

## *Why discuss energy efficiency and climate change goals?*

Energy efficiency is key to achieving the ambitions set out in the Nationally Determined Contributions (NDCs) announced as part of the Paris Agreement at COP21. Therefore, NDCs can be an important driver of energy efficiency, the benefits of which go beyond emissions reduction to include energy savings, economic benefits and improved health.

IEA analysis indicates that NDC targets are not in line with limiting the increase of global average temperature to well below 2°C by the end of the century. NDCs are to be revised and strengthened every five years through a process of stock-taking and ratcheting-up however, so it is vitally important to track development of new energy efficiency policies and their implementation.

### **Key point**

Decoupling economic growth from energy consumption is vital to meeting climate change goals

## *What are the opportunities?*

Energy efficiency measures are among the most cost-effective actions to reduce emissions. Moreover, energy efficiency can be deployed quickly and is the one energy resource that all countries possess in abundance. In IEA modelling, energy efficiency makes the largest contribution to global emissions reduction. That contribution is driven by substantial efficiency gains in all end-use sectors through, for example, fuel-economy standards in the transport sector and highly efficient technologies to provide heat and steam in industry.

### **Key point**

Energy efficiency policies and technologies will play a key role in reducing emissions

## *Key recommendations*

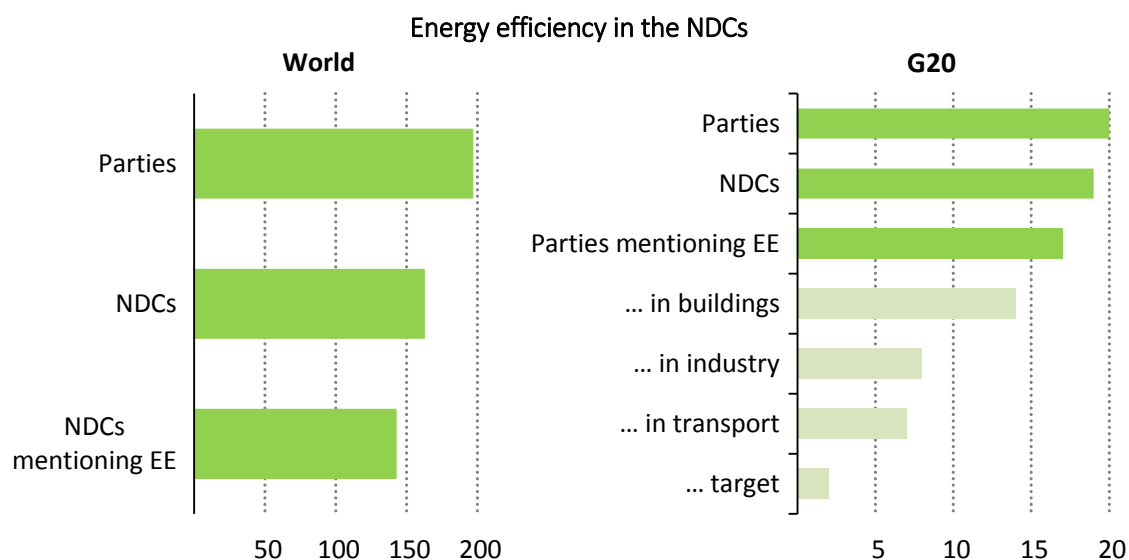
Strong energy efficiency policies are vital in order to address climate change and air pollution, improve energy security and increase energy access. Mandatory energy efficiency policies and regulations such as minimum energy performance standards and energy efficiency obligations have resulted in significant energy and emissions savings worldwide. Given shortening timeframes for action, policies should urgently target sectors and measures with the greatest potential.

### **Key point**

Countries should set and enforce more ambitious energy efficiency policies including mandatory minimum energy performance standards for products and vehicles

## Many NDCs refer to the importance of energy efficiency

The Nationally Determined Contributions (NDCs) announced as part of the COP21 Paris Agreement set out country ambitions to address climate change, as well as actions to realise those ambitions. Energy efficiency measures are key to achieving NDC mitigation contributions. Of the countries that have ratified the agreement and submitted NDCs, most include a broad intention to improve energy efficiency but far fewer specify new energy efficiency policies, and only a handful set specific targets for energy demand, intensity or efficiency.<sup>i</sup>



Notes: EE = energy efficiency. The European Union submitted one NDC for all 28 member states.

