

Developing countries and energy efficiency potential: Strategies for low-carbon development after the Paris agreement

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The energy sector currently contributes more than two-thirds of total global GHG emissions.¹ The transformation of the global energy system must be at the heart of climate action, and energy efficiency can play a significant role to this end. According to the International Energy Agency (IEA), “realising the economic potential of energy efficiency is a central pillar of a cost-effective strategy to mitigate climate change and achieve a peak in global GHG emissions by 2020”.² The world’s total energy use is still growing, yet at a slower pace than before. This growth would have been three times greater if it were not for increased efficiency.³

Energy efficiency is gaining momentum as it remains at the centre of international policy discussions. As of 2015, 146 countries had some form of energy efficiency policy and 128 countries had at least one energy efficiency target.⁴ In the lead-up to COP21, the G20 developed an [energy efficiency action plan](#) and the G8 published a report to support energy efficiency in major economies through IPEEC. Ban Ki-moon, the former Secretary-General of the United Nations (UN), called energy efficiency our best tool, “a tool for all”, to promote clean development and poverty alleviation.⁵ He launched the Sustainable Energy for All (SE4All) initiative, with one of its objectives being to double energy efficiency globally by 2030. The significance of energy efficiency is also echoed in the Sustainable Development Goal 7 on energy. The mobilisation of a wide range of actors provides no doubt on how energy efficiency can deliver significant economic and environmental gains.

The 2015 Paris Agreement requires developed countries to support developing countries through financial and technical assistance. Among the possibilities to be leveraged with such international support, strategies focused on energy efficiency definitely deserve wider application. This is because firstly, such strategies involve huge potential for emission reductions and can be deployed rapidly, and secondly, they can help create the favourable contexts required to implement energy efficiency. Indeed, IPEEC calls for international climate funds to “finance capacity building activities directed towards the creation and strengthening of an enabling environment to catalyse energy efficiency investments in eligible countries, namely emerging economies and developing nations.”⁶

Another component in the Paris Agreement is to take concrete mitigation actions by 2020. Therefore, bold climate actions need to be taken. In 2015, the world’s energy intensity reduction (1.8%) was twice the average rate over the last decade. Despite this encouraging gain, the current pace is still too slow to limit the global temperature rise below 2°C. An annual energy intensity improvement of at least 2.6% would be required to meet the climate mitigation goals set.⁷

¹ IPCC (2014). *Climate Change 2014: Mitigation of Climate Change*.

² IEA (2015). *Energy and Climate Change: World Energy Outlook Special Report 2015*, p.388.

³ IEA (2015). *World Energy Outlook 2015*, p.55.

⁴ REN21 (2016). *Energy Efficiency*. www.ren21.net/gsr-online/chapter06.php (Accessed on August 16, 2016).

⁵ UN (2009). *Secretary-General's Remarks to the General Assembly Informal Thematic Dialogue on Energy Efficiency*. www.un.org/sg/STATEMENTS/index.asp?nid=3931 (Accessed on July 28, 2016).

⁶ IPEEC (2016), Working Paper.

⁷ IEA (2016). *Energy Efficiency Market Report*, p. 17.

Yet, there is large untapped potential for energy efficiency and such potential also exists in developing countries. Quite often, such potential is not well understood by decision-makers who have pledged climate finance support. And even if they do understand, they still need to identify not only those countries and regions where energy efficiency can achieve the highest GHG reductions per dollar invested, but also the most appropriate and effective mechanisms to be employed.

[Econoler](#)ⁱ, in collaboration with the Renewable Energy and Energy Efficiency Partnership (REEEP), have conducted research to (1) present the case of energy efficiency as a key component of low-carbon development; (2) identify a number of developing countries which have a potential for enabling the best leverage of energy efficiency; and (3) identify priorities for deploying such efforts in these countries.

