

LANDSCAPE ANALYSIS

TRANSITIONING CAMBODIA FROM BIOMASS TO 'CLEAN' ELECTRIC COOKING

Working paper*, May 2021

**This is a working document and will be updated as more information is learned and validated over the course of the partnership.*



"The transition from biomass to modern energy cooking in a single country will likely occur in the coming together of the policy, the supply chain and the needs of the customers."

- Simon Batchelor, UK Research and Innovation Coordinator, MECS / Gamos

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Acronyms

ADB	Asian Development Bank
EAC	Electricity Authority of Cambodia (electricity regulator in Cambodia)
EDC	Electricité du Cambodge (utility company - electricity supplier, sells electricity)
EE	Energy Efficiency
ESMAP	Energy Sector Management Assistance Program
FCDO	The Foreign, Commonwealth & Development Office
IPP	Independent Power Producer
PEC	Provincial Electricity Company
RE100	Renewable Energy 100%*
REE	Rural Electricity Enterprise**
SDG 7	Sustainable Development Goal 7
TWG	Technical Working Group

*A global initiative bringing together the world's most influential businesses committed to 100% renewable electricity.

**The term "REE" is used broadly in Cambodia to refer to any electricity supplier other than EDC, even if they provide electricity in urban areas.

Note: There is controversy around whether electricity is genuinely "clean" due to 51% of electricity from the grid generated by coal and oil (Electricity Authority of Cambodia 2019). The global trend is moving from majority fossil fuels to majority clean energy. However, when the document refers to "clean" cooking it is in relation to the health benefits to the user.

1.0 Project overview

Modern Energy Cooking Services (MECS) is a five-year program funded by UK Aid (through The Foreign, Commonwealth & Development Office – FCDO). It aims to break out of a “business-as-usual” cycle by investigating how to rapidly accelerate a transition from biomass to ‘clean’ cooking (i.e. with electricity). iDE Cambodia have been working with the MECS program since 2019, firstly to gather foundational research around current practices, drivers and barriers in adopting modern energy cooking in Cambodia (MECS-TRIID), followed by a second project to test different solutions through rapid prototyping and pilots (MECS-ECO).

The MECS program believes that *“the transition from biomass to modern energy cooking in a single country will likely occur in the coming together of the policy, the supply chain and the needs of the customers”*. This requires long term effort and commitment from the ground. As a result, MECS and iDE have formed an in-country partnership to gain a deeper understanding of the clean cooking ecosystem in Cambodia, building on the momentum of the two previous projects (MECS-TRIID and MECS-ECO), and accelerate the shift toward **clean electric cooking solutions** through engaging enablers and suppliers. iDE will facilitate collaboration and make links across public and private sector organizations in order to co-create an action plan with key stakeholders and experts with the aim to be implemented in 2023. This action plan will be aimed at identifying the most feasible and viable strategies that achieve maximum transition to MECS sustainably and equitably. The MECS-iDE journey is illustrated below:

1.1 iDE’s journey with MECS

HMW position Clean Cooking Products as the next aspirational alternative?

HMW introduce and scale electric cooking solutions meeting household needs, accelerate clean cooking in Cambodia?

HMW address key components necessary for a MECS transition in Cambodia?



1. Foundational research

- In-depth HCD research to understand context, knowledge gaps, triggers, enablers, barriers
- Prototype and test early solutions

2. Market-based pilots for electric

- Sales of PAYGO-enabled induction cookstoves
- Other e-cooking devices: pressure cookers, grills, slow-cookers
- Informing energy-use perceptions through smart energy meters
- Behavior change strategies to increase adoption of electric cooking devices

3. Clean cooking ecosystem

- Building on existing momentum
- Deepen understanding of MECS relating to future customer needs, government policy landscape, trends in cooking and supply chains, etc.

1.2 MECS-IDE partnership objective

The MECS programme has partnered with iDE to deepen the understanding of modern energy cooking services in the Cambodian context. This relates to future customer needs and preferences, government policy landscape, practices and trends in cooking and the supply chains for modern energy cooking solutions in and for Cambodia, specifically around electric cooking. The objective of this partnership is to:

Phase 1: Create a comprehensive landscape analysis of modern energy cooking services within the context of Cambodia distilling information from three key actors: enablers (government, civil societies, etc.), suppliers (startups, manufacturers and distributors) and future customers (households and businesses).

Phase 2: Generate dialogue/ideas between actors, businesses and institutions (committed to clean cooking in Cambodia) to co-design an action plan for change through networking, workshops and brainstorming.

Phase 3: Build and develop the action plan/roadmap for change in Cambodia with the buy-in of key actors involved in the clean cooking sector.

1.3 Specific goal of this document

This document corresponds to the landscape analysis in Phase 1 of the partnership. It includes an overview of the current clean energy ecosystem in Cambodia, the key actors involved in driving forward clean energy policies and plans, specifically around clean cooking. By assessing the current ecosystem, it evaluates how clean cooking might fit with national economic and policy environments. **This is a working document and will be updated as more information is learned and validated over the course of the partnership.**

2.0 Research Methods

The development of this report is based on two main contributions: desk research and expert interviews.

2.1 Desk research

Learnings generated from existing reports and publications in the clean energy sector. The partnership began with a review of key documents, e.g. Multi-Tier Framework (MTF), literature from various ESMAP studies on energy access, and any other relevant documents around the current clean cooking situation in Cambodia to set a foundation of knowledge and context.

2.2 Expert interviews

Conducting interviews with key actors involved in MECS, and clean energy related projects/programs to gather knowledge, expertise, and learning from others in the sector from

the start. We would like to thank NCSD, SNV, UNDP, Geres, ITC for their valuable input and expertise in understanding the landscape of energy related to clean cooking in Cambodia.

Name	Organization	Role
Nop Sokhai	National Council for Sustainable Development (NCSD)	Deputy Director, Department of Green Economy
Mel Sophea	NCSD	Vice-Chief, Department of Green Economy
Bastiaan Teune	SNV	Sector Leader Energy Cambodia & Global Cookstoves Coordinator at SNV
Butchaiah Gadde	UNDP	Technical Energy Advisor
Aude Petelot	Geres	Previous Country Director
Richard Scotney	Geres	Country Director
Dr. Eng OR Chanmoly	Institute of Technology of Cambodia (ITC)	Director of Research and Innovation Center
Chiphong Sarasy	Ministry of Mines and Energy (MME)	Deputy Director of Renewable Energy and Other Energy Department
Bridget McIntosh	Energy Lab	Country Director
Ben Jeffreys	ATEC	CEO
Nikolai Schwarz	ATEC	Country Director (Cambodia)

2.3 Key research topics

- What does the policy environment look like?
- What are Cambodia's overall goals and targets (for clean energy, clean cooking, electrification)
- What are the current/future plans/policies in Cambodia around clean cooking (with electricity)?
- Who is involved in clean cooking efforts and what are their plans?
 - Key stakeholders (policy, organizations, private and public sector)
 - How engaged are they?
- What has worked/not worked in the past (programs/policy)
 - Successes/challenges of other programs, working with government
 - Models to replicate/learn from
- What are the current attitudes towards electric cooking?

- Recommendations on going forward with clean cooking:
 - Barriers/challenges?
 - Opportunities?

3.0 Learnings

3.1 Challenges in accessing clean, modern energy for cooking

Three billion of the world's people lack access to clean cooking solutions. Approximately 40 percent of the world's population still use solid fuels and kerosene, which has severe negative health, economic, and environmental consequences. Every year up to four million people die prematurely from the effects of household air pollution caused by cooking with solid fuels. Almost all of these are in low- and middle-income countries (WHO 2014a; Forouzanfar and others 2016).

Finding a reliable and clean source of cooking fuel in developing countries is a persistent obstacle for poor households. 80% of the rural population in Cambodia do not have access to clean cooking¹. Biomass, which is the primary cooking fuel for the majority of rural households, is available for free in rural Cambodia, and up to 20.3 hours is spent on collecting wood per week. Firewood and charcoal remain key sources of energy for household cooking and for small food businesses. Most rural Cambodians cook with wood (77%) and 6% cook with charcoal, spending approximately 1.5 hours a day on cooking². Stacking of multiple fuels is common in Cambodian households due to reasons that include reliability of the primary fuel source, accessibility, and preference. Households use on average 2.1 different fuels for cooking in their energy mix and this number increases when the households get wealthier²¹.

Despite forest protection, all of the fuelwood in Cambodia comes from unsustainable and illegal logging of local forests, which has resulted in 33.6% of forest cover lost in the last 40 years. In Phnom Penh alone, 100,000 tons of charcoal are consumed every year (equivalent to 600,000 tons of wood), one of the main causes of deforestation in Cambodia. According to a NAA Earth Observatory report, Cambodia had one of the highest deforestation rates in the world in 2015. While being outlawed in most areas, anecdotally wood collection has increased during Covid times in the countryside. With less income, more people are going out to collect wood.

3.2 Negative health and environmental impacts of cooking with biomass

Cooking on traditional biomass stoves not only contributes to deforestation, local natural resource degradation and increased greenhouse gas emissions, but also has severe negative impacts on health through the smoke that pollutes households and the ambient air. Indoor air pollution, mostly from wood and charcoal smoke, is responsible for respiratory, heart and eye problems. A silent killer, there are 11,876 annual deaths attributable to solid fuel use in Cambodia² and it is the second cause of disability-adjusted life years after dietary risks and the third cause of premature death. This health and energy conundrum has a much greater impact on human

health compared to other common diseases, such as HIV/AIDs, malaria or even traffic casualties³.

Literature shows that the use of solid fuels increases the likelihood of low birth weight, respiratory infections and neonatal death in babies⁴. For adults, indoor air pollution from solid fuels also raises the probability of coughing and breathing difficulties⁵, lung cancer⁶, high blood pressure⁷ and blindness⁸. However, the health risks of using firewood for cooking are not completely understood beyond a basic understanding of the immediate (short-term) effects, such as irritation to the eyes and lungs.

Achieving universal access to modern energy cooking solutions is essential to reaching Sustainable Development Goal 7 (SDG 7): access to affordable, reliable, modern and sustainable energy for all by 2030. Meeting SGD7 means rethinking household energy needs for cooking and taking a closer look at both the technical and contextual attributes of access with a focus on users' priorities.

"Clean cooking transforms lives by improving health, protecting the climate and environment, empowering women, and helping consumers save time and money." - The Clean Cooking Alliance

3.3 LPG as a clean, but more unsafe alternative

LPG is a clean-burning and efficient cooking fuel and is only used by 18% of rural households as a main cooking fuel and as back up by 54%. Mainly available in urban and peri urban areas, 48% of rural households intend to switch to LPG when firewood becomes harder to collect². With wealth and urbanization, LPG use increases and wood use decreases. The most common LPG equipment is a small portable stove fuelled with 250 grams canisters. Wealthier families use bigger stoves and bigger cylinders. The cost per kilogram of LPG is higher when retailed in small canisters²¹.