In most cases, when NDCs refer to energy efficiency, they mention either existing policies and funding or areas of focus for future efficiency improvements. The buildings sector is the one most often mentioned for energy efficiency. Energy efficiency is also generally more prominent in submissions from developing countries and emerging economies. An overview of what role (if any) the NDCs of G20 countries give to energy efficiency is provided in Annex A.

Although almost all countries have some energy efficiency policies or goals in place, there is scope to strengthen energy efficiency policies and measures by including them in NDCs; concerted efforts to achieve the goals in NDCs could help to catalyse action on energy efficiency, which is often needed regardless of climate change mitigation. In addition to country level action, thousands of states and cities and hundreds of private sector actors have made climate change mitigation commitments that include energy efficiency actions.

## Development of new energy efficiency policies and tracking their implementation is now crucial...

Under the Paris Agreement, NDCs are to be revised and strengthened every five years through a process of stock-taking and ratcheting-up. It is vitally important to track implementation because the measures proposed in NDCs are not legally binding and because the current NDC targets are not in line with pathways to limit the increase of global average temperature to well below 2°C by the end of the century, let alone 1.5°C. IEA projections suggest that the current NDCs, if achieved, would result in an annual intensity improvement of just 2%.<sup>ii</sup>

The IEA tracks implementation of energy efficiency policies in various ways. First and foremost, the Global Exchange Platform for Energy Efficiency tracks policies at a detailed level by surveying contacts in national administrations and making this information publicly accessible and searchable. The Energy Efficiency Policy Progress Index tracks and analyses policy coverage and strength and is published in the annual *Energy Efficiency* series. Policies are also tracked for modelling purposes as part of the *World Energy Outlook* and *Energy Technology Perspectives* series.

### ... but progress has been mixed so far

Since the 2015 UN Climate Conference in Paris, 163 countries have submitted their first nationally determined contributions (NDCs). Many of these focus on or incorporate energy efficiency, including Indonesia (national energy savings targets), Mexico (Energy Transition Law) and South Africa (Post-2015 National Energy Efficiency Strategy).

In many cases, countries have announced new policies that are directly linked to their NDCs. For example, as part of Japan's effort to achieve its NDC commitments, the country announced its aim to **make more than half of new built-to-order homes zero energy by 2020**, and the government is providing subsidies to advance that goal. Energy efficiency also plays a key role in Brazil's NDC commitment to reduce greenhouse gas emissions by 37% by 2025 compared with 2005. This involves **a 10% efficiency improvement target for the electricity sector** by 2030, promotion of standards for clean technology in industry and a new National Energy Efficiency Action Plan. Finally, the Pan-Canadian Framework on Clean Growth and Climate Change was part of that countries' NDC.

In other cases, countries are implementing policies that will contribute significantly to achieving their NDC, even if it only mentions such policies in brief, or not at all. India's NDC lists the Perform, Achieve Trade (PAT) programme—a **mandatory multi-phase market-based trading instrument**—as an “action that will address climate concerns”. The programme sets energy efficiency targets in energy-intensive sectors, based on annual energy consumption for each “designated consumer” (DC) and adjusted to account for product mix, capacity utilisation, change in fuel quality, import/export of power and other factors. In the second cycle, launched in 2016, commercial buildings may be designated as DCs. For instance, 150 to 200 hotels consuming around 1 000 Mtoe have already been appointed as DCs. India's NDC mentions that the scheme is to be expanded to additional sectors.

In November 2016, the European Commission proposed an update to the Energy Efficiency Directive, **expanding the savings target from 20% of projected primary energy by 2020 to 30% by 2030**. Another requirement is for energy utilities to save 1.5% per year by deploying energy efficient technologies and management strategies, or for member states to come up with alternative measures. The update is part of a package of measures that also includes dedicated measures for buildings, products (Ecodesign), and energy efficiency financing (a new Smart Financing for Smart Buildings programme).

There are many new policies in the pipeline worldwide but full implementation is required before they have an impact. Worryingly, **the IEA's *Energy Efficiency 2017* report identified a slowdown in the rates** at which policy coverage and strength are increasing.<sup>iii</sup> Its Efficiency Policy Progress Index reveals very different rates of progress across countries and an increasing reliance on pre-existing policies to drive energy efficiency improvement. There was a noticeable slowdown in the implementation of new policies in 2016, and this post-Paris pause appears to be persisting into 2017.