A driver for low-carbon development

Currently, about one third of global primary energy is being wasted as energy loss.⁸ At the same time, more than 1 billion people do not have access to electricity. Reducing the proportion of wasted energy will help not only reduce the energy demand, but also increase the amount of energy available at lower costs than adding new capital-intensive infrastructure. So far, energy efficiency has avoided investments of more than USD 1 trillion in electricity generation.⁹

Among the 20 countries with the biggest deficit in energy access, nine have a population growing faster than the electrification rate.¹⁰ According to the UN, achieving energy efficiency in developing countries will help increase access to energy while supporting their sustainable economic growth and offers an opportunity to tackle a number of socioeconomic challenges together. This is especially interesting for fast-growing economies which hope to offer broader access to energy yet have limited resources. In 2015 already, energy intensity improvements were greater in emerging countries than elsewhere.¹¹

In 2012, the non-OECD countries' electricity consumption surpassed that of OECD countries for the first time. In the 10 previous years, the growth of electricity use flattened across developed countries while it more than doubled in non-OECD countries. By contrast, it took 22 years in the 1970s and 1980s for developed countries to double their electricity use.¹² Increased energy consumption is largely a result of growing populations and it is expected to continue, along with rising household incomes, urbanisation and industrialisation.

Delivering electricity to a greater number of people is a driving force for strengthening the reliability and efficiency of energy supply. Higher efficiency allows for the delivery of more energy with the same level of production. In low-income and lower-middle income countries, fossil-fuel-based power generation efficiency is usually low, below 35%¹³, which represents a gap as well as an opportunity. Energy efficiency is an essential complement to increasing power generation capacity and reliability; it is a strategy to 'keep the lights on' during periods of rapid economic growth and development.

⁸ IPCC (2014). *Climate Change 2014: Mitigation of Climate Change*, p. 377.

⁹ IEA (2016). *Energy Efficiency Market Report*, p. 17.

¹⁰ IBRD, World Bank & IEA (2015). *Progress Toward Sustainable Energy 2015: Global Tracking Framework Report*, p. 66.

¹¹ IEA (2016). *Energy Efficiency Market Report*, p. 17.

¹² IEA (2015). *Energy Efficiency Market Report*, p. 29 and p. 92.

¹³ IBRD, World Bank & IEA (2015). *Progress Toward Sustainable Energy 2015: Global Tracking Framework Report*, p. 12.

As demand is being propelled to higher levels, energy efficiency can support a more responsible increase in energy use. Certainly, challenges arise in trying to meet the demand for more energy while minimising climate impacts. But according to the IEA, energy efficiency would be the most effective way to decouple GHG emissions from economic growth, i.e., reducing emissions while maintaining growth. Energy efficiency policies are becoming major drivers of emission reductions and encouraging signs of decoupling are making the case for strong and more sustainable economies. Last year, the global GDP grew by 2.7% while energy demand actually dropped by 0.8%.¹⁴

The World Bank scaled up its investments in energy efficiency after identifying it as a high-impact intervention sector. Indeed, last year, global investments in energy efficiency were two thirds greater than in conventional power generation.¹⁵ Large gaps do exist between available resources and needs, especially in developing countries, but growing interest in energy efficiency helps generate international support.

As energy is central to society, energy efficiency is closely linked to any energy-related theme, be it jobs, incomes, political security, food security, health, well-being or air pollution. Energy transforms lives. There is then no doubt about energy efficiency's positive impact, beginning with its potential to mitigate GHG emissions.

Climate change mitigation potential

Around the world, most energy is produced by burning fossil fuels. Many developing countries do not have any immediate alternative. It is no secret: energy efficiency is a proven strategy for reducing GHG emissions. It has become the most promising option to quickly reduce the carbon intensity of energy consumption. Energy efficiency buys time for both the cost of renewables to fall and new technologies to develop.

