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Sustainable Energy for All in a Post-COP21 World

At COP21 in Paris last year, 196 countries agreed to take action to limit the world's average rise in temperature to "well below 2 degrees Celsius above pre-industrial levels" while pursuing "efforts to limit the temperature to 1.5 degrees Celsius."

Any serious energy discussion following COP21 must necessarily address the energy paradox. On one hand, energy demand will almost double in the next 40 years – stemming from the twin challenges of access to energy and the mega-trends of urbanization, digitization, and industrialization that are driving ever-higher energy demand. However, at the same time, we have to reduce CO_2 emissions by half to avoid significant irreversible damage to our planet. The way we currently manage energy is unsustainable. All government and scientific institutions agree: the choices we make today about energy affect our climate and will impact future generations forever.

How will we meet a growing global hunger for energy while effectively reducing greenhouse gas emissions?

Access to Energy

At Schneider Electric, we believe that access to energy is a basic human right. Everyone on our planet must have access to safe, reliable, efficient, and sustainable energy. But today, about 1.1 billion people have no access to modern energy. What those of us in the developed world take for granted at the push of a button is unavailable to almost 1 out of every 5 people on the planet. Another billion have only an unreliable and intermittent supply. Virtually everyone without access to modern energy is poor, earning less than $2 per day. Access to energy is transformational. Electricity reduces poverty, improves health, increases productivity, enhances educational opportunities, improves the standard of living, and promotes environmental sustainability.

Mega-Trends Driving Energy Demand Worldwide

We all know that there is a rise in energy demand – in fact, globally; it will double in the next 40 years. Three global mega-trends are provoking this increase in demand: urbanization, digitization, and industrialization.

By 2050, the world's cities will be home to an additional 2.5 billion people, two-thirds of the global population. Imagine the stress on infrastructure, on transportation, on public services. The number of cities with a population of more than 10 million has grown from 10 in 1990 to 28 today and will hit 41 in 2030. Cities need to find new ways of achieving efficiencies – especially energy efficiency. A livable city has to be energy efficient.

Digitization is pervasive – in our homes, in our buildings, in the cloud, and in our industries. There will be 50 billion more connected devices and "things" in the next 5 years. According to IDC, we generated some 1.8 zettabytes (1.8 trillion gigabytes) of data in 2011 – enough data to fill more than 57.5 billion mobile phones or tablets with 32GB storage. It is predicted that in 2020 we will generate more than 20 times as much data (40 zettabytes). This implies a continuing rise in energy demand, presenting us with an unprecedented obligation to seize efficiency opportunities.

Industrialization – industries account for one-third of the total world energy consumption. This global industrial energy use is projected to double by 2050 in the absence of any new policy measures. Even with ambitious emissions reduction policy changes, the International Energy Agency estimates that we will still see an increase by at least 50% by 2050 (IEA, 2009c). The IEA, in fact, estimates that 55% of the additional energy demand in the next 20 years to come from Asia.

Indian Context

Expanding access to energy, rapid urbanization and economic growth and development will result in Indian electricity demand quadrupling by 2050. In India, installed power generation capacity is around 300 GW; yet, about a quarter of our population does not have access to electricity and another third of the population gets electricity daily for only 4-6 hours.

To maintain economic growth and to attain equitable development, we need an additional power generation capacity of 500 GW by 2030; which roughly equates to the addition of one 600-700 MW power plant every week for next 15 years. While the Government of India has set a very ambitious target of adding 175 GW via renewable energy by 2022, there is still a lot of work to be done in terms of reducing the energy and carbon intensity of our economy.

The Emerging Efficiency Potential

Today's challenges also present us with new opportunities to realize efficiencies. As our world becomes more electric, more connected and as energy becomes more distributed, there is an unprecedented opportunity to advance energy efficiency.

Our world is becoming more electric. Almost everything we interact with today is either already electric or becoming electric. From the time

you start your day in the morning to the time you finish at night, almost everything is electric – your home, your work, your devices, your entertainment. The rising demand for electricity – in particular, buildings, industry, intelligent devices, and even transportation – demands proven energy management approaches.

Our lives are also becoming more connected. The Internet has already transformed the way we live, work, and play. Now the Internet of Things is going to take this to a brand-new level: connectivity is transforming our world. Connectivity refers to machine-to-machine (M2M), people-to-people (P2P), and people-to-machines (P2M). Sensors and embedded electronics in machines enable new operational intelligence from data uncovered. This, in turn, will drive vast efficiency opportunities.

With such widespread electrification and connectivity, energy models need rethinking as well. Which is why the generation of power needs to be more distributed and closer to users. Distributed energy is rapidly evolving globally. This is driven by new capabilities to provide local energy to facilities, particularly around positive or renewable energy and micro grids. When our world is more electric, more connected, and more distributed, new opportunities emerge that allow us to realize more efficiency – in our cities, in our industries, in our buildings, in the cloud, and even in our homes.

