Access to Energy

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EDITORIAL

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According to the IEA 2017, the energy related carbon emissions remained flat in 2016 even as global economy grew. This delinking of economic growth with emissions has been achieved due to increasing dependence on natural gas, renewable energy, new nuclear capacity and greater focus on energy efficiency both at generation and consumption levels. The trends in the last decade have brought renewables from being on the periphery to the mainstream. Renewables are growing faster than any other energy source, and attracted 16% of the total energy investments in 2015. Simultaneously, their reducing costs have made them competitive with conventional forms of energy.

The trends in the last decade have brought renewables from being on the periphery to the mainstream.

In 2002, the WorldWatch Institute , a global think tank, published a paper on 'micropower- the next electrical era', which discussed about the new technologies that would usher in the decentralisation of electricity systems. Some of these technologies were fuel cell, solar cell, wind turbines, micro-turbines and storage technologies. The paper also mentioned that while the high initial cost would act as a deterrent; demand for green energy and technological improvements would be market accelerators for micropower. Today, the high initial costs are no longer a barrier for at least some of these technologies and the demand for green energy as well as the technological developments have accelerated the growth of micropower as seen by some of the recent global events.

Today, the high initial costs are no longer a barrier for green energy.

When the power crisis hit Southern Australia recently, triggered by the heat waves, storms, closure of coal and gas fired power plants and intermittency of solar and wind generation plants, solution was sought in the 100 MW battery system that would be the nation's largest battery. Back home, in the upcoming 300 MW solar project for Andhra Pradesh & Karnataka by Solar Energy Corporation of India, each 50 MW project is proposed to be connected to a storage capacity of 5 MW/2.5 MWh. The roof-top solar market which is the fastest growing segment in India, is facilitating new business approaches and concepts. For instance, discoms are now offering services such as installing net meters and facilitating subsidies to individual roof-top solar projects.

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In parallel, the policy framework for mainstreaming of renewable energy based mini-grids into the rural electrification planning is in the final stages of consultations. As anticipated by Edison - a highly dispersed electricity system, with individual businesses generating their own power- is coming to a full circuit, *the micropower era!*

Installation of PV systems in Mozambique

David Fernandez
Principal Consultant, ITPEnergised

Since 2013, ITPEnergised has been providing technical consultancy services to FUNAE. The institution is subordinated to the Minister of Energy of Mozambique that works in the fields of energy access for remotely located areas and predominantly focused on solar electrification. The main purpose of the project is to supervise an electrification programme in order to guarantee the quality of the installation of PV systems in line with the programme specifications and as well monitor the whole process progress.

The plan involves the installation of 3,200 PV systems in schools, health centres and communities located in the provinces of Cabo Delgado, Niassa, Inhambane and Manica, including battery based PV installations, PV Pumps and Street Lights. ITPEnergised is responsible for project management activities, design & specification reviews, site visits and technical supervision as well as project monitoring. The other main project component includes the provision of theoretical and practical trainings to 20 field technicians to undertake the supervision of the PV installations. This allows the knowledge transfer to local technicians in Mozambique with the corresponding certificate after the full training completion.

PV Standalone system for local shop (Katapua, Mozambique)

Afghanistan's efforts towards building energy efficiency

Tauseef Ahmad
Consulting Engineer, ITP India

Over the last decade, Afghanistan has made significant reconstruction efforts at all levels of the energy supply chain. Energy efficiency as an area of focus has been catching up fast in Afghanistan. Recently, the Ministry of Energy and Water (MEW) has formulated the Afghanistan Energy Efficiency Policy (AEEP) which is under the approval stage. The work on the AEEP was supported and financed by the German Development Cooperation. ITP India has been privileged to be associated with the drafting of the Afghanistan Energy Efficiency Policy (AEEP).

Afghanistan's energy end use distribution, is quite unique in global context. While industries account for a majority share in world's energy end use statistics in 2014, this spot is occupied by residential sector (73%) in Afghanistan. Buildings in Afghanistan account for about 93% of all electrical energy. The building sector covers a diverse set of end use activities which have different energy use effects. Energy demand from the building sector will continue to increase as the country progresses. Energy efficiency in building sector is, thus, especially significant owing to the rapid new construction.