So far, numerous energy efficiency-related efforts have been made around the world. Mandatory efficiency regulations now cover about a quarter of global energy consumption.¹⁶ It is estimated that since the 1990s, a total of 6,120 MToe (256 EJ) in final energy use has been avoided through energy efficiency.¹⁷ This represents the additional energy that would have been otherwise consumed if it had not been for energy efficiency improvements. As a result, an estimated 13 Gt of GHG emissions has been avoided since 2000.¹⁸

Still, about two-thirds of the economically viable potential remains untapped.¹⁹ Power generation could grow by 70% by 2040 and the related emissions would only rise by 13%, leading to global carbon intensity of power generation that is a third lower than it is today.²⁰ Furthermore, energy efficiency could cut GHG emissions by more than half by 2040.²¹ In the short term, efforts in developing countries could avoid 1.7 Gt/yr of CO_{2eq} by 2020.²² For these encouraging forecasts to materialise,

¹⁴ IEA (2016). *Energy Efficiency Market Report*, p. 17.

¹⁵ *Ibid.* p. 15.

¹⁶ IEA (2015). *World Energy Outlook 2015*, p. 21.

¹⁷ *Ibid.* p.17.

¹⁸ IEA (2016). *Energy Efficiency Market Report*, p. 17.

¹⁹ *Ibid.* p. 398.

²⁰ According to the New Policies Scenario. [IEA (2015). *World Energy Outlook 2015*. p. 329.]

²¹ IEA (2015). *World Energy Outlook 2015*, p. 408.

²² UNEP (2016). *First Report of 1 Gigaton Coalition Finds Potential for Further Reductions*. <http://web.unep.org/actions-on-renewable-energy-and-energy-efficiency-developing-countries-could-reduce-emissions-17> (Accessed August 15, 2016).

much more energy efficiency efforts must be made. Otherwise, under current policies, only a third of the economically viable energy efficiency potential can be achieved by 2035.²³

There is potential across all sectors. The Intergovernmental Panel on Climate Change (IPCC) identified major short-term opportunities in transportation where improvements could reach 50%.²⁴ The IEA suggests great potential in the buildings sector, which can account for 45% of demand-side avoided emissions in 2040.²⁵ The industrial sector's energy intensity could be further reduced by 25% by introducing and adopting the best practices and technologies available, particularly in countries where these are not in use.²⁶ Two-thirds of the world's industrial sector energy is now used in non-OECD countries.²⁷ Four-fifths of potential savings in material production exists in these countries, which will also account for the majority of intensive industrial-sector energy demand by 2040.²⁸

We know much potential exists across developing countries, but where should high-impact actions be taken? Econoler undertook a research project to identify a number of countries where energy efficiency actions can be taken with major overlapping impact on climate change mitigation and socio-economic development.

Selecting high-impact target countries

In the process of selecting high-impact countries, the following objectives were considered:

- › To positively impact national economic development;
- › To reduce GHG emissions to contribute to global climate change mitigation efforts;
- › To relate to existing interest in pursuing energy efficiency as part of the national action plans and targets; and
- › To maximise potential energy efficiency benefits where there is political stability and a lower level of corruption.

Our approach involved assessing the candidate countries against a set of criteria and associated indicators to identify a shortlist of countries where energy efficiency actions would generate the greatest impact.

First, two development indicators were considered to eliminate those countries which have already reached a certain level of development based on their country income classification and the Human Development Index (HDI). The World Bank classifies countries as high-, upper-middle-, lower-middle- and low-income, and no high-income economy was considered for the purpose of this exercise. Countries with an HDI above 0.7 were rejected. According to the UN Development Programme (UNDP), countries with an HDI below 0.7 have a medium to low development level. After applying this first set of criteria, 85 countries were identified as countries with high socio-economic impact potential.

Subsequently, technical indicators were applied. According to the IPCC, energy metrics provide valuable insights on the potential for energy efficiency improvement and energy demand reduction.²⁹ Data was gathered on the countries' total GHG emissions, total electricity and energy consumption, and the emission factor from electricity generation. A number of countries were shortlisted according

²³ IEA (2014). *Capturing the Multiple Benefits of Energy Efficiency*, p. 33.

²⁴ IPCC (2014). *Climate Change 2014: Mitigation of Climate Change*, p. 74.