Gas falls into two categories: LPG and butane. LPG typically comes in larger 5-20kg cylinder bottles, is relatively safe to use and is used mainly by urban households. Smaller butane cylinders, a different type of gas, are much more dangerous and common as a secondary fuel source for rural households. Both of these are poorly regulated in Cambodia which means a strong inhibition to people transferring from biomass across to clean modern cooking has been the perception that gas is dangerous. This widespread negative connotation towards LPG canisters/tanks is restricting adoption. Majority of incidents go unaddressed due to a lack of after sales service from distributors and this mistrust toward LPG suppliers is perpetuated through social media and word of mouth.

The main advantages of LPG for users is the speed of cooking and ease of use, as well as cultural habits of purchasing in small amounts. However, the major market barrier to LPG adoption is safety (both at legal, policy and end-users level) and a fear of dangerous incidents (explosion

being the most common type). The safety issues are not only perceived but are a reality. 0.25kg canisters are the most unsafe cylinders due to not being designed for constant refilling. A second market barrier to LPG is cost, often misperceived by non-users; however safety factors overtake price barriers, as the perception that gas as extremely dangerous leads to people not wanting to use it.

Apart from safety concerns, fragmented LPG value chains, with unregulated service providers, multiple middlemen and isolated retail channels drive costs up for customers. Customers want guarantees that the stoves they buy can last longer and are easy to use in the long term. After sales services for cooking products are a critical need and the lack thereof, is a key barrier to adoption with customers left with no options of repairs in case of breakdowns²³.

There are currently no policies around LPG and no regulations specific to LPG market operations, including import, distribution, taxation, pricing, ownership or liability. Complexities of the informal LPG market in Cambodia have created bottlenecks with lack of attention and enforcement around LPG. Policy focus has been on electrification. There has been no price setting, regulations, or guidelines of safe and affordable LPG distribution. This is also a contributing factor for unsafe products with no checks to safeguard dangerous practices in the supply chain. Many organizations do not have the capacity to work on this due to these complexities; however, a large number of accidents occurring over the last few years could create an opportunity for safety to become a key driver for more regulations in the future.

The LPG consumption in Cambodia is divided in three sectors: 70% for cooking (households and SME), 20% for industry and the remaining 10% for transportation. Around 25% of total LPG consumed in Cambodia is smuggled, in addition to chronic underpayment of VAT during importation²¹. Cylinder diversion and stealing is a significant problem in Cambodia, discouraging investment in new cylinders. There are few barriers to entry for companies looking to operate an LPG business at any level of the supply chain.

People want easily accessible, convenient and time saving fuels. The switch in rural Cambodia to LPG is already happening²³. Small LPG is widely adopted in peri-urban areas. High rates of adoption of LPG and electricity for cooking characterize urban households. A dense market with high competition offers multiple price points for all customer segments, good quality and after sales services, payment instalments and deliveries. Prices of LPG products are influencing people towards it. LPG is seen as a modern fuel source for cooking.

3.4 Improved cookstoves as a less sustainable solution

One solution has been the development of “improved cookstoves” which focuses on improving the performance of biomass stoves by increasing the efficiency of charcoal/wood fuel use and reducing emissions. While improved cookstoves allow users to continue to use the cooking methods they are used to, it has been highly debated in the international development community

whether these are a long term solution. Although “safer” than traditional cookstoves or three-stone-fires, studies have shown that in multiple countries/areas they are not sustainable, uptake over time tends to be poor, and they may not reduce household air pollution enough to provide the health benefits needed to reach SDG7 (Sambandam and others 2015; Balakrishnan and others 2015; Mortimer and others 2016). In addition, encouraging similar cooking habits is not enough of a shift away from more traditional behaviours, and households can be more likely to fall back into old habits of cooking with biomass.

3.5 Electricity as an opportunity for modern energy cooking

Based on research conducted by iDE and documented in the [MECS-TRIID report](#), findings indicate that cooking with electricity is in a nascent stage in Cambodia, but has great promise. High levels of adoption of electric rice cookers - even in rural areas - points to a significant potential for a range of new electric cooking solutions to enter the market.

Cooking with electricity is aspirational, and a majority of households in urban centres use clean fuel mixes. During the MECS-TRIID research study, customers identified ease and convenience as key motivations for improving their cooking experience through electricity, allowing more time for income generation and other household tasks. However, a number of barriers prevent the majority of households from adopting electric cooking technologies, including perceived taste/quality issues, perceived costs, lack of control over the consumption and lack of understanding of the technology, and a lack of access to quality, reliable solutions. MECS-ECO data from market tests supports that customers are making the transition to electricity from small LPG.

3.6 The state of renewable energy in Cambodia

Cambodia has an opportunity to become a leader in clean, renewable electricity as renewable energy sources such as sun, wind, water and biomass energy. Currently in Cambodia, almost 50% of electricity in the country is from renewable energy, 41% hydropower, 56% coal and oil, 3% from solar. Choices made in the next few years could help Cambodia leapfrog and embrace the best technologies now or continue its overreliance on high carbon fossil fuel power generation and non-sustainable hydropower projects²².

ADB is supporting the Power Development planning process out to 2040. Cambodia could potentially source half of its electricity from renewable sources out to 2040. According to EnergyLab, a similar analysis completed for China shows that grid electricity costs could be 10% lower by significantly increasing solar and wind and using renewables for half of its generation. Analysis in Thailand showed a higher share of solar and wind improve grid reliability. Analysis by Intelligent Energy Systems (IES) shows Cambodia has 50GW of excellent solar and wind potential, far greater than Cambodia's total electricity needs of 15GW by 2040²⁰.

Cambodia's big investors such as Adidas, H&M, and VF Corporation, make up more than 30% of all Cambodia garment exports and they are also pushing the government to support more renewables. By encouraging the Government to use the Power Development planning process to consider 50% renewables by 2040, it could lower electricity costs and improve reliability, jobs and investment²⁰.

3.7 Electricity in Cambodia

3.7.1 Opportunities with increased electricity as a modern energy cooking source

According to the World Bank in 2019, Cambodia is one of the "fastest electrifying nations" in the world. Cambodia is a booming lower-middle income country where the newly emerging middle class is adopting more resource-intensive lifestyles and electricity consumption has risen sharply within recent years⁹. A World Bank report of early 2018 found that 97.6% of Cambodian households have access to at least one source of electricity – 71.5% on the grid, and 26.1% off the grid, mostly solar home systems and rechargeable batteries¹⁰.

The government has set energy sector development as a national priority, as a more robust electricity supply will boost economic productivity and quality of life. With ambitions to connect 100% of all villages with grid-quality electricity, households in Cambodia will have access to productive power which can have profound implications for those living in remote rural areas. Moving people up the Energy Ladder achieving sophisticated energy use cases and enhancing community well-being (economy, health, livelihoods). The ability to use appliances connected to electricity, for example stoves, reduces the time burden on women and children who are often responsible for collecting firewood and cooking. This has the potential to diminish the opportunity cost of domestic tasks, and enable household members to spend more time on other activities, (e.g. education). Having access to electricity can support the uptake of electric cookstoves and other modern energy efficient cooking appliances.

The Grid Reinforcement Project includes ongoing assistance from the Asian Development Bank (ADB) to Cambodia in power system planning through an approved loan of \$127.8 Million from ADB to help expand the power grid in Cambodia. This will support the construction of transmission lines and substations to help provide Phnom Penh and three other Cambodian provinces with stable and reliable electricity supply.

ADB and EDC have worked with the private sector to expand out the grid. Rather than EDC doing it themselves, licences were issued to energy enterprises who built the grid, supplying electricity to customers, and billing those customers which resulted in an incredible success rate. Back in 2003 only 15% of the population had access to the electricity grid. Now through EDC, the government has released statistics that present that 99.82% of all villages in the country have access.

Energy efficiency is a key pillar of Cambodia's energy future. Since 2010, Cambodia's demand for electricity has grown at averaging around 20% per year, leading to large investment in electricity generation. Energy efficiency has enormous potential by slowing down the rapidly growing power demand and can play a vital role in ensuring the country's low carbon development path. This translates to increase energy security, promote sustainability, and save money.

In addition, Cambodia is generating much more of its own electricity, from hydroelectric dams and coal-fired power plants. Cambodia's capital, Phnom Penh, consumes 90 percent of the country's electricity and distribution to rural areas is rapidly increasing.

However, there are still some barriers around electricity.

100% grid connection implies "access" but not necessarily reliability and quality, where many households face frequent unpredictable power shortages. In terms of access to electricity there is still a lot of work to be done, not just connecting households to the grid but also giving them reliable grid electricity which is still a large issue. In addition, electricity tariffs in Cambodia are higher than those in neighbouring countries.

Severe power shortages occurred in 2019 and were related to the fact that Cambodia has an oversupply of electricity in the wet season and under supply in dry season. This under-supply in dry season is due to the fact that Cambodia's peak time for demand is in the middle of the day in hot season, led by garment factories who only work during the day, and air conditioning load from large amounts of commercial construction. Hydro dams are a good source of storage of water which can be converted into electricity. However dams are large, not as easy to store seasonally between oversupply in wet season. These dams either need to spill or generate electricity during the wet season. Now the government and EDC are trying to manage the use of water and electricity in hydro dams, so that during November to February not all of the hydropower is used so it can be available later in April/May (hot season).

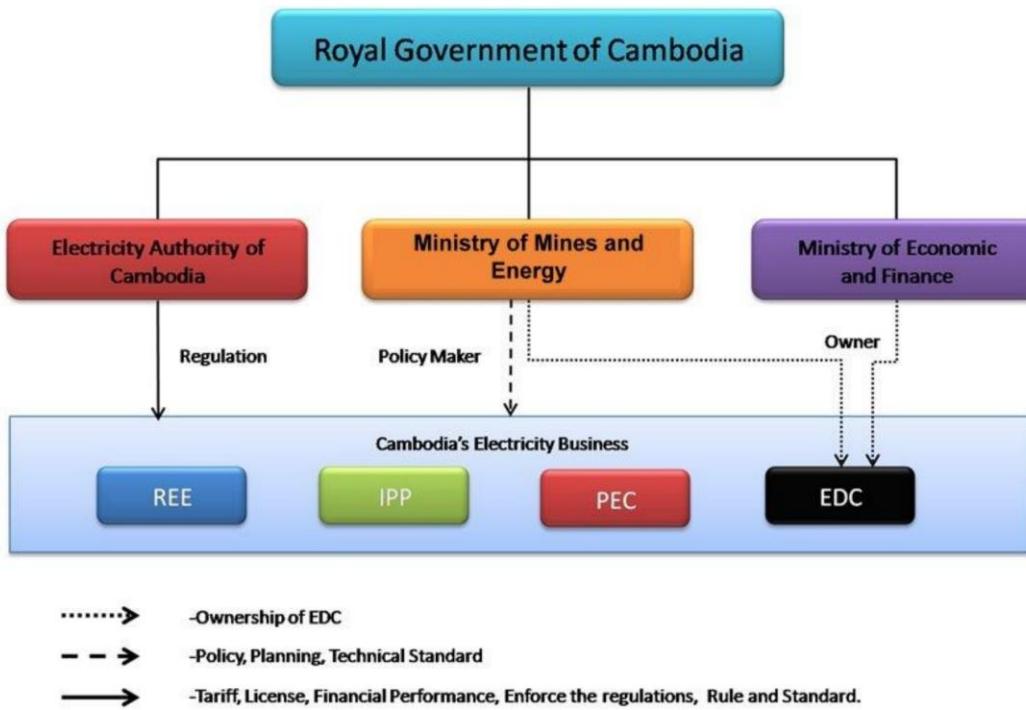
Currently Cambodia imports 30% of its electricity, from neighbouring countries, power shortages in 2019 resulted in the government signing significant power deals: 2400MW power deal for importing electricity from Laos, and that 2400MW is from two new coal-fired power stations. Some coal projects were also approved in Koh Kong and Oddar Meanchey. So by 2030, Cambodia's electricity supply will be dominated by coal and also by imports of electricity from neighbouring countries.