In 2015, the Afghanistan Energy Efficiency Codes for Building (AEECB) was introduced by Afghan National Standards Authority (ANSA). AEECB, which applies to commercial and residential buildings, has specified minimum standards and efficient practices in lighting system; air-conditioning system; elevators, escalators; electrical system; and building envelop which when applied will save energy in buildings. The integration of photovoltaic in building for electricity generation has also been discussed.

ITP India is happy to support the education and nutrition of Karan who studies at KG class of Sshrishti Bal Shiksha Learning Centre, Delhi. Karan's parents are daily wage labourers and have two more children to take care of, which makes it tough for them to continue with Karan's education. Karan is not only good in studies, but also has keen interest in drawing and other co-curricular activities.

Prior to this, GERES had commissioned a project to enhance energy efficiency in buildings using passive solar heating technologies and other applications. Ministry of Energy and Water (MEW), with the support from the World Bank, had established Energy Efficiency unit which conducted energy audit surveys, as "demonstration" projects, at 12 of the government run facilities across Kabul, Nangarhar, and Herat in the year 2011.

Afghanistan Energy Efficiency Policy (AEEP), which provides strategies & actions for improving energy efficiency across all sectors and guidance for implementation of energy efficiency activities in the country, has recommended enforcement of AEECB for new constructions, introduction of green building rating system, minimum energy performance for appliances and equipment, LED based lighting system and among others for the building energy sector.

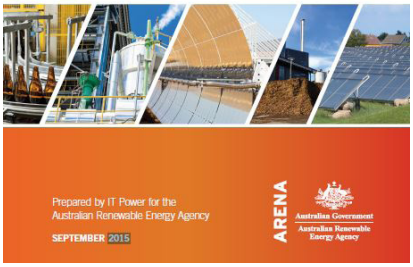
To support energy efficiency program in Afghanistan, AEEP has also recommended several steps like awareness program, establishment of legal and regulatory drivers, standardized source of advice to name a few; which will empower consumers with information and knowledge and act as the first incentives to incorporate energy efficiency practices.

Renewable energy options for Australian industrial gas users

Dr Keith Lovegrove
Head - Solar Thermal ITPEnergised Group,
Managing Director, ITP Thermal Pty Ltd

Industrial gas users consume gas for process heat ranging from below 100°C to over 1000°C, and as chemical feedstock. In Australia, industrial users account for nearly half of domestic demand for gas. This is also the case in countries like India. As LNG exports have now grown with the commissioning of new production facilities, overall demand for Australian gas has tripled. Domestic prices have increased to levels determined by international prices. Industrial gas users are concerned about the uncertainty of future gas prices. There is currently a major political debate in the country around the issue.

8MW boiler burning grape waste, photo Australia Tartaric Product



In anticipation of this, the Australian Renewable Energy Agency (ARENA) commissioned ITP, in conjunction with Pitt&Sherry and the Institute of Sustainable Futures, to research into the options for reducing industrial gas use with renewable energy. The task was to study various technologies that act as a substitute for industrial process heat and check their viability based on the operating temperature required. Solar, biomass, geothermal and heat pumps have all been considered and found to have potential.

The work finds that gas prices paid by users depends on: their size, location, whether they are distribution or transmission connected, and when their contract was negotiated. Renewable energy options could offer potentially lower energy costs, but also greater certainty once the required investment has been made. Globally, uptake of renewable energy technology continues to grow, motivated in part by the imperative to reduce greenhouse gas emissions. All technologies have a strong size dependence on capital cost that makes larger systems more cost effective at delivering heat. However this also tends to be in correlation with large users historically being able to negotiate more favourable gas prices.

A summary of the various technologies and their viabilities is shown via the table in the next page.