#### NDCs driving energy efficiency in buildings

The Global Alliance for Buildings and Construction (GABC) brings together 24 countries and 72 non-state organisations and tracks actions in the buildings sector, including 88 NDCs, 3 000 city-level commitments and 500 private sector actions.<sup>iv</sup> According to GABC, current building policies cover roughly 50% of CO<sub>2</sub> emissions. NDC pledges would extend this to 62%. Improving building energy codes and enhancing the efficiency of space-cooling equipment are the actions mentioned most often.<sup>v</sup> However, space heating – the largest end use in buildings globally – is not mentioned explicitly in most NDCs though it accounts for nearly 30% of buildings CO<sub>2</sub> emissions.

According to GABC, the establishment of a review-and-revise platform reflecting “highest possible ambitions” is already leading to positive developments with regards to end-use equipment efficiencies and building code implementation. For example in 2016, six countries submitted NDCs that include energy efficiency components related to buildings:

- **Korea** identified technology strategies to reduce coal consumption. Low-carbon products such as high-performance heat pumps will replace coal-fired and space heaters in households and offices as well as hot-water heaters in residential areas. Efficient wood stoves will replace conventional wood stoves and coal stoves, and efficient air conditioners will also be deployed.
- **Sri Lanka** pledged to use building management systems to take advantage of demand-side response of refrigerators, fans and compressors.
- **Pakistan** expressed determination to use energy standards and labelling to deploy high-efficiency LEDs, space heaters, refrigerators and air conditioners, pairing those pledges with efforts to improve roof insulation. Pakistan will also strengthen public-sector capacity to promote, regulate and monitor energy standards and labelling.
- **Chile** targeted a 20% reduction in energy consumption by 2025, as well as a national construction strategy with guidelines for integrating sustainable development.
- **Panama and Malaysia** submitted NDCs with economy-wide targets.

In 2017, two more countries submitted NDCs with significant energy efficiency components related to buildings:

- **Timor-Leste** promoted clean cook stoves to reach a target of 20 000 households. It also mentioned efficient lamps and building codes as ways to drive energy efficiency in the buildings sector.
- **Uzbekistan** announced its plan to improve energy efficiency in buildings through a programme of measures for transition to low-carbon development. The NDC specifies that the electricity, housing and utility sectors will be covered by the programme.

## Meeting and exceeding NDC ambition on energy efficiency...

There is plenty of scope for further policy action that would help meet or exceed the ambition contained in the NDCs. Over 68% of the world’s energy use is not covered by efficiency codes or standards. Only four countries regulate the energy efficiency of trucks, a major source of fuel demand as well as emissions growth, and space-cooling demand is rising fastest in countries with the weakest air conditioning efficiency regulation.

Countries have a range of high-impact policies available to them to ratchet up energy efficiency to achieve the goals in their NDCs (and global climate change goals more broadly). These include end-use standards and labelling for appliances and equipment, regulations and standards in the transport sector, building energy codes and incentives for renovation, and a range of market-based instruments.

The IEA has proposed specific energy efficiency measures with a focus on proven policies and technologies that can have a rapid impact on energy demand (see below). These measures are

applicable to varying degrees in all countries. In all cases, capacity building, communication and awareness are essential. There are also many policies and measures available, in addition to those below, that can enable an even greater impact on global emissions reduction.

