

***Energy and Development Discourse in Cambodia: Gaps between Energy Infrastructure for Industrial Development and the Energy Needs of People***

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**Abstract**

As the Royal Government of Cambodia attempts to lead the country from least developed to a middle income status country as classified by the United Nations, the relationship between energy and development policies and energy provision becomes a priority. Key energy and related development policy documents were collected and subjected to discourse analysis. The analysis also included transcripts of interviews with participants from the solar energy industry, development NGO's and the United Nations in Cambodia. This mixed-method investigation has identified substantial gaps between a path towards centralized energy generation with large-scale hydroelectricity and a path to decentralized energy generation including off grid, household and utility scale solar PV. With limited grid access in the rural areas of Cambodia, the policy documents recognise the role of decentralized renewable energy, particularly solar PV and small scale hydro power. They also place significant emphasis on the private sector providing energy services. However, this research has identified a lack of policy framework and incentives for providing energy for people in much of the country. It also identifies an opportunity to overcome the absence of energy network infrastructure through the adaption of supportive policy settings for transitioning Cambodia's energy sector to include a mix of decentralized renewable energy, largely comprising solar PV with grid integration where available. Additionally, more proactive energy projections and planning for energy services is required to meet the needs of industry and people.

Keywords: Cambodia; development; infrastructure; decentralized; energy policy; discourse.

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## **Introduction**

The Cambodian government's energy and related development policies are examined in this article to understand the relationship between energy policy and provision in Cambodia and discourses of the Royal Government of Cambodia, United Nations, regional organisations, non-governmental organisations (NGOs) and the solar energy industry in Cambodia. The policy analysed in this article broadly correlates to development thinking in the post 1990 era where human development, focusing on capabilities and the development of the state is central (Nederveen Pieterse, 2010, p. 10). Discourses of private investment, trade and markets also feature prominently in the policy analysed as well as themes around international cooperation.

The policy approach to development and energy services in Cambodia broadly correlates with development and ecological modernization thinking as discussed by Käkönen et al. (2014) and Moore and Schmitz (1995) with industrialization and economic growth as the foundation, however this approach is becoming increasingly obsolete and does not necessarily support the population to have access to electricity or to ensure Cambodia's future energy security.

Sachs (1993) identified the priority of sustaining 'development' that emerged from the United Nations Conference on Environment and Development (UNCED) in 1992. The 1992 declaration did not exclude discourses of climate change and renewable energy but its overall agenda prioritized economic growth and investment based on a paradigm of rapid industrialization in the name of 'sustainable development'. This is hardly surprising as highlighted by Moore and Schmitz (1995, p. 22), who discuss how the use of development as a term between 1945 and 1995 was based on an industrialization model with economic growth at its foundation. Energy services as a fundamental foundation of economic growth have largely been developed as centralized systems based on industrial and residential energy use. To consider a change in the energy trajectory (Smits, 2012) for Cambodia it is necessary to consider and recognise the competing discourses related to centralized energy generation, grid electrification, industrialization and growth that may significantly influence energy policy and provision of energy services in Cambodia and the Association of South East Asian Nations (ASEAN). This article thus seeks to begin to answer the fundamental question of what energy related policy in Cambodia is responding to with regards to energy needs, but also in relation to the influence of competing discourses, investment decisions and government priorities.

## **Selection and analysis of data**

Six Cambodian policy documents were selected for analysis (Table 1) in this study. Except for the Electricity Law of the Kingdom of Cambodia 2001 (hereafter electricity law) (Electricity Authority of Cambodia, 2001), all the policy documents were released between 2007 and 2017. These policy documents, including multiple drafts of the Environment and Natural Resources Code of Cambodia, were selected to capture variation and variety (Flick, 2007, pp. 27-28) in policy texts focusing on energy and development across an important period of rapid economic and energy production growth in Cambodia. In addition to the policies listed in Table 1, regulations on connecting solar PV to the national grid from the Electricity Authority of Cambodia (2018) have been released subsequently and are referred to in this article

where relevant. While discourse analytical studies are usually carried out on untranslated material (Yates et al., 2001, p. 18), the use of some translated policy documents has been an unavoidable limitation of this study. Sources of all the policy documents have been included in the list of references, and whenever a policy document has been translated from Khmer it has been indicated clearly in Table 1.