The main issue becomes the contracting for the power under the power purchase agreement. Cambodia has to pay for 80% of electricity regardless of whether it needs it or not, which has made it more difficult for the government to incentivise electricity generation in, for example, the dry season and pay less overnight when there is less demand, or in the wet season when there is an oversupply. Prior to 2019 the government was not keen to sign onto solar projects because they have to pay up to 80% for the electricity whether or not it has been used. The electricity

shortage in 2019, exacerbated by low water levels, mostly brought out by drought, changed a part of this. Cambodia had to quickly address the issue. Decisions made after the 2019 blackouts means Cambodia has locked in an oversupply of electricity for at least 10 years - and the plan will have 3/4s of Cambodia's electricity depending on imports and fossil fuels.

Rural energy enterprises *could* produce their own electricity in close proximity to their consumers and sell that in combination with electricity from EDC. However, regulations in Cambodia do not allow that at the moment. Only EDC is allowed to buy electricity and sell it to customers.

3.7.2 Structure of electricity organizations and electricity capacity in Cambodia



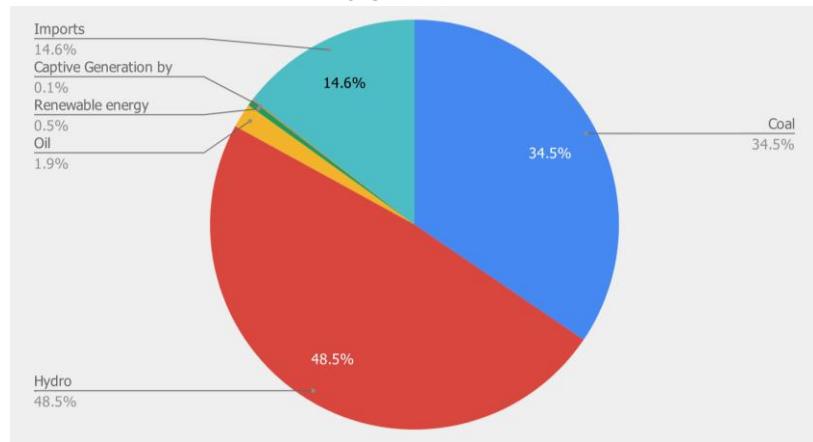
EDC = Electricité du Cambodge, IPP = Independent Power Producer, PEC = Provincial Electricity Company, REE = Rural Electricity Enterprise.

Diagram: Workshop on SDG7 Implementation in Asia and Pacific: National Expert SDG Tool for Energy Planning (NEXSTEP) and the Asian Pacific Energy Resources Modelling Platform, 19-21 March 2019. Source: Government of Cambodia. 2016. Scaling-up Renewable Energy for Low Income Countries Program Investment Plan for the Kingdom of Cambodia. Phnom Penh.

Electricity Demand - Electricity consumption in Cambodia has been increasing significantly. In 2005, the per capita consumption of electricity was 66 kilowatt-hours (kWh), which went up to 400 kWh in 2015. In 2016, the Asian Development Bank (ADB) forecast that by 2020, annual power usage would grow by 9.4%.

Electricity Supply - Hydropower accounts for the largest share of domestic capacity and output, with coal second, diesel third, and industrial (captive) generation fourth.

Cambodia share of electricity generation in 2018



Source: Data from EAC, Chart: cambodianeconomy.org

Biomass power and generation by small licensees (mainly REEs) account for less than 1% of supply, and solar power and generation account for none as of now. There is growth in domestic supply and demand and Cambodia is slowly weaning itself off energy imports from neighbouring countries. Statistics from EDC show a total of domestic power generation in 2019 at 8,986,330MWh and according to EDC the capacity of local power sources has increased 14.5 times over in the last 15 years, and amount of energy delivered to consumers has increased 12 times. The Royal Government of Cambodia has been expanding and strengthening the grid but electricity supply is still unreliable.

Tariff - As a result of the fragmented power supply and reliance on costly energy import, the electricity prices in Cambodia are higher than those in neighbouring countries. Expensive tariffs reflect the high cost of petroleum-based generation and the fragmented power supply system in the country, as well as inefficiencies in power generation and transmission infrastructure. In Phnom Penh, households pay about \$0.18/kWh and industrial consumers pay as much as \$0.21/kwh. Tariffs are even higher outside of Phnom Penh, at about \$0.70/kWh, and supply is even less dependable¹³.

The government is keen to invest in the expansion and upgradation of the electricity infrastructure and build a sustainable generation mix that will support the expansion of the national grid and trim the electricity prices with lower imports.

Strategic Issues - Cambodia is experiencing rapid economic growth, increased electrification rates, and a corresponding growth in energy demand. The country is being challenged to keep up with this rapid demand growth while continuing to expand access to previously unserved areas and addressing issues of energy security, affordability, and environmental sustainability.

NGOs are not actively working with policy making/assistance. There is a gap in government understanding of issues related with energy access, needs, supply and distribution. Cambodia

requires a more cohesive energy sector strategy linking policies and physical infrastructure plans (including generation, transmission and distribution) to support further economic growth and competitiveness. The current power development planning process often relies on unsolicited bids and business-to-business arrangements for new power generation, primarily from hydropower and coal.

The capacity of EDC to scale up clean energy generation through the private sector and public-private partnerships is limited. The utility needs more experience in conducting competitive tenders in a structured approach, which requires standard tender documents and established procedures for the review of investment proposals. EDC is skeptical about renewables, specifically solar in its ability to provide adequate, consistent power across Cambodia¹⁴.

3.7.3 Solar providing cheaper electricity and alternative options in Cambodia

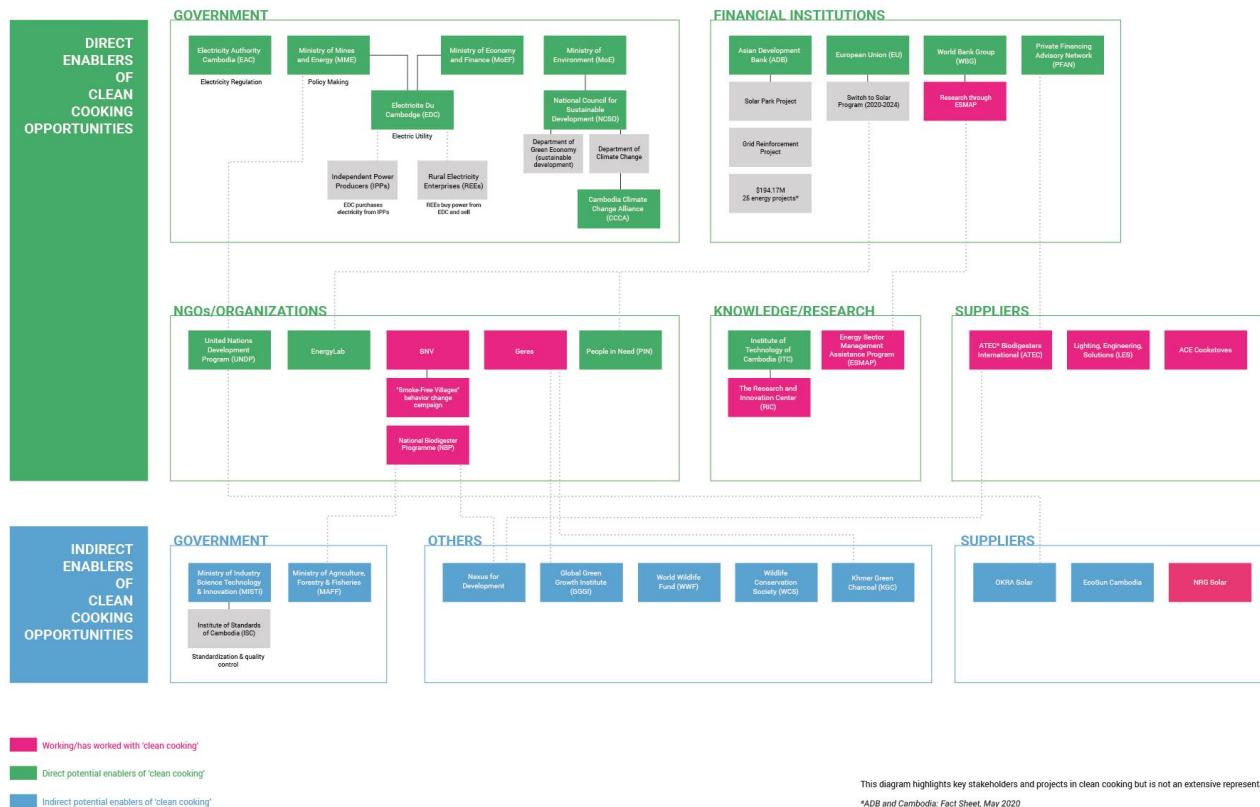
Cambodia has come a long way in solar. In 2016 there were no solar projects connected to the grid, no solar farms, except for one project that was approved by the King. Today the government has approved a space for new solar projects. With the support of ADB, a 10 MGW solar farm has been built that allows for a price of 9.2 cents per kWh. Very rapidly more solar farms have come online from the private sector at 7.6 per kWh (2018-19). With support of ADB for an EDC tender (competitive auction process), Cambodia has achieved a solar power price of 3.8 per kWh - the cheapest solar price for any solar project in Southeast Asia at the time.

There are a set of households and villages that will unlikely ever have the grid connected to them because they are too remote or it is too costly. In these instances it is far more cost effective to install a solar micro grid or a mini grid, or for some remote households, installing solar home systems as a standalone option. As an example, OKRA, a solar Australian Cambodian startup, has established microgrids which use solar systems on individual household roofs, connect them together into a micro mesh grid, and share the supply of electricity. This is much more cost effective than extending the grid out to remote villages, e.g. those on an island.