²⁵ IEA (2015). *World Energy Outlook 2015*, p. 408.

²⁶ *Ibid.*, p. 81.

²⁷ IBRD, World Bank & IEA (2015). *Progress Toward Sustainable Energy 2015: Global Tracking Framework Report*. p. 104.

²⁸ IEA (2015). *World Energy Outlook 2015*. p. 415.

²⁹ IPCC (2014). *Climate Change 2014: Mitigation of Climate Change*. p. 377 and p. 443.

to a minimum level of carbon emissions and electric/energy consumption. It was also established that the threshold emission factor should be at least higher than Canada's (186 gCO_{2eq}/kWh). Therefore, a number of countries were eliminated because of their low potential for tangible energy efficiency impacts, and 38 countries remained as potential target countries.

The level of energy efficiency varies from one country to another across the globe. Some countries are already quite far ahead. Based on a country's current energy efficiency policies and programmes, the American Council for an Energy-Efficient Economy (ACEEE) ranked the top 25 leading countries.³⁰ Amongst the 38 remaining potential target countries, three are among the top 25 leaders, namely India, Indonesia and South Africa. These three were removed from the shortlist of potential target countries to prioritise countries which could benefit more from external support.

The shortlist was further refined assessing the level of interest in energy efficiency demonstrated by the national government, as shown by the Nationally Determined Contributions (NDCs), which outline the actions a country intends to take under the Paris Agreement. The remaining 35 countries' NDCs were examined to identify those involving energy efficiency. A score of 0 to 10 was assigned according to the importance assigned to energy efficiency and GHG emission reduction. The examination showed that some countries did not set targets, while others stated unconditional and/or conditional targets to receiving financial support. Among the 35 countries, 15 assigned limited importance to energy efficiency or made no mention of energy efficiency at all and were therefore removed from the shortlist.

As for the political criteria, those countries under sanctions³¹ and those with a Corruption Perceptions Index (CPI) below 30 were eliminated. The CPI measures the perceived level of corruption in the public sector and provides a score from 0 to 100, where stable democracies with higher levels of transparency have higher CPI values³².

After this set of indicators was applied, the remaining 10 potential target countries were ranked according to an empirical equation to determine the magnitude of the potential impact of energy efficiency:

$$Impact = \frac{GHG_{Total}^{0.5} \times EF_{Elec}^{0.5} \times EC_{Total}^{0.3} \times EE_{NDC}^3}{HDI \times 10^{-6}}$$

Where:

- › GHG_{Total} = Total GHG Emissions
- › EF_{Elec} = Electricity Emission Factor
- › EC_{Total} = Total Energy Consumption
- › EE_{NDC} = NDC Score

The equation was developed in a way to assign more weight to certain parameters. Countries with lower HDIs were favoured and more importance was assigned to higher NDC scores. The total

³⁰ ACEEE (2016). *International EE Scoreboard*. <http://aceee.org/portal/national-policy/international-scorecard>. (Accessed August 10, 2016).

³¹ Sanctions currently imposed by Canada were considered since this work was used to inform a Canadian audience. See: Global Affairs Canada (2016). *Current sanctions imposed by Canada*. <http://www.international.gc.ca/sanctions/countries-pays/index.aspx?lang=eng> (Accessed on July 10, 2016)

³² Transparency International (2015). *Corruption Perceptions Index 2015*.

amounts of GHG emitted and electricity produced were given a slightly higher weight than the emission factor.

