Myanmar, has been facing a negative reaction from local villagers as well as local and international NGOs²⁸ and has raised concerns of hampering the peace process²⁹. Myitsone dam would be the first dam in the Irrawaddy river, of which 40 million living or depending on it raising the concerns of potential countrywide negative impacts. The contracts have also been accused of being too favorable to the Chinese side while providing few benefits for the local villagers that assume the burden of the construction. In fact, the agreements based on 90% export would add little extra capacity to the national grid, but even they do not provide electricity to the nearby villages. As a result, a more structured opposition to the construction of dams has emerged. This had a major milestone when the project was paralyzed by the government of Myanmar in 2011³⁰, creating major concerns from Chinese investors³¹. A special commission was created in order to assess the continuation of the project, and the final

decision is still pending³². Nevertheless, Chinese pressures have reduced in what appears to be a movement towards favoring the development of dams in different locations upstream^{33,34}. The development of similar large-scale hydropower dams has also become an impediment to the peace process.

Contrary to the "conflict" exacerbated by the development of large-scale dams such as Myitsone, energy policies can, and must, be a part of the conflict resolution strategies. Ours and others' studies have found that a more ambitious use of other renewable energy sources such as solar and mini-hydro can deliver results indeed in more advantageous conditions from social, environmental, and economic perspectives.

Scaling up sustainable rural electrification

Mini-grids are currently a preferred solution by the government and citizens so to facilitate wider socio-economic impacts beyond the capabilities of solar home systems (SHS). For some time, private entrepreneurs and local and international NGOs have independently developed these solutions. The increase of inflow of donor funding has triggered the launching of several initiatives aiming at the diffusion of

²⁷ Kattelus, M. et al. (2015) Hydropower development in Myanmar and its implications on regional energy cooperation. *International Journal of Sustainable Society*, <https://doi.org/10.1504/IJSSOC.2015.068071>

²⁸ China Dialogue (2012, March 28) Behind Myanmar's suspended dam. <https://www.chinadialogue.net/article/show/single/en/4832-Behind-Myanmar-s-suspended-dam-1-50>

²⁹ Kittner, N., Yamaguchi, K. (2017) Hydropower threatens peace in Myanmar -- but it doesn't have to. *Asian Nikkei Review* March 17, 2017 <https://asia.nikkei.com/Viewpoints/Noah-Kittner-and-Kensuke-Yamaguchi/Hydropower-threatens-peace-in-Myanmar-but-it-doesn-t-have-to>

³⁰ BBC (2011 September 30) Burma dam: Why Myitsone plan is being halted. <https://www.bbc.com/news/world-asia-pacific-15123833>

³¹ International Policy Digest (2015 April 14) The Impact of Energy on China-Myanmar Relations. <https://intpolicydigest.org/2015/04/14/the-impact-of-energy-on-china-myanmar-relations/>

³² Myanmar Times (2017, February 8) Longer wait for final word on Myitsone dam project. <https://www.mmmtimes.com/national-news/24860-longer-wait-for-final-word-on-myitsone-dam-project.html>

³³ Kristensen, J. (2016) Solving Myanmar's Myitsone Dam Conundrum. *The Diplomat*. <https://thediplomat.com/2016/04/solving-myanmars-myitsone-dam-conundrum/>

³⁴ Japan Times (2017, April 6) China may shelve controversial Myitsone dam in exchange for other interests in Myanmar. <https://www.japantimes.co.jp/news/2017/04/06/asia-pacific/china-may-shelve-controversial-myitsone-dam-exchange-interests-myanmar/#.XAYoaLpuK3A>

renewable-based mini-grids for rural electrification. Commonly, villagers organize themselves in village electrification committees (VECs). These decide on matters pertaining to energy such as fuel procurement, tariffs, and the exemption of poor households, and in some cases, oversee tariff collection.

The Department of Rural Development (DRD), from the Ministry of Agriculture, Livestock, and Irrigation (MOALI), has been allocated the responsibility for off-grid electrification. As part of the National Electrification Program (NEP), DRD has initiated the so-called "60/20/20" program. Under this, private companies invest 20% of the capital expenditure (CAPEX), VEC invests 20% and 60% is covered by a subsidy from the government.

Mini-grid projects under the 60/20/20 are approved through a competitive bidding process managed by the DRD-NEP team. The approval grants the right for operation for 5 to 15 years to the private investor. This includes a capacity building component and the transfer of its operation and ownership after that period. The program was launched in 2017, with 8 projects were selected out of 40 proposals (34 solar PV, 4 hydropower, and 1 biomass) in its first round, and 74 projects were selected out of 83 proposals in the second one. Currently, the third round is on-going.

Scaling up the electrification through mini-grids is challenged by their financial sustainability. Nevertheless, this program cannot

be financially sustained to cover the entire country. The government is currently lending the loan funds for later grants. To avoid this, further research is needed to identify the barriers and most promising alternatives to reduce the economic costs³⁵, which are currently superior to global and regional standards. The program is currently in its third round for project selection, and, not without troubles, has been attracting interest from communities and developers.