Expert analysis has shown that the Cambodian electricity grid can take 10-20% capacity solar with no problem, up to 40% with limited impacts that can be managed. It is currently 8% capacity and 3% of generation²⁰.

3.8 Key Players in the Clean Energy Space in Cambodia

Clean Cooking Stakeholder Map



(Please refer to the Clean Cooking Stakeholder Map that accompanies this document for a more detailed view).

Direct Enablers of Clean Cooking

Potential key stakeholders who can contribute to enabling a clean cooking with electricity transition in Cambodia due to their current influence, agendas, activities, and/or interests.

3.8.1 Direct Enablers - Government/Authority

Ministry of Mines and Energy (MME) (through the General Department of Energy – GDE) is the main government agency responsible for policy formulation, strategic energy planning, development of technical standards for the power sector, as well as some energy data.

The MME is the main agency responsible for setting and administering government policies, strategies, and planning in the energy sector, including setting technical standards. The agency has three core departments: (i) the Department of Energy Development, responsible for energy and electricity planning; (ii) the Department of Hydropower; and (iii) the Department of Technical Energy, responsible for renewable energy (other than hydropower) and energy efficiency.

Clean cooking would fall under MME, but they have not included it in any policies. Priorities for MME are electrification of the country, to provide reliable and sustainable electricity to all consumers, both urban and rural at an affordable price.

[**Ministry of Environment**](#) leads and manages environmental protection, biodiversity conservation, rational and sustainable uses of natural resources and sustainable living. Clean cooking targets related to reducing deforestation and GHG emissions could be related to this ministry.

The MoE plays an important role in facilitating and carrying out the development of policies, environmental planning, and other legal instruments that are necessary for sustainable development in coordination with inter-ministries, international organisations, non-government organisations, and private and public sectors. Simultaneously it also has the duty to encourage the public participation within the decision making process relevant to environmental issues and natural resource utilisation.

While small, their coordinating body (NCSD) can potentially be of benefit for clean cooking agendas as explained below.

[**The National Council for Sustainable Development \(NCSD\)**](#) was established in 2015 as a policy-making coordinating body to promote sustainable development and to ensure economic, environmental, social and cultural balance within the country. It is a part of the Ministry of Environment and comprises 36 ministries and agencies, operating as a separate structure to the ministry.

The objective of NCSD is to strengthen national systems and capacities to support the coordination and implementation of Cambodia's climate change response, contributing to a greener, low carbon climate-resilient, equitable, sustainable and knowledge-based society. Within NCSD are 4 technical departments: 1. Green economy, 2. Climate Change, 3. Biodiversity, 4. Science and Technology. The Department of Green Economy focuses on three areas: sustainable cities, sustainable energy, and sustainable consumption and production.

The Department of Green Economy is most relevant to clean cooking through sustainable energy; however it currently does not cover any clean cooking related policy in its agenda. The Climate Change Department could also have some relevance in terms of reducing emissions from cookstoves.

Currently, NCSD has made efforts to improve the coordination of climate change activities in Cambodia and to promote a stronger, comprehensive and effective climate change response, including the preparation of the Cambodia Climate Change Strategic Plan 2014-2023, the Sectoral Climate Change Action Plans and the Climate Change Financing Framework.

[Cambodia Climate Change Alliance \(CCCA\)](#) program builds on the achievements of the first phase (2010-14) and aims to strengthen national systems and capacities to support the implementation and coordination of Cambodia's climate change response. CCCA is a joint initiative of the Royal Government of Cambodia and a partnership between UNDP, the European Union and the Swedish Government. It is implemented by the National Council for Sustainable Development (NCSD) and managed by its Department of Climate Change to address climate change in Cambodia. The CCCA includes a mix of technical and policy advisory support, and financial support (grants). Reducing GHG emissions is an opportunity to highlight clean cooking for climate change policies, and support funding around clean cooking initiatives.

[The Ministry of Economy and Finance \(MoEF\)](#) can potentially help with tax reductions for cookstove suppliers to help make the price of cookstoves more affordable for local communities. (One of the main barriers to adopting electric cooking appliances, aside from rice cookers, is the perceived high cost, not only of consumption charges, but also of the appliances themselves). NCSD/MoE can help by sending a supporting letter to MoEF for any tax exemption cases.

MoEF is responsible for the administration of economic policies and affairs in Cambodia including establishment of the country's uniform financial system, preparation and implementation of the national budget, distribution and redistribution of the total national revenues, inspection of the public's finances, and monitoring of the government's economic and financial policies. Important industrial players have engaged with the MoEF to strengthen industry in Cambodia by embracing renewable energy. 260 RE100 companies worldwide have made a commitment to go "100% renewable" and prioritize it based on this goal.

Cost is a perceived barrier to adopting clean cooking technologies and MoEF can assist in tax exemptions and pricing standardizations to reduce costs, while reinforcing renewable energy goals (cooking with electricity generated through solar, wind, hydropower), and supporting renewable solutions.

[Electricity Authority Cambodia](#) (EAC) is an autonomous government agency created under the Electricity Law, responsible for regulating electricity services. It issues rules, regulations, and procedures; and provides monitoring, guidance, and coordination of operators in the energy sector—both suppliers and consumers—including requiring them to follow the policy, guidelines, and technical standards issued by the MME. The EAC as the regulator confirms whether the provision of services and the use of electricity are performed efficiently, qualitatively, sustainably, and in a transparent manner. All power service suppliers must be licensed by the EAC, and clean cooking technology with electricity can be promoted as a way to increase energy efficiency and more demand for electricity through policy regulations¹⁵.

[Electricite Du Cambodge \(EDC\)](#) is a state-owned and vertically integrated monopoly

responsible for generation, transmission, and distribution. It is owned jointly by the MME and the Ministry of Economy and Finance (MoEF). Generation in Cambodia is private sector-driven, and EDC buys power from independent power producers (IPPs), mainly joint ventures of Cambodian and foreign investors. EDC is also responsible for power imports. With regard to distribution, EDC serves mainly the larger urban areas whereas rural areas of Cambodia are served by several small, privately owned electricity enterprises. EDC mainly supplies the capital city, Phnom Penh.

Many rural areas are supplied by Rural Electricity Enterprises (REEs), which operate as licensees, buying power from EDC and selling power into local distribution networks. REEs may have their own generation assets (typically diesel). Provincial electricity companies (PECs) have operated as integrated utilities at the province and sub-province level; these organizations have mostly been phased out in favour of REEs and IPPs.

EDC is a profit-generating utility unlike some regional peers. However, as a state-owned entity with a mandate to extend electricity supply to the population, it continues to enjoy concessional loans from bilateral and multilateral development institutions including ADB's public sector operations, for undertaking its investment, including transmission lines and rural electrification. There is an opportunity to promote increased electricity demand generation through clean cooking technologies to the advantage of EDC¹⁵.

	MME	MoE/NCSD	MoEF	EAC	EDC	CCCA
Policy	✓	✓	✓	✓		✓
Research						
Finance						✓
Technology Development/ Innovation						
Distribution					✓	

Authority	Core Focus/Priorities	Opportunities for Clean Cooking
MME	Electrification of the country, expanding the power grid, power plants. Clean cooking falls under this ministry, but there are no policies around it.	Promoting cooking technologies linked to electricity. Find a political champion for clean cooking
MoE/NCSD: Department of Green Economy	Sustainable cities, sustainable energy, and sustainable consumption and production	Reducing emissions from cookstoves
MoEF	Monitoring government's economic and financial policies	Tax reductions for cookstove suppliers to help make the price of cookstoves more affordable for local communities
EAC	Regulating electricity in the country	Promoting cooking technologies linked to electricity
EDC	Increasing electricity sales	Promoting cooking technologies linked to electricity
CCCA	Supporting Cambodia's climate change response	Clean cookstoves reducing GHG emissions

3.8.2 Direct Enablers - Financial Institutions

[Asian Development Bank \(ADB\)](#) - Since 1994, ADB has awarded nearly \$200 million in loans and grants to Cambodia's energy sector and provided \$6 million in technical assistance. ADB funding has focused on expanding transmission and distribution networks and support for sector reforms and institutional capacity building. In 2019, ADB committed \$7.64 million to support the construction of the solar park through public-private partnerships, along with a roadmap for solar energy development¹⁶. They have also approved a \$127.8 million loan to support expanding the power grid to create a stable and reliable electricity supply through the Grid Reinforcement Project. Cumulative lending, grant, and technical assistance commitments from Asian Development Bank to Cambodia includes a total of \$194.17M in energy over 25 projects¹⁷. ADB is supporting the Power Development planning process out to 2040.

[The World Bank Group](#) administers ESMAP to contribute to knowledge sharing and research. ESMAP's analytical and advisory services are fully integrated within the World Bank's country financing and policy dialogue in the energy sector. Through the World Bank Group, ESMAP works to accelerate the energy transition required to achieve SDG 7 to ensure access to affordable, reliable, sustainable, and modern energy for all. It helps to shape WBG strategies and

programs to achieve International Development Association (IDA) policy commitments and the WBG Climate Change Action Plan targets.

[The European Union](#) is funding The SWITCH to Solar project through the SWITCH-Asia program 2020-2024. The project is being implemented by People In Need (PIN), together with partners Sevea and EnergyLab, with the goal of supporting sustainable and inclusive economic growth in rural Cambodia. Additionally, it will strengthen the capacities of local solar technology providers (STP); improve awareness of and access to a range of solar energy devices for entrepreneurs and consumers; provide options for financing and customer service; improve the business environment for solar technology solutions; and create synergies among the industry's main stakeholders.

[Private Financing Advisory Network \(PFAN\)](#) uses small amounts of public funding to leverage large amounts of private sector investment for clean energy and climate adaptation projects in low- and middle-income countries. They have supported businesses such as ATEC* Biogesters International (ATEC), a Cambodia-based social enterprise that provides high-quality, prefabricated biogesters to rural households. Initiated by the UNFCCC and the Climate Technology Initiative (CTI) in 2006, PFAN is hosted jointly by the United Nations Industrial Development Organization (UNIDO) and the Renewable Energy and Energy Efficiency Partnership (REEEP).

	ADB	World Bank	EU	PFAN
Policy				
Research	✓	✓	✓	
Finance	✓	✓	✓	✓
Technology Development/ Innovation				
Distribution				

Financial Institution	Core Focus/Priorities	Opportunities for Clean Cooking
Asian Development Bank	Electrification, power grid expansion, solar power, Power Development 2040	Promoting cooking technologies linked to electricity
World Bank Group	SDG 7: access to affordable, reliable, sustainable, and modern energy for all	Promoting cooking technologies linked to electricity

European Union	Solar expansion and improved access to solar technologies	Promoting cooking technologies linked to electricity generated by solar energy
Private Financing Advisory Network	Supporting SMEs in clean energy and climate adaptation	Supporting businesses that supply clean cooking technology

3.8.3 Direct Enablers - NGOs/organizations

[United Nations Development Program \(UNDP\)](#) is working closely with the government (MME) to achieve SDG 7 affordable and clean energy. They are investing in solar, wind and thermal power, improving energy productivity, and expanding infrastructure and upgrading technology to provide clean and more efficient energy. Their particular focus is on electrification of the country so that 100% of the population has access to electricity. They have partnered with OKRA to roll out microgrids to increase shared power between households, with higher energy efficiency. UNDP sees electricity as a way to unlock opportunities for households, such as access to kettles, refrigerators, icemakers, etc, with possibilities of new businesses with appliances such as juicers that add scope for alternative livelihoods for families.