In particular, two transformational developments are driving new opportunities and advances in energy efficiency: the convergence of Operational Technology (OT) and Information Technology (IT), driven by the Internet of Things (IoT); and the progression towards a more distributed energy model, enabled by today's Smart Grid technology.

IT-OT Convergence

Traditionally, IT managed information for humans, and OT managed data for machines. But this paradigm is undergoing a radical change as OT systems now are connected to the same networks as IT resources. The operational intelligence that allows IoT devices to communicate in a bi-directional fashion makes "active energy efficiency" possible. Active energy efficiency leverages connected "smart" technology to automatically measure, monitor, and control energy consumption and demand. (This is different from "passive" energy efficiency efforts – LED lamps, building insulation, low-energy appliances, etc. – which are basically measures to reduce energy demand.) It is this aspect of automated control that is critical to achieving maximum efficiency. A prerequisite to extracting optimal efficiency is the coming together of energy, automation and software & analytics. This makes the energy value chain more intelligent – more predictable. Adding IoT connectivity to automation and software & analytics drives even greater energy and process optimization.

Empowering Distributed Energy Resources

Traditionally, we have addressed the energy equation from the supply side – adjusting the amount of electricity generated to ensure that supply matches demand. But depending solely on supply-side solutions will not allow us to meet our obligations to reduce our carbon emissions and reduce energy consumption. And in our new energy world, we are better able to address the problem from the other side – from the demand side, from the perspective of the energy user.

The old world of energy is going through a massive transformation: from a centralized, one-way, supply-side-oriented grid designed for answering peak demand; to a distributed, two-way, demand-side-oriented model where consumers are empowered to take a more active role in their energy decisions.

This paradigm shift literally gives "power to the people." Electricity is increasingly distributed and connected, and flow is bi-directional between smart supply and smart demand.

Made possible by Smart Grid technologies, the emerging new world of distributed energy offers enormous potential to boost efficiency and reduce CO2 emissions. Grid automation and a more flexible distribution model enable a more responsive network that allows consumers to realize their active energy efficiency savings. Micro grids and distributed energy resources (DER) – small-scale renewable energy sources and energy storage – allow consumers to produce their own energy and shift to a greener energy mix. The costs of both solar and storage have dropped by a factor of 5 in the past few years. And analysts expect the renewable sector to account for up to 50% of new capacity additions by 2030.

Energy Efficiency: our cheapest, cleanest and most abundant source of energy

In the discourse around energy and climate, it is often said that energy efficiency is the cheapest, cleanest and most abundant source of energy. The premise being: Energy is not used, therefore it does not need to be generated, transmitted or distributed – a Nega Watt (negative of a Mega Watt) – a term coined in 1989 by Amory Lovins of Rocky Mountain Institute.

If one were to consider the notion of the cost per unit of energy saved from energy efficiency projects; when done right, energy efficiency always offers the lowest levelized cost of energy – by far – when compared to any other source of energy. It goes without saying that energy that is not used is cleaner than any other source of energy. Across sectors and geographies, abundant opportunities lie untapped in terms of the energy efficiency potential.

So, while this works in principle – and in practice – for developed economies; does this position make sense for an emerging economy, where the challenge is usually of an energy deficit (more demand than supply, or more energy imports than consumption)?

Let's consider the case of India here, as an example.

- India is the fourth largest consumer of energy in the world, but it is only the seventh largest producer of energy worldwide.
- In terms of primary energy, our deficit is about a third of our overall energy need; that is, the energy we produce at home only covers two-thirds of our needs. Put another way, we need to import 50% more energy over and above what we produce in India.
- Over 17% of the global population that resides in India uses less than 5% of the total energy consumed worldwide.

- Approximately 300 million people in India are without access to electricity and another 400 million or so have access only for 5-6 hours a day.
- Given this context, is it even morally right to talk about energy efficiency first, for India? Well, as it turns out, it still makes perfect sense to prioritize energy efficiency at the end use, as a source of energy, even in India.

To better understand this, let's consider the energy efficiency opportunity (the difference between best practice energy performance and business as usual) across sectors in India. Best-in-class office buildings in India consume 60-80% less energy than business as usual. Best-in-class hotels and hospitals consume 50% less energy than average. Even a best-in-class steel plant consumes 30% less energy than its run of the mill counterpart. While it's easiest to capture this opportunity cost-effectively (with no added costs) in new projects; even in existing facilities, at least half of this energy efficiency opportunity can be tapped with a compelling business case (2-3 years effective simple payback). There is a caveat here though – it needs to be done right – with an integrative design approach, taking the right steps in the right order, coordinating energy efficiency upgrades in sync with replacement cycles, and so on.