Securing the financing for the rolling program of mini-grids is another challenge. From private investors, the promotion of productive uses is a fundamental requirement to make profits due to the low demand from households. As from the government side, keeping the 60% subsidy for reaching to the entire population in the promised timeline would represent a severe financial burden. In a sense, the electricity subsidy only benefits the urban population, whilst being a barrier for the rolling out of rural electrification programs. Electricity tariffs for residential sector in grid-connected areas are heavily subsidized, up to the level of having the lowest electricity tariffs in the region (about US\$3cents/kWh in average)³⁶. It is far below to cover the operation and maintenance of generation and transmission/distribution of national grid still less rural electrification.

Under such conditions, and with the impossibility of increasing the subsidies to the rural populations, additional funding

sources become a major need. Special revenue funds have proven successful in other countries as represent an interesting alternative for the government of Myanmar to secure the required capital. Thailand's Energy Efficiency Revolving Fund³⁷, also known as the Energy Conservation Promotion Fund (ENCON Fund), is a good example and could provide a model for Myanmar to replicate.

Securing also a sustainable national grid

Meanwhile, the demand in the areas supplied by the national grid keeps growing, and the blackouts in the dry season continue representing a burden on the citizens' life and businesses which needs to rely on backup generation. The government is currently looking at different options so to increase the generation capacity in a sustainable manner.

Hydropower remains as an option, and some new projects have started to move on. But any more ambitious plan will require a rebuilding of the trust from local residents and the establishment of fair-benefit sharing mechanisms.

Natural gas can introduce reliability into the system as a baseload resource, but the government should not rely exclusively on existing reserves in the country. Currently, most indigenous production is exported to Thailand and China³⁸, and it is expected that the reserves will begin depleting in a few years. Myanmar could potentially re-

³⁵ Numata, M., Sugiyama, M., Swe, W., Anbumozhi, V. (2018). Technoeconomic Assessment of Microgrids in Myanmar. ERIA Discussion Paper ERIA-DP-2018-05. <http://www.eria.org/research/technoeconomic-assessment-of-microgrids-in-myanmar/>

³⁶ ADB (2016) Myanmar: Energy sector assessment, strategy, and road map. <https://www.adb.org/sites/default/files/institutional-document/218286/mya-energy-sector-assessment.pdf>

³⁷ Ballesteros, A., Brown, L. H. (2013) Lessons from Thailand: Mobilizing Investment in Energy Efficiency. World Resources Institute (WRI). <https://www.wri.org/blog/2013/04/lessons-thailand-mobilizing-investment-energy-efficiency>

³⁸ ADB (2016) Myanmar: Energy sector assessment, strategy, and road map. <https://www.adb.org/sites/default/files/institutional-document/218286/mya-energy-sector-assessment.pdf>

negotiate these contracts to utilize a large portion for its own supply. However, even if successful, importing LNG represents a more solid opportunity in the medium and long terms. The government approved new projects in the last year. Still, discussions on the price can raise some concerns.

Solar remains the area of large potential still to be explored. The country is endowed with an abundant solar resource, which could be utilized to rapidly increase the supply to the grid. The Central Dry Zone has abundant potential that could be connected to the national grid without the need to construct large transmission lines in remote conflict-ridden areas. Myanmar's climate, which is divided into dry

and wet seasons, makes solar and hydro energy seasonally complementary. Despite this potential, solar energy remains unexplored as a grid-connected resource. A small number of projects have been proposed so far and are currently at different levels of agreement with the government. Minbu's 170 MW solar project in the Magway region is the most advanced at the moment. After several delays, it is expected that the initial phase of 40 MW, out of a total of 170 MW will be finally completed in 2019³⁹. Another two solar projects have been approved in Mandalay, in Nabuaing and Wundwin, for 150 MW each of them⁴⁰. Some other projects are in the pipeline, but little progress has been reported so far.^{41,42}

Summary

Myanmar is undergoing a major transition that should take it in the path for a positive sustainable path. Energy is going to play a major role in this process. Starting from a very low level, the investments and policy decisions taking now can help the country to leapfrog others and avoid a carbon lock-in. Studies show what the country must gain from it, such as positive impacts of health. As well, sustainable energy plans can contribute to the country's national reconciliation process. Whilst many other issues remain in the negotiation table, energy should be one that creates positive discussion rather than exacerbates conflict. ■

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³⁹ Times (2018, August 18). Govt still mulling hike in electricity tariffs, explores solar options. <https://www.mmtimes.com/news/govt-still-mulling-hike-electricity-tariffs-explores-solar-options.html>

⁴⁰ See <http://mandalaysolar.com/>
PV-Magazine (2018, January 20) The weekend read: Myanmar's solar lifeline. <https://www.pv-magazine.com/2018/01/20/the-weekend-read-myanmars-solar-lifeline/>

⁴¹ PV-Magazine (2018, August 29) 130 MW solar project announced in Myanmar. <https://www.pv-magazine.com/2018/08/29/130-mw-solar-project-announced-in-myanmar/>

⁴² PV-Magazine (2018, August 29) 130 MW solar project announced in Myanmar. <https://www.pv-magazine.com/2018/08/29/130-mw-solar-project-announced-in-myanmar/>