Under the new Country Programme (2019-2023), UNDP is focusing on an issue-based approach in areas such as environmental protection, climate change related, prosperity, resilience, good governance and economic policies.

Realizing the need for energy in protected areas, the Ministry of Environment, with the support of UNDP, recently launched a solar power plant in Siem Reap, providing productivity benefits to the local community as well as to research and conservation.

[EnergyLab](#) is a hub for energy resources in Cambodia and works to support the growth of the clean energy market, with a particular focus on innovation, startups and entrepreneurship. They run a range of programs to help entrepreneurs develop, launch and grow new energy businesses, also providing co-working space, ideation and opportunity analysis, support programs and investor introductions. They are one of the partners in the EU Switch to Solar program led by People In Need (PIN).

EnergyLab works to connect and create a clean energy ecosystem of businesses, industry, investors, entrepreneurs and research institutes through a range of programs, partnerships and events. Every year they host *CleanEnergyWeek* to showcase green energy opportunities in Cambodia, and release an annual edition of the *Future of Energy Magazine*, (special report by SE Asia Globe), highlighting where Cambodia is today and opportunities for the future.

[SNV](#) started in the clean cooking space with 'Improved Cookstoves'* and have been trying to accelerate innovative cookstoves, (such as the ABC advanced biogas stoves in Laos),

establishing the connections between air quality and diseases caused by biomass cooking. They are keen collaborators in the clean energy space and can potentially join hands in the effort. Bastiaan Tueune, Sector Leader Energy Cambodia & Global Cookstoves Coordinator at SNV has extensive experience supporting clean cooking in SouthEast Asia. He has been starting the process to engage with health officials in the government about the health impacts of clean cooking.

SNV largely contributes through behaviour change and demand creation. They have reached 100 villages in 4 provinces with their "Smoke-Free Villages" behaviour change campaign that has leveraged the successful learning from the Open-Defecation Free models for WASH that has been used for the uptake of latrines in Cambodia. Smoke-Free Villages has taken a multi-dimensional approach to tackle the negative impacts of cooking with traditional biomass, engaging communities, involving the local authorities and actors to train villagers, pagodas to inspire, and private sector collaboration for improved stoves and fuels, including local entrepreneurs so there are different options to reduce smoke and villagers can choose and purchase according to their needs. Through this they can focus on demand being the trigger for cooking with modern energy, and build trust with the local authority through the campaign, being able to continue dialogue around new cookstoves. SNV believes creating a slow transition, "mini steps" towards establishing new norms through behaviour change interventions, and addresses 4 areas: 1. Good governance of clean cooking, 2. Cookstove demand creation, 3. Behavioural change communication, 4. Supply chains and finance.

Through the Mekong Development Challenge grant, SNV have created an incentive scheme to provide monetary commissions to those who sell cookstoves from Dec 2020 - April 2021.

Since 1989, SNV has implemented clean cooking projects in over 25 countries in Asia, Africa and Latin America. SNV commissioned [research](#) to quantify the health impacts of the [ACE-1 gasifier stove](#) and the biogas stoves, locally produced under the [National Biogester Programme](#) (government-owned program initiated by MAFF). Set up to reduce their dependence on polluting firewood and expensive fossil fuels for cooking and lighting.

SNV is entirely project driven and funded by the ABD, EU and WBG. They use a market-based approach to achieve tangible results, and leverage Public-Private Partnerships (PPP). Within the energy sector they have accelerated markets in 25 countries, including work with biodigesters, solar, improved cookstoves, microgrids, results-based financing, etc. They are a knowledgeable partner to have on board in terms of understanding the energy, and specifically clean cooking, sector.

[Geres](#) is one of the early advocates for clean cooking in Cambodia with their Improved Cookstoves*. Today they focus on sustainable charcoal. Geres is MECS' partner in Myanmar and are currently exploring electric cooking adoption and piloting models there. Geres has been working in Southeast Asia for over 25 years, positioning them as a regional knowledge hub on

wood and biomass energy related topics, for households and for the industry. Geres works to improve living conditions, preserve the environment and limit the impacts of climate change, providing sustainable solutions with a triple bottom line: planet, people, and the local economy. They focus on sustainability of their programs through a holistic approach of market-based solutions, innovative financing, awareness raising, local capacity building, enhancement of public policies and sustainable scale-up. At the moment their focus is on sustainable charcoal. They are keen to collaborate in clean cooking discussions.

In the past Geres set up a cookstove association: ICOProDAC (Improved Cookstove Producers and Distributors Association of Cambodia) which was created to coordinate the members of the existing supply chain (producers, mobile sellers, one wholesaler). It was coordinated by Geres with the objectives of training producers in production, and increasing awareness. The association increased awareness and managed to sell over 5 million cookstoves through 3 types of events: 1) Government and local authorities meetings, 2) Cooking demonstrations 3) Sales events, with cooking demonstrations being the most successful.

Geres has worked on solutions to support low-carbon development by industries in Cambodia by tackling the barriers towards a switch to sustainable biomass energy supply for thermal energy generation, with a focus on the garment manufacturing sectors. Geres estimates that 70% of the wood burnt by garment factories comes from natural forests, mainly from illegal harvesting and questionable land clearing practices. They have partnered with the Global Green Growth Institute (GGGI) and the Garment Manufacturers Association in Cambodia to implement a joint project with the aim to increase investments in sustainable energy practices by garment factories in Cambodia.

[People in Need \(PIN\)](#) is leading the Switch to Solar program (2020-2024), funded by the EU. It will be implemented in five provinces around the Tonle Sap Lake up to Phnom Penh, aimed to help reduce the environmental impact of pollution generated by sources of energy used by small and medium enterprises (SMEs) in the agricultural and fisheries sector. It will also help create 'green' job opportunities for people living in the area. SWITCH to Solar aims to reduce energy costs and help SMEs shift from unsustainable or non-renewable energy to renewable energy. Farmers using solar energy will save time and money on their production chain as well as protecting the environment compared to those who stick to fossil fuels.

	UNDP	EnergyLab	SNV	Geres	PIN
Policy	✓	✓			✓
Research	✓	✓	✓	✓	✓
Finance			✓		

Technology Development/ Innovation	✓	✓	✓	✓	✓
Distribution		✓			

NGO/Organization	Core Focus/Priorities	Opportunities for Clean Cooking
UNDP	Electrification, solar power microgrids, expanding infrastructure and upgrading technology to provide clean and more efficient energy	Cooking with electricity as a way to unlock opportunities for households, improving energy efficiency in cooking
EnergyLab	Supporting businesses focused on clean energy solutions and making connections across the sector.	Leveraging as a hub for networks around clean energy knowledge and initiatives. Supporting businesses that supply clean cooking technology.
SNV	Smoke-free villages, behaviour change around biomass cooking practices Reducing cooking with biomass and indoor air pollution in households. Focus on demand triggering modern energy cooking	Potential partner for clean cooking. Collaborate to set up dialogue workshops to bring together like-minded organizations and communicate about clean cooking SNV are currently meeting Ministries to begin dialogue and will keep iDE informed
Geres	Sustainable charcoal Sustainable energy practices in garment factories	Collaborate to create consistent communication around clean cooking with other like-minded organizations Piloting clean cooking with electricity in Myanmar Clean cooking knowledge-sharing in garment factories
PIN	Switch to Solar Project Help SMEs shift from unsustainable or non-renewable energy to renewable energy	Promoting cooking technologies linked to electricity generated by solar energy.

* 'Improved' cookstoves are more efficient, meaning that the users spend less time gathering wood or other fuels, suffer less respiratory diseases common in smoke-filled homes, while reducing deforestation and air pollution.

3.8.4 Direct Enablers - Knowledge/Research Institutions

[Energy Sector Management Assistance Program \(ESMAP\)](#) is a global knowledge and technical assistance program administered by the World Bank. Developed the Energy Access Diagnostic Report Based on the Multi-Tier Framework (MTF) for Cambodia: Beyond Connections. This report

details the results of the MTF survey in Cambodia and provides an informed account of the status of both access to electricity and access to modern energy cooking solutions in the country.

ESMAP is a partnership between the World Bank and 19 partners to help low and middle-income countries reduce poverty and boost growth through sustainable energy solutions. ESMAP's analytical and advisory services are fully integrated within the World Bank's country financing and policy dialogue in the energy sector. Through the World Bank Group (WBG), ESMAP works to accelerate the energy transition required to achieve Sustainable Development Goal 7 (SDG7) to ensure access to affordable, reliable, sustainable and modern energy for all. It helps to shape WBG strategies and programs to achieve the WBG Climate Change Action Plan targets.(esmap.org)

[Institute of Technology of Cambodia \(ITC\)](#) is a Cambodian Higher Education Institution. Their research unit - The Research and Innovation Center (RIC) - is dedicated to Energy Technology and Management and brings expertise in specific areas to contribute to the development of new and renewable energy, energy efficiency and energy conservation. Areas of research include conversion of biomass and agricultural waste and by-products into energy, solar PV and thermal energy, innovative smart grid, micro-grid for remote areas, wind energy, energy consumption measurement and analysis, energy management system, simulation of large energy systems, and low emission technologies and materials.

The original research lab at ITC was formed by Geres, through a grant for a 5-year project for improved cookstoves. After the project ended, Geres wanted to hand over the lab to MISTI because they have a department that can standardize cookstoves, but they did not have the space or resources to manage it. So in 2015 the lab started being managed by ITC, and it is currently being used to test cookstoves (performance, fuel savings, emissions, CO, CO₂, PM, fuel consumption, volatile content, etc.) Currently they are doing research on air pollution and effects of cooking with biomass. A lot of the data is not publicly available but can be a valuable knowledge resource in terms of recording safety standards of cooking appliances, and providing scientific evidence of emissions and negative health impacts.

	ESMAP	ITC/RIC
Policy		
Research	✓	✓
Finance		
Technology Development/ Innovation		✓
Distribution		

Organization	Core Focus/Priorities	Opportunities for Clean Cooking
ESMAP	Understanding access to electricity and modern energy cooking solutions, and cost implications	Knowledge resource for policy-makers
Research and Innovation Center (within ITC)	Testing cookstove performance, fuel savings, emissions, CO, CO2, PM, fuel consumption, volatile content, etc.	Using research to promote clean cooking technology, and inform policy-makers

3.8.5 Direct Enablers - Suppliers

[ATEC* Biodigesters International \(ATEC\)](#) is a Cambodia-based social enterprise that provides biodigesters to rural households. The biodigester unit collects, treats and converts farm waste (animal manure and green waste) into clean gas and organic fertilizer, which can then be used for cooking. ATEC's biogas digesters are accompanied with a modern biogas twin cookstove and a biogas rice cooker.