*Table 1: Cambodian energy and development policy analysed for this article*

<b>Policy or Plan</b>	<b>Government Ministry</b>	<b>Focus</b>
Electricity Law of the Kingdom of Cambodia 2001 (translated)	Electricity Authority of Cambodia	Reliable and adequate power supply at reasonable costs for consumers, principles for licensees and operations in the provision of electricity, EAC as regulator, competition and favourable conditions for investment in the power sector, and the promotion of private ownership of facilities.
National Strategic Development Plan 2014-2018 (translated)	Ministry of Planning	Comprehensive and broad focus on economic development, investment and growth, as well as governance and institutions, international cooperation and references to reducing poverty. Also contains development aspirations for Cambodia to move towards an upper middle income and developed country.
Cambodia Industrial Development Policy 2015-2025 (translated)	Ministry of Industry and Handicraft	Focus on the industrial sector. The vision of the policy is a transformation and modernisation of Cambodia's industrial structure from a labour intensive industry to a skill based industry by 2025.
Cambodia Climate Change Strategic Plan 2014-2023	Ministry of Environment (National Council for Sustainable Development)	Reducing climate change impacts to the most vulnerable, move towards a green development path and promoting awareness of and participation in climate change response.
Environment and Natural Resources Code of Cambodia (7 <sup>th</sup> , 9 <sup>th</sup> and 10 <sup>th</sup> Drafts)	Ministry of Environment	Comprehensive overview of environment and natural resource issues in Cambodia. Sustainable energy is included.
Cambodia's Intended Nationally Determined Contribution (INDC)	Royal Government of Cambodia	Cambodia's submission to the United Nations Framework Convention on Climate Change for the 21 <sup>st</sup> Conference of Parties (COP) in Paris December 2015. Details Cambodia's contribution and commitment to assist in reducing global greenhouse gas emissions.

Ten qualitative semi-structured interviews were also conducted in English with representatives from the solar energy industry, NGOs and the United Nations

Development Programme (UNDP) in Phnom Penh from 5 May 2017 to 4 June 2017. Further interviews and observations were undertaken in Phnom Penh throughout February 2018, however comprehensive data from these interviews are not included in this article, except where updates and clarifications of interpretation have been required given the fast moving context of the energy sector in Cambodia. The policy documents in Table 1 and transcriptions of the interviews from 2017 became the corpus for this study that was entered into an NVivo server for coding (Rapley & Flick, 2007, p. 130) by thematic nodes. This discourse analytical approach to energy related policy in Cambodia provided insights into the evolving narratives, changes in policy and actors shaping sociotechnical change in the country (Bulkeley, 2014, p. 961).

### **Energy situation in Cambodia and regional influence**

Electricity consumption in Cambodia has risen at an average annual growth rate of 19 per cent between 2010 and 2015 (Intelligent Energy Systems & Mekong Economics, 2016, p. 14; Ministry of Mines and Energy & Economic Research Institute for ASEAN and East Asia, 2016, p. 46). The high increase in electricity consumption in Cambodia can be related to annual Gross Domestic Product (GDP) rates of approximately 8 per cent, urban population growth and increased electrification (Intelligent Energy Systems & Mekong Economics, 2016, p. 14). Approximately 70 per cent of electricity demand is in the capital, Phnom Penh (Intelligent Energy Systems & Mekong Economics, 2016, p. 14), home to approximately 9 per cent of the national population of 16 million (United Nations Statistics Division, 2017). With rapid development in Cambodia and increasing electricity demand, there are various challenges for energy policy and provision in Cambodia. One of these challenges is meeting the actual energy needs of people in the country. In 2015, 56.1 percent of the population in Cambodia had access to electricity (World Bank, 2016), however the rate of electrification is increasing rapidly in Cambodia. Figures from an energy access workshop in Phnom Penh in November 2017 state that 71.5 percent of households in Cambodia are now grid connected based on a multi-tier framework survey conducted in 2017 (World Bank Group, 2017). It is not clear however if energy related policy in Cambodia is responding to the energy needs of the population.