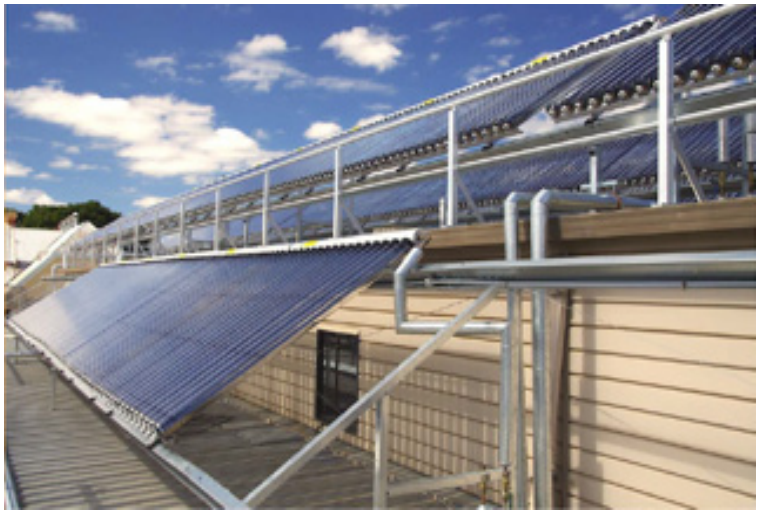
ITP India is proud to become an Industry Member of Skill Council for Green Jobs (SCGJ), aligned to the National Skill Development Mission and is promoted by the Ministry of New & Renewable Energy (MNRE) and Confederation of Indian Industry (CII).

Renewable energy technology	Indicative temp range °C	Status	Comments	Economic viability	Attractiveness
Biomass fired boiler	80–800	Commercially mature with existing support industries	Capex higher than gas boiler	Only if locally sourced material	✓✓
Biomass gasification and combustion	80–1000+	Commercially mature with existing support industries	Capex higher than gas boiler, considerable extra cost to produce pure methane	Only if locally sourced material and for non sensitive application	✓
Biomass digestor and combustion	80–1000+	Commercially mature with existing support industries	Capex higher than gas boiler, considerable extra cost to produce pure methane	Only if locally sourced material and for non sensitive application	✓✓
Solar thermal unglazed	30–60	Commercially mature with existing support industries	Requires unshaded roof space. Significant seasonal output variation	Cost competitive for very low grade heat applications	✓✓
Solar thermal flat plate	30–85	Commercially mature with existing support industries	Requires unshaded roof space and a structural assessment. Significant seasonal output variation	Cost competitive for modest temperature heat applications	✓✓
Solar thermal evacuated tube	50–200	Commercially mature with existing support industries	Requires unshaded roof space and a structural assessment. Significant seasonal output variation	Cost competitive for modest temperature heat applications	✓✓
Concentrating solar troughs and Fresnel	60–450	Commercially mature but support industries are mainly overseas	Design needs to be done by specialists in field	May be cost competitive up to 250°C under good conditions	✓
Concentrating solar heliostats and tower or dish	300–1000+	Less commercially available with support industries mainly overseas	High land requirements and not applicable at small scales. Thermal storage easily integrated	Not yet cost competitive	×
Enhanced geothermal systems	90–250	Still at R&D stage	Most identified resources are remote from gas users	Not yet cost competitive	×
Geothermal hot sedimentary aquifer	40–100	Commercially mature but limited supply chain	Highly site specific	Can be low cost if resource is not too deep	✓
Heat pumps with Grid electricity	40–100	Commercially available but support industries are mainly overseas	Compare cost of gas to cost of electricity/COP. Some storage may be required	Cost competitive for modest temperate heat applications	✓✓
Heat pumps with photovoltaics	60–100	Commercially mature but support industries are	Appropriate storage may be required to ensure heat pumps do not	More costly than solar thermal, but could be	—

ITP India offers a 4-week online Certification Course on DesignBuilder, a globally preferred building performance analysis software which is used to simulate and analyze the energy performance of the building.