[Lighting, Engineering, Solutions \(LES\)](#) have been selling electric clean cookstoves and supporting solar projects, a first-of-its-kind company with financiers to provide financing solutions to deploy clean cookstoves and solar solutions to underserved rural Cambodian.

[ACE Cookstoves](#) supply an ACE 1 solar biomass energy system (developed by African Clean Energy, Samaritan's Purse). It provides clean cooking with a range of biomass fuels as well as offering solar electricity for mobile phone charging and LED lighting. The burn chamber becomes a gasifier, saturated with oxygen pulled in from the base by a fan. Everything burns, even particles that would normally escape as smoke. The stove reduces smoke emissions to negligible levels, a fact [verified](#) The Berkley Air Monitoring Group.

Indirect Enablers of Clean Cooking

Stakeholders who may influence a clean cooking with electricity transition in Cambodia.

3.8.6 Indirect Enablers - Government

[Ministry of Industry Science Technology and Innovation \(MISTI\)](#) houses the Department of Industrial Property in charge of patents and industrial designs in Cambodia. MISTI manages industry, science, technology and innovation sectors including handicraft and clean water. Within MISTI is their standard department, which is related to cooking stove standards (ISC) explained below.

- [Institute of Standards of Cambodia \(ISC\)](#) - As part of MISTI, the ISC is the national standards body responsible for the preparation and publication of Cambodian standards and guidelines for products, commodities, materials, services and operations. Promoting standardization and quality, they assist to protect consumers in safety and quality of goods and services, and certify the conformity of production and services.

[Ministry of Agriculture, Forestry and Fisheries \(MAFF\)](#) is the governing body responsible for activities related to agriculture, forestry and the fishery. In addition to this, they also define regulations on the management, preservation of natural resources of the agricultural sector. Responsibilities relate to the management of wood-fuel and the production of crops as a source of renewable energy. Therefore, targets around deforestation may be related, but clean cooking is still far from their focus. However, it is important to keep them in mind when thinking about livelihoods and agriculture-related motivations, and reducing biomass cooking using forest fuels. They also initiated the National Biogas Programme with SNV to reduce household dependence on wood-fuel, one of the first large-scale biogas projects certified to Gold Standard.

Authority	Core Focus/Priorities	Opportunities for Clean Cooking
MISTI / ISC	Standards for products	Standardizing safety and quality of modern cookstoves that produce less emissions
MAFF	Wood-fuel management	Reducing wood-fuel usage for cooking through modern energy cooking solutions

3.8.7 Indirect Enablers - Others

[Nexus for Development](#) provide financing for many clean cooking related enterprises - ATEC biodigesters, OKRA Solar (last mile electrification and solar technology for microgrids), National Biodigester Programme - NBP (transforming waste into biogas) and solar power for a farm (Nalen). Collaborate with project developers and social entrepreneurs across Asia, fostering the growth of low-carbon clean energy to maximize environmental and community benefits.

[Global Green Growth Institute \(GGGI\)](#) do not work on clean cooking, but their objective in Cambodia is to support the government in achieving its ambitious climate, green growth and sustainable development agenda, through capacity development, policy and investment advice at the national and sub-national level. Since 2011 they have been assisting the government in establishing a national policy framework and institutional arrangements for inclusive green growth. In the energy sector, GGGI works with the governments and private partners to transform energy markets, scale-up green investment, and achieve efficient use of energy resources across economic sectors.

[World Wildlife Fund \(WWF\)](#) aims to protect forests from commercial land clearance, agricultural expansion and illegal trade in luxury wood and wildlife. Clean cooking influences the reduction of wood-fuel usage for cooking, prevents deforestation, and minimizes air pollution, in favour of related WWF goals.

[The Wildlife Conservation Society \(WCS\)](#) aims to protect wildlife and conserve wild areas.

[Khmer Green Charcoal \(KGC\)](#) have developed a clean cooking fuel providing a sustainable alternative to the wood-charcoal consumption. They manufacture a sustainable alternative to wood charcoal: char briquettes made of organic waste. As a private company KGC are able to supply its Green Charcoal to more than 6,500 end-users in Cambodia.

Organization	Core Focus/Priorities	Opportunities for Clean Cooking
Nexus	Financing social enterprises	Financing for enterprises working in clean cooking, experience working with and investing in related businesses
GGGI	Climate and green growth	Investing in clean cooking solutions to achieve efficient use of energy resources
WWF	Conservation of wood and wildlife	Reducing wood-fuel usage for cooking through modern energy cooking solutions
WCS	Conservation of wood and wildlife	Reducing wood-fuel usage for cooking through modern energy cooking solutions
Khmer Green Charcoal	Reduce deforestation through sustainable char briquettes	Involve in clean cooking discussions

3.8.8 Indirect Enablers - Suppliers

[OKRA](#) is an Australian tech company working in Cambodia on distributed solar and microgrids that make it commercially viable to energize last-mile households. They have created a technology that allows solar panels and batteries to be connected together resulting in the creation of mini solar grids. The Okra Pod enables energy companies to sustainably deploy and scale in remote areas. By combining IoT with machine learning and hardy power electronics, last-mile households can connect into plug-and-play mesh-grids that deliver 24/7 productive power, or as standalone high power Solar Home System. OKRA is collaborating with UNDP to create mini-grids in rural areas in Cambodia.

[EcoSun Cambodia](#) is a social enterprise working toward energy/electricity solutions. Their mission is to increase energy efficiency and free energy sources through installing and maintaining renewable energy sources. They have solar home systems, solar pumps, off-grid and on-grid solar systems for rural families; medium scale biogas for farms that can connect to a generator for free electricity; and Small micro hydropower, tubular turbine, can generate 20Kw for a small village.

[NRG Solar](#) piloted solar cookers many years ago and even though the product worked well, it was not something people wanted here as it meant changing the way they cook and having cheap alternative solutions meant the change was impossible... even if they were more expensive in the long term or had health and fire risks.

IPPs - Independent Power Producers. EDC buys electricity from IPPs, mainly joint ventures of Cambodian and foreign investors (power generation is private sector-driven).

REEs - Rural Electricity Enterprises supply power to many rural areas. They operate as licensees, buying power from EDC and selling power into local distribution networks. The term "REE" is used broadly in Cambodia to refer to any electricity supplier other than EDC, even if they provide electricity in urban areas. REEs may have their own generation assets (typically diesel).

Organization	Core Focus/Priorities	Opportunities for Clean Cooking
OKRA	Provide clean and reliable energy access to off-grid households through the Okra Pod.	Promoting cooking technologies linked to electricity generated by solar energy. Connections to key players in the clean energy space.
EcoSun Cambodia	Energy saving technologies and renewable energy. Provide a sustainable alternative source to combat energy shortages and meet basic household needs such as cooking, drawing water, heating and lighting.	Promoting cooking technologies linked to electricity generated by renewable energy
NRG Solar	Solar energy	Promoting cooking technologies linked to electricity generated by solar energy
IPPs	Power generation	Promoting cooking technologies linked to electricity
REEs	Supplying electricity to rural areas	Promoting cooking technologies linked to electricity

3.9 Clean Energy Policies in Cambodia

3.9.1 Clean energy policies in Cambodia do not include clean cooking

Below highlights a list of policies/action plans over the years for energy efficiency in Cambodia. Multiple policies around clean energy and energy efficiency exist in draft; however none of these policies mention clean cooking in their agendas.

Year	Policy, strategy or action plan
1999	Cambodia Power Strategy
2001	Electricity Law
2006	Rural Electrification Action Plan (<i>Goal: At least 90% of all households in Cambodia have access to grid quality electricity by the year 2030</i>).
2007	National Policy on Rural Electrification by Renewable Energy
2013	Cambodian Climate Change Strategic Plan 2014-2023 (CC CSP) Climate Change Action Plan for Manufacturing, Industry and Energy National Policy, Strategy and Action Plan for Energy Efficiency (draft) National Policy for Green Growth 2013-2030 (NPGG) National Strategic Plan for Green Growth 2013-2030 (NSPGG)
2015	Industrial Development Policy National Determined Contribution (NDC)
2017	National Energy Efficiency Policy 2018-2035 (draft)
2018	Regulations on General Conditions for Connecting Solar PP Generation Sources to the National Grid The Environment and Natural Resource Code (draft)
2019	Cambodia Basic Energy Plan
2020	Updated National Determined Contribution*

*Most recent and updated policy document. Commitment to reducing the carbon intensity of Cambodia's energy sector.

Electricity consumption in Cambodia has been growing fast, averaging 20% growth per annum since 2010 and the rate of increase is accelerating as the national grid is rapidly developed and average incomes rise. Ensuring that there is sufficient supply to meet this rapidly growing demand is a key priority for the Royal Government of Cambodia, including:

- Further expanding electricity production, especially from new and clean energy sources
- Encouraging private sector investment, focusing on technical and economic efficiency and minimizing environmental and social impacts;

- Further supporting the rural electrification fund to achieve equitable electricity access for the population – through government budget, social fund from Electricity Du Cambodge (EDC) and support from other development partners²².

In December 2020 an updated **Nationally Determined Contribution (NDC)** for Cambodia was submitted to the UNFCCC and presents commitments and needs of the country for the next decade for a low carbon and resilient society, in accordance with the Paris Agreement on Climate Change. Prime Minister Hun Sen has stated "Cambodia has been committed to formulating a long-term strategy in 2021 to achieve Carbon Neutrality" which focuses on waste, agricultural biogas and energy efficiency in buildings, factories, and transport. The NDC includes contributions from many stakeholders in the country, including relevant ministries and agencies, civil society representatives, development partners, academia, and the private sector. It strengthens aspirations towards a cleaner and greener economy and covers many aspects such as climate change impact and Cambodia's adaptation and mitigation efforts. This NDC commits to 25% renewable electricity by 2030. However, currently in Cambodia, almost 50% of electricity in the country is from renewable energy, 41% hydropower, 56% coal and oil, 3% from solar. So the NDC commitment is actually a reduction in renewable energy from where it is today.

For electricity production, initially, MME targeted 2,500MW of solar by 2030, however, this was replaced by a target to reduce renewable electricity production from almost half to a quarter by 2030. Government support for renewable energy is essential - not for subsidies (electricity production in Cambodia is cheaper from solar than coal), but because EDC is the only entity authorised to buy electricity. For example, the 200MW solar farm announced last week or the 80MW wind farm at Kampot approved in 2019, can only go ahead if EDC agrees to sign an agreement to purchase the electricity (EnergyLab).

