Access to Energy

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EDITORIAL

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On October 2nd, thousands of school children around the world assembled and used their solar lamps and also took a pledge of non-violence towards the environment. The event created two Guinness World Records-most people assembling solar powered lamps simultaneously, and largest environmental sustainability lesson. The do-it-yourself-solar message was conveyed widely and effectively by these Solar Ambassadors. The energy access discourse that came to limelight about a decade back, focused on small appliances of everyday use that can be powered by renewable energy mostly in pico or micro form. That discourse quickly moved to mini-grids, distributed power and utility scale projects, engulfing in it the charm and convenience of a tiny solar lamp that is now branded as a gizmo. Another recent event - Greta Thunberg sailing in a solar ship to attend the UN Climate Change Summit, also supported the same message- solar can power any device anywhere with ease.

While utility scale renewables are preferred by countries to green their economy and meet RE targets, decentralized renewables hold the promise to provide clean energy to its citizens not only for their everyday use, but also in emergency situations. When thousands of homes in California lost power as their electric utility, PG&E was prompted to shut down the grid to avoid risk of fire due to windy and dry weather, people used solar power to light their homes.

The DRE (Decentralised Renewable Energy) practitioners in India (i.e. CLEAN members) are making an appeal to the politicians to include the promotion of DRE in their election manifesto. India might be targeting to become world's largest producer of solar energy one day, it still needs to underpin that with DRE solutions.

OpenCEM – A Free, Open-Source Capacity Expansion Model for Australia's Energy Market

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ITP Analytics (a division of ITP Renewables, Australia) has developed[1] an open-source Capacity Expansion Modelling Tool (openCEM) which permits all stakeholders, including decision makers, energy system planners, regulators and project developers to freely undertake extensive scenario modelling that will provide insights into potential pathways for the evolution of Australia's National Electricity Market (NEM) from the present day to a low-carbon power system. The modelling tooluses publicly available datasets for technology and fuel costs, electrical demand projections and renewable energy resources (i.e. wind and solar). Interested stakeholders can also incorporate additional datasets. Results for a range of scenarios are displayed and shared by users using captivating visualisation techniques through the host website. With openCEM, one can run unlimited scenarios to explore the implications of assumptions about future energy technologies and policies on the NEM.

Why use Open-Source Capacity Expansion Modelling (OpenCEM) Tool?

By using this tool, users will be able to examine the impact of:

- a range of new policy or regulatory measures
- economic factors such as technology costs or changes in fuel prices
- technological change, including cost reduction and performance improvement of energy generation, transmission, storage and energy efficiency
- specific large energy projects

Unlike similar models that are privately held, often expensive to commission, and offer the public limited detail on how they actually work, openCEM is free to use and open to scrutiny and expert review. Users can inspect every line of code and can control every input assumption. We expect a community of expert users to collaboratively improve the model over time.

What does openCEM actually reveal?

Ten pre-run scenarios (selected to demonstrate the model's capability) are presented on the openCEM website. The graphics essentially display capacity and dispatch of each technology for each of the 16 NEM planning zones, and energy trade between the zones. Within each scenario a slider bar allows users to jump forward in five yearly increments out to 2050.

There's a lot to unpack, but at first glance the key results of the pre-run scenarios appear to be that:

1. openCEM reflects what other modelling studieshave shown; that the least-cost replacement of the NEM fleet includes a significant amount of renewables. A combination of wind, solar, dispatchable renewable generation (hydro, biomass and solar thermal) and storage can meet increasing shares of electricity demand into the future at costs that are competitive with conventional generation.
2. Most scenarios show electricity costs that are similar. This is fundamentally because there is

[1] openCEM has been developed by ITP's Analytics division, together with the Centre for Energy and Environmental Markets at University of New South Wales, the Energy Transition Hub at the University of Melbourne, and the software development specialists ThoughtWorks. The development of openCEM received funding support the Australian Renewable Energy Agency and the Governments of NSW, Victoria and South Australia. openCEM is available at www.openCEM.org.au

little difference in the forecast prices of wind, solar and storage, dispatchable renewable generation and conventional generation. What this also means is that there are many technological pathways to achieve any particular outcome.