Shove and Walker (2014, p. 42) have challenged energy policy to focus less on the technologies, infrastructures and politics of power and more on the fundamental question of what energy enables us to do in daily practice. This question is significant for Cambodia if we consider the lack of electricity access for a significant percentage of the population and increasing energy demand in the region, however Smits (2012, pp. 188-189), argues that this focus is predominately based on western practices of energy use. Kivimaa and Kern (2016, pp. 208, 215), also discuss the most beneficial policy support for sustainability transitions, which includes support for niche innovations such as research and development funding, as well as a destruction of incumbent regimes through the withdrawal of supportive policies including taxes and regulations. Yet, Cambodia's current energy policy settings have not provided a supportive environment for effectively leading a transition in the energy sector and in some cases are further entrenching the incumbent regime by hindering the export of household solar PV generation to the grid (Electricity Authority of Cambodia, 2018).

Affordability of electricity is another issue and a key focus of the Cambodian Government with the country suffering from some of the highest electricity prices in the world, largely due to electricity imports (Urban et al., 2017). Individual households are also required to pay the grid connection costs as grid infrastructure becomes available. Figures on connection costs for households vary from USD \$80 to \$300. Historically, Cambodia was reliant on imported oil for electricity generation with prices fluctuating with world oil prices. From 2012 onwards with increased imported electricity from neighbouring countries (mainly Vietnam and Thailand) and increased generation from coal and hydroelectricity, electricity tariffs have been reduced. This is projected to continue to decline, however prices remain high in comparison to the region (Derbyshire, 2015, p. 5).

Within ASEAN, the rate of electricity consumption grew 5.1 per cent per year on average between 2010 and 2015, compared to 19 per cent per year in Cambodia over the same period (ASEAN Centre for Energy, 2015a, p. 32). Projections for the growth of electricity in ASEAN remains around 5-7 per cent per year from 2016 to 2020 (ASEAN Centre for Energy, 2015b, p. 17; Chang & Li, 2013, p. 153). Increasing energy needs within ASEAN has created the impetus for centralized and interconnected power grids across the region. Vietnam, Thailand, Malaysia and Singapore are expected to be the beneficiaries of imported electricity from Myanmar, Laos and Cambodia (International Energy Agency, 2015, p. 109). The transmission of electricity through borders is planned across an integrated power network throughout Southeast Asia, named the ASEAN Power Grid. The vision for this grid was determined at the second ASEAN Informal Summit in 1997 by heads of state as part of the ASEAN Vision 2020 (Chang & Li, 2013, p. 153). Cambodia was not a member of ASEAN at this time, becoming the last member to join in 1999 (Narine, 2006).

Although the full vision of the ASEAN Power Grid has not yet been implemented, transmission and trade of electricity already occurs between Cambodia, Vietnam, Thailand and Laos with Cambodia importing 56 per cent of electricity demand in 2013. However, 2014 and 2015 shows lower imports than the peak of imported generation in 2013 at 2282 GWh (Ministry of Mines and Energy & Economic Research Institute for ASEAN and East Asia, 2016, p. 12). Imports of electricity from Laos to Cambodia have been reduced by additional hydroelectric generation in Cambodia (Intelligent Energy Systems & Mekong Economics, 2016, p. 42).

Cambodia is also increasingly influenced by foreign donors and investors from China, India, Korea and Thailand (Sato et al., 2011, p. 2091). Cambodia, as part of the Lower Mekong Basin is affected by hydropower projects along the various tributaries of the Mekong River. These hydropower projects are supported by international finance and the Asian Development Bank to contribute to plans for the Greater Mekong Subregion, that includes energy trade and cooperation across borders (Yong & Grundy-Warr, 2012, pp. 1037-1038). China is also investing in hydropower and infrastructure projects in Cambodia, including roads and transmission lines (Sato et al., 2011). According to Heng (2015), there are 17 power generation projects planned in Cambodia for completion by 2020, eight of which are hydropower projects and several are coal fired power plants. Transmission lines and substations are also being constructed as part of these developments. Heng (2015, p. 415) notes an investment of USD \$1.8 billion from China to provide hydroelectric dams with a total capacity of 915MW.