The Royal Government of Cambodia has drafted a **National Energy Efficiency Policy 2018-2035** which set the goal to reduce energy use in industries and buildings by 25% and in the transport sector by 15%. These targets aim to be achieved cost-effectively by applying a four-folded strategy focusing on (1) awareness-raising, (2) financial incentives, (3) capacity building, and (4) energy efficiency standards. However, this is still a draft and is currently being updated with support from ADB. It is anticipated that the Energy Efficiency Policy will be approved in 2021. This policy will create the regulatory framework for EE in Cambodia¹⁹. The draft National Energy Efficiency Policy presents a good opportunity to promote the use of efficient electric devices, and a MECS agenda provides a natural fit within this policy.

The Royal Government of Cambodia (RGC) is trying to accelerate the transition to a climate-resilient, low-carbon sustainable mode of development, and has supported global efforts against climate change by being a Party to the United Nations Framework Convention on Climate Change (UNFCCC) since 1996. It has developed and continues to implement the [Cambodia Climate Change Strategic Plan 2014 – 2023 \(CCSP\)](#) (2013) and each relevant ministry has developed

associated action plans: Climate Change Action Plans (CCAPs). For example, under the Ministry of Environment, through a number of strategic actions, targets environmental protection, conservation and sustainable use of natural resources, green growth, environmental education and awareness raising, and climate change governance. These efforts are expected to enable the country to address climate change challenges and opportunities through improved coordination and more effective implementation of strategic climate change interventions.

Prime Minister Hun Sen in 2013 launched the Cambodian Climate Change Strategic Plan 2014-2023 (CCCS), the National Policy for Green Growth 2013-2030 (NPGG) and the National Strategic Plan for Green Growth 2013-2030 (NSPGG). All of these propose policy actions in the energy sector which can support greener more inclusive growth, including: increasing renewable energy uptake; working with the finance sector to facilitate loans for sustainable projects; and improving the energy efficiency of industry and households.

4.0 Key Takeaways

4.1 Challenges

Renewable energy and clean cooking is not prioritised in the national agenda

At the moment clean cooking is not a priority for government ministries and does not fall into any specific ministry ownership. Clean cooking does not fit into any specific ministry and therefore it is difficult to find anyone to take a leadership role to champion this transition to electric cooking. While MME have their focus on electrification of the country and mines, Ministry of Environment is a small unit that is focusing on climate change, MAFF on deforestation, and Ministry of Health focuses on health services and building hospitals, rather than health issues around air pollution.

Increased coal investments make the country less appealing to manufacturers with commitments to 100% renewable energy who drive a large part of the national economy.

Off-grid will not be a big part of the solution in Cambodia because of the rate of electrification across the country. While off-grid solutions have a role to play in remote areas, electrification will become the standard in the country, (unlike in Africa where decentralised/grid solar is a much larger percentage of the overall energy mix). Renewable energy providers are struggling. Okra diversifying to Nigeria is a sign. Gaps in energy policy and lack of incentives for the private sector co-relate to low innovation and scalability.

Financial limitations prevent scaling clean cooking solutions successfully

Scaling up access to clean cooking solutions is challenging due to the limited investment by the public and private sector to support such interventions. The level of investment in the sector is not proportionate to the size of the problem that needs to be addressed²⁰.

There are currently no subsidies for energy in Cambodia. Despite the potential return on investment for shifting to solar, start-ups and MSMEs have limited access to capital, with the majority using informal channels.

In addition there is no public financing from government institutions to spread messaging around the negative health impacts of cooking with biomass.

Risk of cheaper copycat alternatives that can damage the electric cookstove market potential

There is no control on industry standards to prevent cheaper copycat alternatives that do not meet high quality production which can harm the electric cookstoves market.

Producing quality electric cooking appliances that meet industry standards, and ensuring the market does not get taken over by imitation appliances that do not meet high quality standards and also could be unsafe, and damage the electric cooking market potential. An early example of this pattern can be seen with the New Laos Stoves where the quality of the improved cookstoves was being supervised by Geres. However, based on a cookstove market assessment qualitative study conducted in 2015, as soon as their engagement finished, the quality of the improved cookstoves deteriorated.

There are many regulations around electricity consumption and limiting solar set by the EDC

EDC have concerns around the rapid rate of demand for electricity and are concerned about solar's ability to sustain consistent reliable power across the country. Hence they are heavily invested in coal-fired power. Cambodia generates less than 2% output from solar.

There are many regulations in place. A solar project seeking to connect to the grid must be approved by MME and EDC and must meet certain technical standards and safety conditions. The regulation also includes a two-part tariff system, which comprises charges for consumption and contracted load. Only in exceptional cases may electricity be sold back to the grid; this requires a PPA with EDC and approval from EAC. Solar PV systems are designed for self-consumption but if they are connected to the grid then the consumer pays double: time of use and capacity charge. If a consumer is only connected to the national grid they just pay consumption.

In other countries excess solar at business locations/factories can be sold into the grid, which helps the business cover costs of the solar investment. However, EDC is hesitant about taking excess solar from rooftop systems and has set up a policy that bans any rooftop solar system from exporting electricity into the grid. A policy also limits supply to only 50% of the demand of that customer, limiting size of the solar system.

Despite Cambodia's success in expanding access to the grid, electricity tariffs are amongst the highest in the region and businesses in rural areas tend to pay up to twice more than in urban, grid-connected areas (from 0.14\$ kW/h in the capital vs. up to 0.25\$ kW/h charged by diesel-

powered mini- grids). Expensive and unstable electricity access negatively impacts MSME's operations by raising their operational costs and incurring financial losses caused by unpredictable power outages.

Cambodia has approved 400MW of solar since 2016 and since 2019 approved 4000MW of coal. While there is a lot of investment and developer interest in solar projects in Cambodia, there is a need for certainty and transparency from the government around how much solar they need every year to attract investors on a long term basis.

Cooking requires a lot of heat so it may not be suitable for Solar Home Systems, but perhaps for mini-grids that can handle more power. It is also a tough environment for solar startups to compete with grid (depending on where grid is and the density of the population). While countries like Africa have innovations around pay-as-you-go solar, mini grids and microgrids are popular. However in Cambodia, the grid is already in most villages. Startups that set up solar battery charging stations in 2015 were successful for a year. Then their business model was killed when the grid arrived and households were better off connected to the grid than using batteries.

While Cambodia has improved electricity access, there are still issues with it

69.3% of grid-connected households face frequent unpredictable power shortages, 32.6% of grid-connected households experience appliance damage due to voltage fluctuation, only 13% have access to 23 hours of supply a day "with adequate reliability, quality, affordability, and health and safety"¹⁰.

Electricity planning holds back clean energy progress in Cambodia. The country has been locked in an oversupply of electricity for at least 10 years - and the plan will have 3/4s of Cambodia's electricity depending on imports and fossil fuels²¹.

Gaps in energy policy

- Gaps in policy include missing targets and renewable goals, non-alignment with the UN SDG goals and vested interest in Chinese companies/legacy infrastructure.
- Energy policy does not incentivize small scale renewable energy production - kWh of energy is sold and bought at wholesale price without any subsidy. This means the cost goes straight to the consumer and contracts are provided to the highest bidder.
- This becomes a challenge because of path dependency, i.e. the sunk cost of legacy coal/hydro power infrastructure bringing costs down over several years is impossible for solar to match early on. This is why there is a need for incentives and commitment from the government to support clean energy providers.

- Right now the government is only interested in legacy coal infrastructure leased through Chinese investment or hydro power generation which has serious consequences for the Mekong which are being overlooked.
- As a result there is a large risk for energy providers because of the high investment for renewables. No financing strategy has been outlined to level the marketplace for clean energy providers.

There are still knowledge gaps

- It is not clear which Ministry is in charge of clean cooking, and if anyone will take the lead in clean electric cooking.
- How tariffs will be priced for electricity as a cost-effective energy source
- How much animal and environmental conservation organizations want to be involved with clean cooking agendas - is it too far from their objectives?
- There is no formal working group that meets regularly to share knowledge and discuss clean energy collaboration. There is no group that discusses clean cooking, even informal. How can a collective of passionate clean energy individuals influence the transition?
- How much is public sector engagement needed for an effective transition?
- How can clean cooking with electricity become a priority in Cambodia? How can we ensure it gets added to policy targets?
- Can there be interest in clean cooking from the Ministry of Rural Development (MRD) around livelihoods creation through clean cooking technology?
- How can public funding be used to aid the clean cooking transition instead of the private sector paying for demand creation?

4.2 Opportunities

Position clean cooking as a quick win for the public sector to take notice.

Changing the narrative to the public sector to show that the current priorities and electricity infrastructure efforts are going to have a large impact on clean cooking as well. Decentralized problem-solving is difficult for governments to do in any country. The current focus is centralized infrastructure projects that they can move forward. Therefore a viable strategy can be to bring in the Cambodian government to show what is being done collaboratively by different organizations in the sector and how they can make an impact in the clean cooking space. Through electrification efforts that are already happening, (without having to spend any more money), the government will also be helping to solve the cooking problem with electric cooking. This becomes a narrative the government will get interested in because they can claim this positive outcome without having to spend any more money or doing anything extra.

Then policies should incentivize the uptake of electric cooking; however, the immediate step is to convince the government that what is being done already is going to have a huge impact on the future of clean cooking in Cambodia. Start to include in their announcements and discussions

that electrification will play a big role in solving clean cooking in the country. If it is viewed this way, then perceptions can begin to shift.

Understand how much of a role safety is playing in the decision-making to transfer to clean modern cooking. Key triggers including safety and price can be used to develop awareness-raising marketing campaigns to promote benefits of electric cooking.

Anecdotal evidence suggests that safety is a bigger concern than price, and can be used to position electricity as a safer option for cooking in Cambodia. The danger and poor regulation of small gas butane cans has created fear around the use of LPG and encouraged continued use of charcoal and wood fuel options. The perception of safety is one of the biggest determinants of fuel use (more than price) which could be used as a key trigger to introducing electric cooking as the safer alternative.

This is where electric cooking has a significant advantage because it is cheaper than LPG, (around half of the running cost). However, the perception of safety with electricity is not there yet; some people think electric cooking is dangerous because it is unknown and unfamiliar. Therefore there is a need for marketing and awareness-raising that needs to happen for electric cooking, to not only show it as a safe option, but also change perceptions of price (being expensive). Marketing needs to be done through traditional means such as TV, social media, and face-to-face interactions emphasize electric cooking as a cheaper and safer way to cook (than biomass, and even LPG).

Building understanding of key challenges related to energy access.

Foundational research conducted by iDE in the MECS-TRIID project explores key enablers and barriers to adoption of modern energy cooking in Cambodia, reinforced with the MECS-ECO pilot that is currently being conducted to understand whether electric cooking solutions meet households needs and desires. These findings can be explored deeper through Cooking Diaries to understand how people cook and why they make the choices they do, by closely monitoring a select number of households to document their cooking behaviour and energy use. This will create a strong foundation of knowledge and human-centred insights to develop a viable strategy for implementing clean cooking in Cambodia. The foundational understanding of challenges in clean cooking can be promoted through the iDE-TRIID report, and sharing this with the sector itself could be a good starting point.