3. openCEM shows that orchestration of many renewable and storage technologies, and timely transmission upgrades, is the cheapest way to achieve emission reduction or renewable target policy objectives. That is not necessarily intuitive, and some might be surprised that the model does not rely strongly on just one or two relatively cheap technologies. Rather, the optimisation calls upon a wide range technology options, each with unique cost and operational characteristics, to simultaneously satisfy demand across the system.

4. The openCEM results indicate that, to keep pace with the energy transition, it is crucial that regional and interregional interconnectors are upgraded in a timely manner. For example, the model predicts large expansions in transmission between Northern SA, Country Victoria and South West NSW by 2025, strengthening of intra-regional transmission in NSW by 2030, and construction of the Marinus link by 2035 in most scenarios.

5. The mix of energy generation out towards 2050 depends on how we get there. Early action to transition to renewables favours wind and PV, but other technologies such as solar thermal with storage become cheaper later. Thus, more of the latter will be built if the transition is delayed.

Future developments

openCEM is an active open-source project which means work is ongoing to refine modelling assumptions and functionality. Planned improvements to *openCEM* include updating input data as it becomes available, including demand side participation in dispatch calculations, and extending the geographical coverage to include smaller, remote networks. openCEM will also be redeveloped to similarly model electricity networks in other countries.

Sustainable energy access to manage waterresources: Addressing the energy-water nexus

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Cabo Verde is an archipelago located in Atlantic Ocean west of westernmost point of Africa. Like other Small Islands Development States (SIDS), Cabo Verde is extremely vulnerable to climate change and faces severe adaptation challenges associated with water resources availability, energy security, and desertification processes. Due to its location Cabo Verde only receives on average 260 mm of rain per year placing it in the semi desert category. In fact, water availability in Cabo Verde is only 537 cu.m. per person per year; the second lowest of all countries in sub-Saharan Africa. Country experiences a long dry season and short intense rainy periods,

only 13% of the precipitation is able to recharge the soil, and the rest is lost to evaporation and the sea. The drinking water supply coverage has been growing in the country,but it is far from covering the increasing demand. Besides, access to piped water is still limited with low geographic coverage and significant discontinuities in service.

Therefore, water security is one of the government's major concerns. To overcome the low availability of fresh water, desalination plants in urban areas and underground boreholes in rural areas have been used to secure access to freshwater even though they require large amounts of energy to operate. It is to be noted that, Cabo Verde is facing an increasing power deficit which is hampering economic and social development.The current dependence on imported fossil fuels for power generation has resulted in electricity tariffs of US$ 0.32/kWh which are the highest in the region. The high electricity costs associated with water pumping and desalination plants have been one of the main deterrents to advance water access in the country.Thus, to improve water access, the production of affordable energy and its adequate use are of outmost importance.

In order to contribute to mitigate these issues,the Government of Cabo Verde, with the support of UNIDO and GEF, looked into the development of the project "Sustainable energy access to manage water resources: addressing the energy-water nexus". The project aims tocatalyse the commercial use of Renewable Energy (RE) and Energy Efficiency (EE) technologies in water management solutions (with a special focus on desalination and pumping systems) while supporting the development of a comprehensive network of Energy Service Companies (ESCOs) inline with Cabo Verde's Nationally Determined Contributions (NDC). ITPEnergised was the consultant hired by UNIDO responsible for the establishment and design of the project and for the development of all documentation required for GEF CEO Endorsement approval process.

By bundling a set a set of key interventions in the area of investment policy and capacity development, as well as awareness raising, the project is expected to deliver the main overarching results:

- Energy-water nexus and Energy Services Companies (ESCOs) approach integrated in relevant national policies and regulations.
- Local capacity on energy-water nexus and ESCOs approach enhanced
- Around 3.6 MW of private investments in projects addressing the energy-water nexus identified / installed.