Now, let's connect this energy efficiency opportunity with the fact that over two-thirds of the building stock that will exist in India in 2030 is yet to be built. So also for power generation capacity – what we have now is only about a third of what we will need in 2030. This is likely the case for all sectors. Taking into consideration plant efficiencies along with transmission & distribution losses in India; it takes 4 units of primary energy input at the power plant to deliver 1 unit of electricity at the site. But, these compounding losses in the electricity supply chain become compounding gains if we can capture the energy efficiency opportunity at the end use. Every unit of electricity not needed at site reduces the need for 4 units of primary energy input at the power plant. So, if it is technically possible using state-of-the-shelf technology to cost-effectively (with no added costs) reduce the electricity demand at site – thereby reducing the need for additional power generation capacity – by 50%; why wouldn't we consider it as the first fuel?

Even if we were able to scale up and capture only a quarter of this energy efficiency potential nationwide, we're still talking in terms of avoiding the need for approximately 100 typical thermal power plants. The economic, environmental and social benefits make a compelling case for energy efficiency as the first fuel, especially for an emerging economy.

Making Energy use Visible, Meaningful and Actionable

We believe that the defining challenge of energy efficiency is of visibility – of making energy use visible. Energy is invisible, and energy efficiency is the absence of energy use – or the absence of that which is invisible. So how do you make a compelling business case for the absence of that which is invisible?

Schneider Electric has been focusing on making energy use visible and turning a mirror on a facility's energy performance. Even in a building with best-in-class energy performance (65% reduction as compared to business as usual); by simply making the right kind of energy data visible and meaningful, we have demonstrated that about 5-6% energy savings optimization opportunities are available (at low or no costs). Feedback drives improvement – displaying the fuel efficiency (instantaneous kilometers per litre) to drivers of vehicles gradually results in significant changes in drivers' behavior to achieve higher fuel savings.

This is corroborated with our own internal program – Schneider Energy Action. By making energy performance visible, accessible and easy to understand – we're achieving between 5-10% savings in our most energy intensive plants and offices in India (approximately INR 15-20 million annual savings). An additional 15-20% savings is attributable to other energy efficiency measures.

Making energy use visible, meaningful and actionable in turn facilitates an effective way to make energy efficiency a top-of-mind issue for leadership or management, and fits well into efforts for energy management system certifications such as ISO 50001, which provides a systematic framework for engaging with organizational leadership on energy performance.

Enterprise Sustainability is easier and more profitable than ever before

Myths about sustainability abound: it's too expensive, there's no quantifiable return on investment (ROI), it's only for big companies, or it's a type of philanthropy. In the recent past, such views may have been justifiable. But now, technology advancements that leverage the power of the 'Internet of Things' and Big Data have changed everything. Not only can energy and water consumption now be measured with a high degree of precision but the financial impact of efficiency projects can also be measured with greater precision. Increasingly, consumers are demanding insight into a company's sustainability initiatives. A bottom-line reality today is that sustainability influences purchasing decisions.

Through robust smart monitoring of facilities and assets, a baseline can be established to track down how resources are consumed. Improvements to efficiency can also be simulated, tested, and measured. With accurate measurement comes the ability to facilitate change and to engineer real (and financially quantifiable) improvement. The resulting modifications to business processes then dramatically reduce operating costs.

The sustainability challenge that lies before all of us includes a mix of important global issues: social and environmental commitments, CO_2 emissions, the search for efficiency, energy poverty, responsible governance and corporate citizenship, and enablement of a circular economy (where reuse / recycling take on a much bigger role). Today, energy management and sustainability are crucial to enterprise viability. With a proper strategy in place, energy management and sustainability programs can deliver a clear path forward that will help grow your business, control or reduce energy costs, mitigate risks, and meet new obstacles head on, all while minimizing risk and impact on the environment.

Our contribution towards a low carbon paradigm

Schneider Electric is committed to bringing modern and sustainable energy to everyone. When energy is accessible, people, everywhere, develop a passion to make a difference; we get the energy to tackle the toughest challenges; energy to turn the best technologies into innovation; and energy to deliver the best for our customers.

Without question, urbanization, digitization, and industrialization enrich our lives. Yet we know that each trend is escalating energy and resource consumption worldwide. From the enrichment of the energy value chain to the modernization of industrial technologies, the principle of business growth must be balanced with an equal effort to reduce carbon emissions. Schneider Electric products are designed to embrace our philosophy of "green premium". A green premium product allows our customer to calculate carbon footprint, anticipate and ensure full regulatory compliance, and reduce the end-of-life cost of installation by optimizing recyclability.

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