## **Energy related discourse**

The official policy of the Royal Government of Cambodia consists of two electrification targets based on two different indicators for energy access. The first target, based on the village level is that all villages will have access to electricity supplied by the grid and other sources by 2020 (Electricite du Cambodge, 2015; Royal Government of Cambodia, 2014). The second target is that 70 per cent of households will have access to grid quality electricity by 2030 (Electricite du Cambodge, 2015; Sarraf et al., 2013). The distinction between these two targets is important to clarify. In interviews with NGOs and the solar industry in Cambodia, it was pointed out that what is happening in regards to the first target of all villages having access to electricity supplied by the grid by 2020, is that in a particular village, one house may be connected to the grid, leaving the remaining houses in that village without access to grid electricity. Observations from fieldwork in Cambodia and discussions with the solar energy industry in February 2018, indicate that distribution lines are going through villages, however many houses remain unconnected.

The actual costs for a household to connect to the grid is prohibitive for many people in Cambodia and this cost falls on the individual household to pay for this connection. Discussions with the solar energy industry in Cambodia indicate that many people want access to grid electricity. The Royal Government of Cambodia does have an incentive program in place to assist people to pay for this connection cost, called Power to the Poor. This program provides interest free loans for connection fees and installation of wires from the connection point to the house (Electricite du Cambodge, 2015). It is unclear what the uptake of this program is and interviews with the solar energy industry in Cambodia suggest this is minimal. It was suggested that many people in areas that have the connection point of one house connected, will still choose solar PV and a lead acid battery for their energy needs due to the prohibitive cost and perceptions of reliability for grid electricity in rural areas. Household energy use in rural areas is largely for lighting, TV, fan, sound system and charging of phones. For cooking there is still significant reliance on wood fuel and charcoal, with more than 80 per cent of the population still reliant on wood fuel (Royal Government of Cambodia, 2013).

Reference to regional energy cooperation and the ASEAN Power Grid is mentioned in the National Strategic Development Plan 2014-2018 and the Cambodia Industrial Development Policy 2015-2025. The concept of integrated energy networks and energy trading between nations in ASEAN and the broader region is not included in any other policy documents analysed. Discussion of the ASEAN Power Grid is noted in reference to Cambodia having participated in the implementation of the ASEAN Power Grid as well as noting Cambodia's participation in the Greater Mekong Sub-region Power Trade Plan (Royal Government of Cambodia, 2014, p. 47). With increasing distribution infrastructure being developed in Cambodia, there is the real possibility of increased energy cooperation between nations within ASEAN and China, however the significant transmission losses throughout the national grid in Cambodia makes the efficiency of a fully integrated network questionable (World Bank, 2014). Energy and development policy in Cambodia does not appear to be focused or strategically planned for energy trading between nations of ASEAN and if the simulation discussed by Ahmed et al. (2017) is an accurate depiction of the future of energy cooperation in the region, substantially more generation capacity would be

required from Cambodia.

Article 16 of the 7<sup>th</sup> draft of the environmental code, discussed the promotion of mini and micro grid supply, in areas where the national grid exists or where the grid is yet to arrive (Vishnu Law Group, 2016). References to the grid have been removed from the 9<sup>th</sup> and 10<sup>th</sup> drafts as well as reference to the responsible entity, Electricite Du Cambodge (EDC). The same article 261 in the 10<sup>th</sup> draft is devoid of any responsible institution and instead refers to competent ministries or institutions that support the provision of mini and micro grids and does not specify any particular generation source such as solar or diesel. This particular article also notes the entering into agreements with electricity providers to sell electricity, however again the electricity providers are not identified (Vishnu Law Group, 2018, pp. 76-77). There is a requirement under the electricity law to have a license as an Independent Power Producer from the Electricity Authority of Cambodia (EAC) to operate a mini or micro grid. As discussed with the solar energy industry in Cambodia, these licenses are traditionally difficult for the solar energy industry to get, as a proven record is required. One Rural Electricity Enterprise (REE) in Cambodia was able to set up a solar mini grid system through the use of a sub-license, however over the long term it was not financially viable for the REE due to a lack of enforcement for payments.