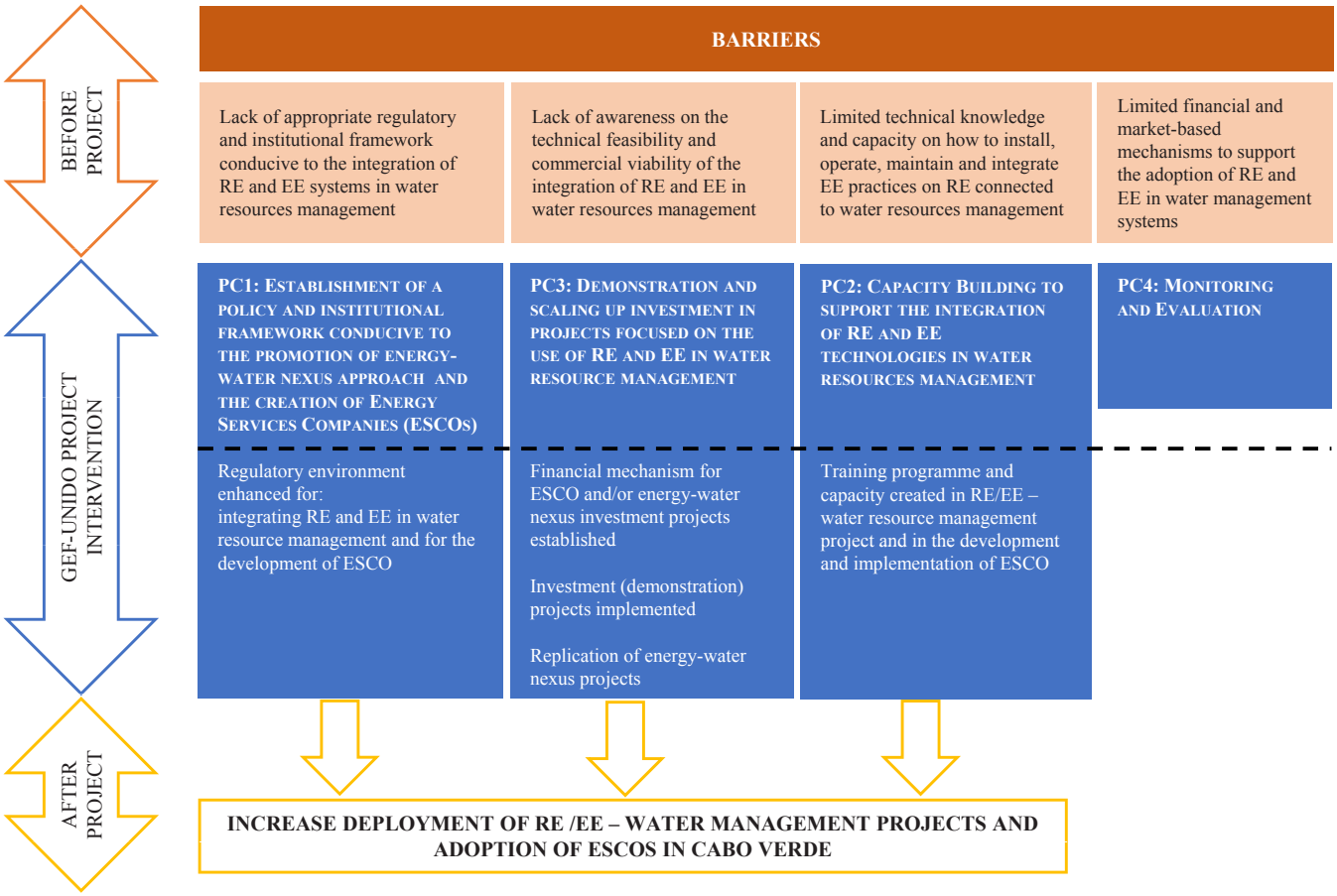
Figure below shows how the project aim to address the main existent barriers and what are the expected results of the project interventions.

The full developed documentation includes energy baseline report, pre-feasibility study reports, full GEF CEO Endorsement document with its corresponding project results framework and identification of sources of co-financing.

The energy baseline report describes the status of RE and EE technologies in water resource management, supply chain availability and technology sustainability, identifies and characterises the market enablers and identifies market barriers such as financial, capacity building, technical, etc., as well as illustrates the policy & regulatory framework.

Pre-feasibility studies were conducted for nine (9) renewable energy-water nexus pilot projects (mainly water desalination and pumping projects). These include identification and analysis of the: (i) technical feasibility parameters such as size, technology, location and others; (ii) financial feasibility parameters like IRR, LCOE and sensitivity analysis; (iii) identification of environmental and social impacts and risks of the projects.

As a result of this work the documentation was submitted to GEF and successfully approved for implementation in 2018. Full details of the project can be found here: https://www.thegef.org/project/sustainable-energy-access-manage-water-resources-addressing-energy-water-nexus



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