Table 1: Target Countries and Assessment Results

Country	Rank	Income Group	HDI	GHG Emission (ktCO ₂ eq)	Electricity Use (GWh)	Electricity EF (gCO ₂ /kwh)	Energy Use (Mtoe)	CPI	NDC Score	Empirical Result
Morocco	1	Lower-middle	0.628	80,437	28,385	718	19.0	36	10	32
Vietnam	2	Lower-middle	0.666	310,664	115,283	432	55.0	31	7	23
Senegal	3	Low	0.466	54,185	3,079	637	2.2	44	10	16
Ghana	4	Lower-middle	0.579	107,784	10,583	259	4.7	47	10	15
Burkina Faso	5	Low	0.402	43,910	1,037	490	0.6	38	10	10
Pakistan	6	Lower Middle	0.538	369,735	78,890	425	60.0	30	4	6
Egypt	7	Lower Middle	0.690	295,500	137,591	450	91.0	36	4	4.81
Namibia	8	Upper Middle	0.628	38,049	3,772	197	1.3	53	10	4.76
Togo	9	Low	0.484	22,932	1,000	195	0.7	32	6	0.8
Gabon	10	Upper Middle	0.684	34,571	1,805	383	1.4	34	5	0.7

Four of the five countries selected assigned a high priority to energy efficiency in their NDCs. With an NDC score of 7, Vietnam still finds itself among the five countries with the biggest potential impact due to its high GHG emission and energy consumption levels. Although Pakistan and Egypt also scored high in this respect, these two countries did not set specific energy efficiency targets as part of their NDCs. Although Namibia appeared to be more committed to energy efficiency than Pakistan or Egypt, its lower scores on the technical indicators relegated it to a lower overall rank.

According to the IPCC, the Middle East, Africa and Latin America have high GHG mitigation potential and Asia has the highest absolute reduction potential.³³ Few Asian and Middle East countries were in the final shortlist because their level of development generally tends to be higher. Although low- and lower-middle-income country groups have accounted for a smaller share of the avoided energy use so far, the share accounted for by the lower-middle-income countries keeps increasing and has moved from only 1% in 1991-2000 to almost 10% in 2011-2012.³⁴

Next steps

So far, Econoler has collaborated with partners in each of the five target countries to further assess their energy efficiency contexts by reviewing past and current initiatives, including legislative and regulatory frameworks, financial mechanisms, programmes, internationally funded projects, main market players, barriers and priorities. So far, efficient lighting, energy audits in energy-intensive industries, and building codes are some initiatives identified as low-hanging fruits that have been achieved or have almost been achieved in all five target countries. These countries have very different histories of working on energy efficiency, with some having achieved much more than others; however, they all plan on seizing a number of opportunities and undertaking energy efficiency with clear targets. Going forward, Econoler also intends to conduct a comparative study of best practices in developing countries to better understand the most effective approaches, technical assistance and financing mechanisms that can best leverage energy efficiency, address the existing gaps and

³³ IPCC (2014). *Climate Change 2014: Mitigation of Climate Change*, p. 434.

³⁴ IBRD, World Bank & IEA (2015). *Progress Toward Sustainable Energy 2015: Global Tracking Framework Report*, p. 99.

develop guidelines on what should be done to create favourable contexts to implement energy efficiency and achieve the NDC objectives set.

Overall, energy efficiency remains one of the most cost-effective strategies to rapidly address the need to significantly reduce GHG emissions. The potential impact of energy efficiency is significant across the globe. However, the benefits can only materialise as a result of strong leadership, commitments and efforts from both the global community and national decision-makers. Let's join forces in building this growing momentum and make the best out of this potential.

Mr. Pierre Langlois, President of Econoler, has over 30 years of experience in working in all energy-efficiency-related fields in Canada and internationally. He has worked in over 60 countries for numerous international financial institutions, multilateral and bilateral development agencies, government bodies and energy efficiency agencies, and funds specialised in supporting energy efficiency.

Ms. Audrey Yank is an energy efficiency specialist with Econoler. She has extensive experience working on projects related to climate change and energy efficiency, as well as impact analyses of energy efficiency programmes in the residential, commercial, industrial and institutional sectors. She holds a Master of Science degree with a specialty in biomass energy. As a bioresource engineer, she has also worked on energy efficiency projects in the agricultural and food-processing sectors in Canada and several developing countries.

ⁱ *Econoler is a Canada-based international firm actively involved in developing and implementing climate change mitigation*