Improve linkages between NGOs/Research Institutions and government policy makers to provide policy-making assistance.

There is a huge drive for renewable energy and a case can be made for efficient electric cooking appliances. There is a need to persuade policy-makers that clean cooking is a priority, so the standard on cooking technologies can move forward. There is a lot of information around clean cooking gathered by organizations and research institutes but many research studies are not

publicly available, nor highlighted as a prioritized goal. More collaboration between different stakeholders can benefit all parties.

Leveraging existing Technical Working Groups (TWGs) to spark discussions about clean energy and modern energy cooking.

TWGs are working groups where multiple ministries, development partners and NGOs meet to discuss current affairs around a specific related topic. Currently there is a solar TWG, which will be changed to address Sustainable Energy. This group consists of MME, MoE, EDC, EAC, MoEF, and a key platform to leverage when planning a clean cooking transition in Cambodia. An NGO has to be invited by a member to observe. The next meeting will most likely take place in March/April, but is fairly inactive. It is important to note that two key electricity players EAC (electricity regulator) and EDC (electricity supplier) are present in these TWG meetings. How can these groups be leveraged and revived to become a valuable space for sharing information with key policy-makers, and how can they be persuaded to add clean cooking to their agendas?

Electricity demand is growing and is associated with a ‘modern’ convenient lifestyle that could include clean cooking in the new technology mix.

Thanks to increasing electrification and massive economic growth, electricity demand now grows by an average of 17% annually. (Han Phoumin, senior energy economist with the Economic Research Institute for ASEAN and East Asia). EDC (national utility) has reported last year's increase in demand was at more than 23% in Cambodia. This puts pressure on the government to supply more reliable, stable electricity, reduce costs, and lead to an increased demand for electrically-powered appliances, influencing norms and contributing to a “modern” lifestyle, aspirational to the majority of the population. With increasing demand and improved supply in the future, this could complement the uptake of clean cooking appliances in the home. Already many people are buying rice cookers due to time-saving ability; recently in the capital, electric bicycles are being promoted. There is a strong lean towards electric-powered devices that are more convenient and cost-effective, and from existing research we know that trends move from the city into rural areas.

The solar boom for multiple sectors means cheaper cost of solar, and therefore potential increase of more electrically-powered appliance usage (and clean cooking).

“Expanding solar generation is aligned with the country’s goal of increasing access to affordable and reliable sources of electricity,” - Mr. Pradeep Tharakan, ADB Principal Climate Change Specialist¹⁶.

Solar produces electricity during the day when demand is highest and in dry season, is faster to build and more incremental. Cambodia is uniquely positioned to take advantage of cheaper solar and wind energy costs. The cost of new renewable energies, such as solar, has dropped significantly and the technologies have improved to allow for higher levels of penetration into the grid from solar parks, rooftop PV and floating solar. Employing a multi-stakeholder approach and

building domestic capacity in energy planning will help Cambodia develop a competitive strategy for investment and sector growth. Solar energy in Cambodia has increased suddenly. The Royal Government of Cambodia wants to see cheaper electricity and a good transition which involves changes to energy governance and upgraded transmission infrastructure.

The use of solar energy is becoming a new opportunity for Cambodia, especially for farmers who are able to use energy that is available anywhere, anytime and at a low cost without having to rely on the power supplied by the state grid. While electricity supply has reached every targeted village in Cambodia farmers still have to spend high amounts for daily use of electricity from the grid. However, solar energy can be obtained by people everywhere and with just solar panels and batteries, they can efficiently produce energy for use.

Costs of solar and wind are falling rapidly, which means this power is now cheaper than new coal or gas power plants. As Cambodia moves towards integrating cheaper solar and wind, there is more potential for electric-powered cooking products. Rapid technological advances in smart grids and batteries are helping with integration. However, cost alone will only take the country so far. In relation to clean cooking technology and hardware needs to be designed or adapted for DC power/solar PV.

30% of rural households rely on off-grid power for electricity, including solar home systems, solar lanterns, and rechargeable batteries. With improvement of transmission and distribution systems, as well as promotion of expanded grid connections and solar home systems, Cambodia will strengthen the potential of its economy¹⁰, as well as increased opportunities for cooking with electricity.

Cambodia in the future has some opportunity for more decentralised generation, particularly solar. More solar projects in the country will help Cambodia gain more energy independence and less reliance on importing from neighbouring countries, and solar is cheaper than all other energy sources.

"This is a new era for renewable energy development in Cambodia and the region, and particularly for solar power generation. This is good news for EDC and the people of Cambodia... We believe more governments in the region will adopt auction as a strategy to procure renewable energy generation capacity, and this structure and tariff will serve as a benchmark for future projects." - Mr. Siddharta Shah, Director of ADB's Office of Public–Private Partnerships (PPP - the auction for 60 megawatts (MW) of solar photovoltaic (PV) capacity conducted by EDC, 2019)¹⁶.

Behaviour change can be used as a strategy, building on existing models

To create demand, using social pressure/proofing as key triggers for behaviour change. Leveraging SNV's campaign for Smoke Free Villages and collaborating with them for key learnings and action steps. Create a slow transition and natural trajectory to clean cooking

through small steps towards establishing new norms through behaviour change interventions. Promote appliances through innovators and entrepreneurs. There will always be pockets of people using wood and charcoal to cook, but it is important to establish the new norm in the village. Focus on demand being the trigger for cooking with modern energy, and build trust with the local authority so they can be an entry point and dialogue can be continued around new cookstoves.

The need for collective 'power'

Through collective effort and engaging with interested stakeholders, there is potential to find opportunities to change the narrative around the issues caused by cooking with biomass, and scale up a national transition to clean electric cooking. Having key players involved who can push forward a collaboration, and get the public sector involved.

The public and private sector need to work together to accelerate the clean cooking transition in Cambodia, by including cooking services in policy and overall planning, guided by strategies that can bring the most suitable clean cooking solutions to the population at the least cost. There are opportunities to improve linkages between NGOs/Research Institutions and government policy makers to provide policy making assistance. Universal access to modern energy cooking services to improve health, the environment, gender inequality and efficiency can be achieved if all stakeholders work together to improve the overall cooking ecosystem in the country. It will also be important to channel, accelerate and expand finance for cooking solutions that will enable Cambodia to overcome its heavy reliance on biomass for cooking and switch to a more fuel-efficient, cost-effective, less harmful energy source.

Employing a multi-stakeholder approach and building domestic capacity in energy planning will help Cambodia develop a competitive strategy for investment and sector growth. Ensuring public and private sector collaboration and engagement can help accelerate the transition, also highlighted in Cambodia's National Determined Contribution that outlines the country's post-2020 climate actions: *"With regard to private sector engagement, Public-Private Partnerships (PPPs) are key to the industry, waste, and energy sectors."* - NDC

"As Cambodia is committed to doing her part to address the global challenge of climate change, we look forward to working with all our partners to address our remaining needs in financing, capacity development, and technology transfers. This cooperation and support will be crucial to achieve the ambitious vision set out in this document." - NDC - Say Samal, Minister of Environment, NCSD

Incentives for SMEs working in the clean cooking sector.

There are benefits for enterprises who work in the clean cooking sector, or to encourage other businesses to add clean cooking technologies to their portfolios. There is a VAT exemption for environmentally friendly products, and carbon financing is an international subsidy.

4.3 Early ideas to start transitioning Cambodia to modern energy cooking

(working list)

- Create a collaboration with other like-minded organizations to propel transition to clean electric cooking, a space to discuss ideas and share information with others.
 - Key organizations to form a collaboration to drive clean cooking forward: SNV, Geres, EnergyLab and iDE
 - Leverage EnergyLab networks and events to build awareness of clean cooking
 - Feature articles on clean cooking in EnergyLab's annual Future of Energy Magazine
 - Set up informal "Energy Drinks" to start up conversations about clean energy and clean cooking in Cambodia, and to build relationships and networks
- Involving government as much as possible is key to the transition, but not relying on them to drive it. Make it as easy as possible for ministries to support the sector without making them responsible for it.
 - As clean cooking does not formally sit in any ministry (apart from potential MME in their energy department), it will be faster/easier to take a decentralized approach to come up with a plan and get their buy-in.
 - Involve government actors, especially from MME, in collaborative workshops and building an action plan.
 - Disincentivizing non-clean options for cooking through policy or other means.
- Join the Sustainable Energy TWG to start conversations with multiple government ministries about clean electric cooking, and get buy-in from the public sector
- Work with the Institute of Standards of Cambodia (MISTI) to ensure there is a way to build credibility and recognition around electric cooking appliances
- Set up learning events for reporters to publicize information about clean cooking, build awareness and get the attention of the population (and public sector). A similar private event took place in a cafe in January 2021 organized by ITC where the topic of discussion was impacts of indoor air pollution from cooking. RIC presented the scientific implications of emissions from cooking, and SNV talked about what they are doing in the clean cooking space around their 'Smoke Free Villages' behaviour change campaign. Engaging journalists could be a potential strategy to spread information and start important discussions about clean cooking.
- Create a Khmer version of the MECS-TRIID report around enablers and barriers to clean cooking and share with key government stakeholders.

5.0 Conclusion

The sector has always invested in biomass solutions, but based on research studies the smoke has long term negative health impacts. Using electricity will change the behaviour of people

quicker than improved cookstoves. Once someone is using electricity or gas they will not come back to wood or charcoal due to the different appliances they have invested in and the new cooking behaviours it requires. If people continue to use improved charcoal, they are still not being taken out of this 'smoke' scenario, even if there are less emissions, because the behaviour has not changed. Starting a new behaviour becomes the biggest hurdle, but social proofing is one of the biggest triggers to people adopting new technologies in Cambodia, as learned through multiple research case studies over the years.

Clean cooking as a sector does not fit into any specific area/responsibility. It is not clear which Ministry is in charge of clean cooking. While there are energy policies drafted, they have not necessarily been implemented and 'clean cooking' is not a priority on a national level. However, electrification is a top priority, which presents a promising energy source for electric cooking solutions.

Early hypothesis is that clean electric cooking will develop with more push from the demand side, rather than from the government. If demand is supported by the supply side and private sector companies selling better quality products, paired with social proofing and better understanding of cost-effective energy usage, this could slowly increase the uptake of electric cooking appliances. Therefore the transition from biomass to electric cooking may come from the private sector offering solutions, demand choosing what they need, and the government controlling the price of electricity.

Universal access to modern energy cooking services under SDG 7 can be achieved if all stakeholders work together to improve the overall cooking ecosystem. This includes the coming together of political commitment, financing, policies, and partnerships to accelerate access to modern energy cooking services. Understanding how stakeholders can work together to incorporate electricity for clean cooking, and how the public and private sector can work together to incorporate cooking services into their strategies to bring the best fitting cooking solutions to households at an affordable price.

"The clean energy transition won't happen without collective effort, and we need to bring in the skills, expertise and motivations from all sectors in society, within and outside the energy industry" – Future of Energy, SE Asia Globe

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