There appear to be potential opportunities for reducing gas usage with renewable energy that are economic, across all mass markets and some large user industry sectors, and these will grow as gas prices rise. Lower temperature applications have more renewable options available and at lower cost. There is no single favoured sector or application; each case must be considered separately. There is also no clear link between industry sector and most likely renewable technology. The closest observation that could be made in this regard is that agriculture, food, beverage, wood and paper related gas users are more likely to have low to zero cost biomass available and if so should consider exploiting this. Those users that have no low-cost biomass available but are obviously in high solar resources areas are more likely to favour solar thermal solutions.

The full report plus a summary and an economic screening tool spreadsheet are publically available at: https://arena.gov.au/resources/renewable-energy-options-for-australian-industrial-gas-users/



Evacuated tube solar field producing water at 95oC 470kW, photo Greenland Energy systems

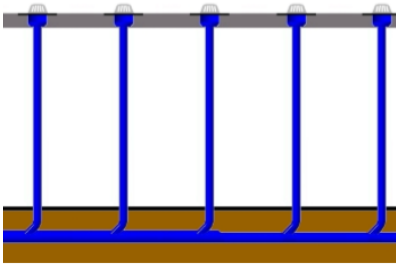
Siphonic Roof Drainage (SRD)

Bhawana Gautam
Associate, ITP India

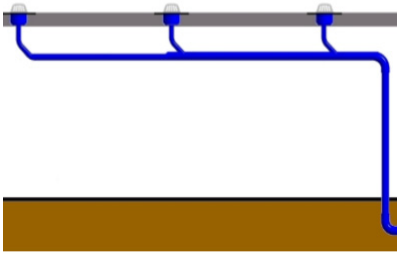
Energy demand and consumption are the indicators of economic growth and development of a country and one of the greatest challenges of modern economics is to protect the environment. International Energy Outlook 2016 (IEO2016) shows rising levels of demand of worldwide energy use, led by developing countries including India and China. India has the world's fastest growing economy, 5.5 % per year from 2012 to 2040.

As a result of increasing urbanization and rising living standards with the economic growth of the country, residential energy consumption in India grows by 3.2 % per year and commercial energy consumption grows by 3.7 % per year (IEO2016). Construction industry (buildings) consumes a large quantity of materials and other resources and is responsible for a significant share of emission of greenhouse gases. This shows the need to achieve energy and emission reduction in building sector for the sustainable development of the country. According to UNEP, the limitation in environmental impact with the reduction in total material and energy throughput of any product and service at production, operation and disposal stage is known as dematerialization. One of the potential aspects in building dematerialization is the inefficient roof drainage system.

For the drainage of rainwater runoff from the roof, water flow is channelized from the roof down though the gutters, outlets and downpipes to the ground below in conventional roof drainage system. Despite its suitability for the small roof areas, water flow never exceeds one third of its full flow capacity in the downpipe due to the presence of air and its effect, hence, requires larger diameter pipes and same number of downpipes as the outlets. For this reason, Siphonic Roof Drainage is emerging in the construction industry as a sustainable technology.