When it comes to energy supply, a priority of the Royal Government of Cambodia is the supply of reliable electricity to major production zones and to areas that have factories to presumably assist in meeting the goal of industrial development in the country (Royal Government of Cambodia, 2015b). The language used in the recent Scaling up Renewable Energy Program (SREP) Investment Plan for Cambodia also suggests that a great deal of new renewable energy projects will be located in industrial areas with the change in the revised investment plan. The change is due to lessons learned from the competitive tender process for the 10MW Bavet solar project as well as work done on grid integration for utility scale solar, which concluded that it is possible for Cambodia to have up to 150MW of utility scale solar on the grid (Climate Investment Funds, 2017). Focusing efforts on utility scale solar will meet the goals of prioritising energy supply to production zones, however it may not resolve meeting the energy needs of people in Cambodia. The lack of public sector financing and strategic direction in energy policy throughout many of the documents analysed and discussed in this paper may have longer term detrimental effects on achieving poverty reduction and electricity access for the population (Aalto, 2016, p. 95; Falkner, 2014, p. 193).

Several of the policy documents also refer to support and promotion of decentralized energy in the form of solar, biogas, biomass, solar home systems, household rooftop solar and micro and mini hydropower as well as the integration of renewables into the grid, particularly solar (Royal Government of Cambodia, 2013, 2015a; Vishnu Law Group, 2016). Article 260 of the 10<sup>th</sup> draft of the environmental code specifically promotes the supply of decentralized electricity, noting that electricity users shall have the right to choose to use the electricity from any source of electricity generation (Vishnu Law Group, 2018, p. 76). This suggests that there is a recognition from the Royal Government of Cambodia that not all households will have access to grid electricity, and that decentralized sources of electricity have a place in Cambodia now and in the future. However, when it comes to connecting these sources of decentralized energy to the national grid, particularly in the case of household solar

PV, the EAC in their recent regulations on connecting solar PV to the national grid, prevent any export of this electricity to occur (Electricity Authority of Cambodia, 2018). Thus decentralized sources of energy that are for own use and located off the national grid can be promoted, however there are barriers in place for household decentralized solar PV to connect and export electricity to the grid. Within the EAC regulations, allowances are made for medium to high voltage customers to install solar PV as long as certain conditions are met which include inverters programmed so that consumption of the electricity from the solar PV occurs, with no export. However there may be exceptions where permission is provided for the export of electricity, if an agreement is in place with EDC (Electricity Authority of Cambodia, 2018, pp. 5-6).

The discussion with the solar energy industry in Cambodia reveals that there is a recognition that having some regulations and grid connection codes would be useful as a longer term strategy and particularly that net metering should be a focus in order to deduct electricity generated and exported into the grid from consumer's electricity bill. The 7<sup>th</sup>, 9<sup>th</sup> and 10<sup>th</sup> drafts of the environmental code also includes an article on net metering, noting that this legal instrument shall be established by the responsible legal entity. In the 7<sup>th</sup> version of the code, this responsible legal entity was identified as EDC, however this reference has been removed in later versions (Vishnu Law Group, 2016, 2017, 2018). Despite the promotion of decentralized energy production, there is still a desire for grid expansion evident throughout the policy documents and the grid infrastructure is indeed expanding in Cambodia.

Issues of capacity and technical knowledge and skills were also discussed with the solar energy industry in Cambodia and this was an area that the industry and NGOs in the solar energy sector were actively involved with by providing training for local electricians and installers. According to the industry members, the capacity and technical skills for solar PV installations exist in the country, however when questioned on whether the technical skills in designing off grid renewable energy systems were available it emerged that these skills were limited in Cambodia. The solar energy industry in Cambodia however are proactive in developing training for people in the country. Some institutions and NGOs in Cambodia also offer courses and training, such as the Institute of Technology which offers a free 100 hour course for solar engineering. The Department of Physics at the Royal University of Phnom Penh also has some course modules on renewable energy systems and electricity generation that was developed with assistance from Engineers without Borders (Royal University of Phnom Penh, 2016).