Conventional Roof Drainage



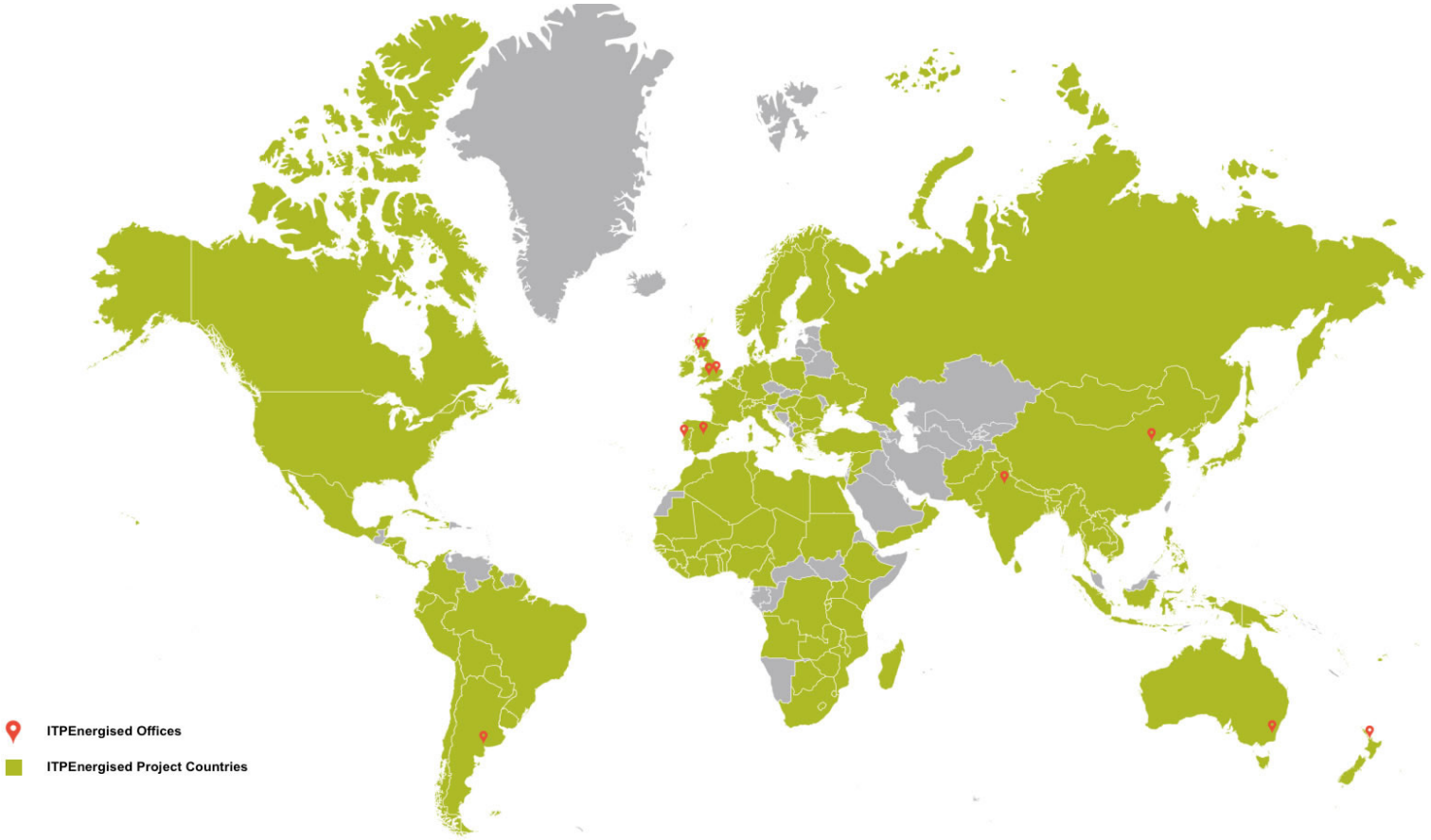
Siphonic Roof Drainage

Siphonic roof drainage maximizes the flow of water through the pipe due to its full flow capacity and eliminating air within the pipework. A baffle present in the siphonic system creates negative pressure and prevents the entry of air into the pipe, thus creating high flow velocities and full bore flow. For the drainage of same volume of water, SRD needs less pipework (diameter and number of downpipes) as compared to conventional roof drainage system.

Ideal for low-rise buildings with large footprint like airport terminals, warehouses, office complexes, factories and several others, SRD is not limited to material and cost savings only. Due to the high flow velocities in this system, there is no requirement of sloping horizontal collecting pipework. Thus, drainage in buildings can be provided with architectural flexibility, in terms of space and aesthetic parts, also because of fewer downpipes. Less material means less embodied energy in the building and hence less environmental impact. SRD also has a benefit in mitigation of urban flooding and sewer load protection by controlled delay of several minutes to fill the pipework and constant discharge, even during heavy or catastrophic rainfall.

Siphonic roof drainage is a proven technology originating from Europe. With the advantages it offers and continuous research and development, SRD is becoming a dematerializing approach towards green construction, widespread throughout the world.

ITPEnergised Offices



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