## **Conclusion**

Development and energy related policy and the recent SREP investment plan for Cambodia has a significant reliance on private investment for energy infrastructure, including generation, transmission and distribution infrastructure. With a significant proportion of the country still not electrified, the focus on private investment in energy infrastructure is likely to intensify. The policy also has a focus on energy infrastructure for industrial development and this is apparent where new energy solar PV generation is located, such as the 10MW solar PV plant in the Special Economic Zone of Bavet and the revised SREP investment plan which prioritise a 100MW project and utility scale parks. Where this leaves the population without energy access



is still unclear, particularly with the relatively high costs for grid connection that householders are required to pay. In terms of rural electrification, the Royal Government of Cambodia appears to be *laissez-faire*, apart from ensuring regulations and licenses for Independent Power Producers, grid connection fees and ensuring that the generation of solar PV on the grid is kept to a minimum. Anything outside of these parameters is open to private actors and local communities to either informally connect to the few houses in the village that may have grid access or source their own power from Independent Power Producers or solar PV and battery systems. The approach is one of recognition of the need for decentralized energy, however there is hesitancy in the policy documents on the role of decentralized renewable energy in Cambodia and there is no clear strategy to ensure that people have access to affordable electricity.

Electrification is occurring rapidly in Cambodia, however it is not clear where electrification of the country is leading to with regards to electricity access as the focus appears to be on industrial development. In addition, the policy documents do not have a strong focus on an integrated regional network, such as the ASEAN Power Grid and the lack of strategy in increasing generation capacity and the ability of the national grid to integrate renewable energy generation such as solar PV suggests a lack of vision for the energy sector in Cambodia. However Cambodia is interesting as there is recognition by the government of the role of decentralized energy and on the ground there is a great deal of innovation in the energy sector by various private actors with a focus on energy access and also to some extent training and capacity development. This innovation and enthusiasm for developing the solar PV sector more on the ground is not being supported and in some cases is being actively stifled by recent policy developments in Cambodia. If Cambodia is serious about meeting international policy commitments, such as the Intended Nationally Determined Contribution submitted to the Conference of Parties in Paris, which states the intention to connect decentralized renewable energy to the grid, it may be strategic for energy and development policy in Cambodia to include a mix of supportive policy mechanisms to transition the energy sector toward a more sustainable path.

As discussed by Kivimaa and Kern (2016) supportive policy can be multifaceted to include niche support to increase knowledge such as funding for research and development in the energy sector as well as policies and regulations that reduce risk and uncertainty for investors and entrepreneurs in decentralized renewable energy projects. As there is a focus in the policy documents on the development of human capacity, this support can be better targeted into educational institutions in Cambodia as well as working strategically with the wealth of knowledge that is available in Cambodia through the solar energy industry and other entrepreneurs already working on the ground. It may also be prudent to strategically look at the gaps in energy services, as well as the energy needs in rural areas to assist communities to have energy services that meet their needs. In addition, having supportive regulations, grid connection codes and net metering, could assist Cambodia in better projecting and planning for energy generation in the future as well as being able to manage and better integrate renewable energy generation on the national grid. Private investment is unlikely to meet the needs of local communities and affordability of these energy services may also be an issue.

The development of capacity within the energy sector is an enormous opportunity for

Cambodia and some NGO's have started this process as discussed such as the development of a renewable energy curriculum at the Royal University of Phnom Penh. The solar energy industry in Cambodia are also reasonably proactive in developing capacity within Cambodia in terms of training for installations of off-grid solar PV systems, which could be more effectively utilized, supported and scaled up by the Royal Government of Cambodia through dialogue with the solar energy industry in Cambodia. As poverty reduction is also a significant focus of the Royal Government of Cambodia, it may be prudent to note the overreliance on private investment in energy infrastructure and adopt a broader development approach that includes longer term benefits, employment, training, and education opportunities for Cambodians. Providing a clear policy framework for the energy sector in Cambodia informed by energy needs of people, industry and involving relevant stakeholders would be of strategic value to the Cambodian Government. If there is to be a mix of centralized and decentralized renewable energy, particularly solar PV, it would be helpful for the Cambodian Government policy to provide this direction and support in meeting the energy needs of people and industry.

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