### Energy efficiency policy recommendations by sector<sup>vi</sup>

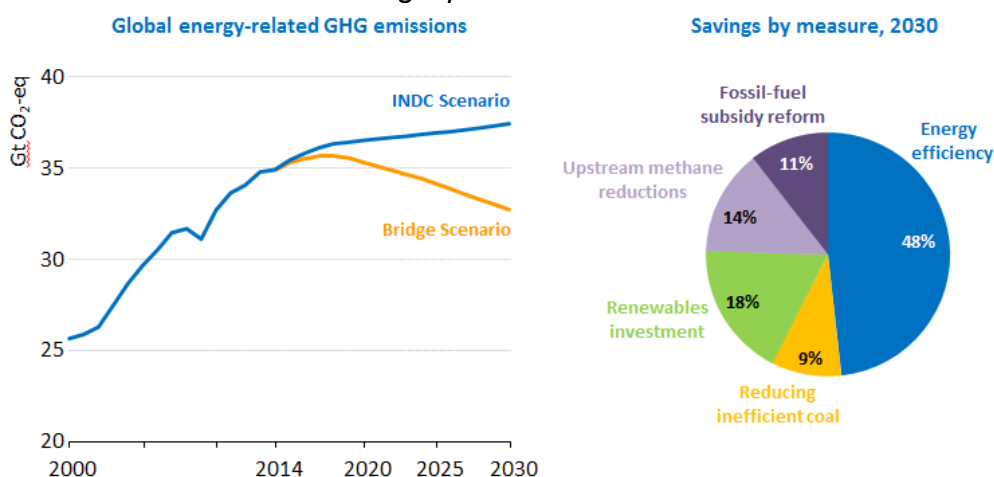
Industry	Buildings	Transport
<ul style="list-style-type: none"> <li>• Minimum energy performance standards (MEPS) for electric motor systems, including motors and driven equipment</li> <li>• Mandatory adoption of variable-speed drives where applicable</li> <li>• Mandatory energy audit programmes to exploit system-wide savings in motor systems</li> <li>• Incentives for heat pumps providing low-temperature heat</li> </ul>	<ul style="list-style-type: none"> <li>• MEPS to support phase-out of least-efficient refrigeration, cleaning appliances, televisions and computers by 2030;</li> <li>• Ban on incandescent bulbs by 2020 and halogen lights by 2030 in residential and commercial buildings</li> <li>• MEPS for heating and cooling equipment</li> <li>• Increase in insulation levels for new buildings to help move towards near-zero energy buildings</li> </ul>	<ul style="list-style-type: none"> <li>• Mandatory fuel-economy standards for new light-duty vehicles</li> <li>• Adoption of fuel-efficiency standards for new freight trucks</li> </ul>

Effectiveness can be increased by grouping policies into a package and targeting the sectors with the most abatement potential (taking into account the energy mix). For example, countries can look at emissions inventories to determine how energy efficiency can deliver big gains quickly.

## ... would improve the outlook for emissions at no cost to GDP

A critical first step toward reaching a well-below 2°C target by 2100 – achieving a peak in global energy-related greenhouse gas emissions by around 2020 – could be delivered with proven technologies and policies, and without affecting economic and development prospects.<sup>vii</sup> The IEA Bridge Scenario shows that energy efficiency is foremost among five key actions to reduce emissions compared to the Intended NDCs (INDCs) submitted in the run up to COP21:

### Global energy-related emissions under the INDC Scenario and Bridge Scenario, and share of emissions savings by measure to 2030



Under the Bridge Scenario, **energy efficiency contributes 48% of global emissions reduction by 2030**. This includes direct savings from reduced fossil-fuel demand and indirect savings as a result of lower electricity demand, which would lead to a reduction in emissions from power generation.

The Bridge Scenario indicates that there are substantial emissions reductions in China, India and Africa by improving the energy efficiency of industrial motor systems, while in the Middle East these would be mostly related to gains in heating and cooling efficiency. In the European Union and the United States, the emissions reduction would be due to equal shares of gains in efficiency in heating and cooling, appliances and lighting, and road transport. Globally, approximately 43% of efficiency measures are implemented in buildings, with industry and transport taking up 39% and 18% respectively.

The Bridge Scenario **comes at no cost to GDP but implies additional investment of USD 2.0 trillion between 2015 and 2030 compared to the INDC Scenario**. This would represent total investment of USD 10.5 trillion in energy efficiency under the Bridge Scenario over 15 years. The increased investment needed will require innovative measures to overcome the barriers to finance. Other analysis has been carried out that examines the impact of an even greater role for energy efficiency.

#### Energy efficiency investment pays back

A study commissioned by ClimateWorks Foundation to Fraunhofer ISI, in line with scenarios limiting temperature increases to 2 degrees Celsius above pre-industrial levels until 2050, shows that an aggressive global energy efficiency pathway could lead to annual greenhouse gas emissions reduction of 15.4 billion tonnes of CO<sub>2</sub>-equivalent (GtCO<sub>2</sub>-eq.) by 2030 (equivalent to almost 50% of global CO<sub>2</sub> emissions from fuel combustion in 2013), resulting in cumulative savings of USD 2.5-2.8 trillion and annual savings of USD 440-480 billion by 2030 (approximately 0.6% of global GDP today).

Although this model cannot be directly compared with the IEA Bridge Scenario, it helps to illustrate not only the significant emissions reduction from a very ambitious energy efficiency investment scenario, but also the potential significant energy-cost savings that would offset some of the investment needed to decarbonise the energy system under aggressive mitigation scenarios.

These studies show that energy efficiency could be scaled up beyond the levels in the NDCs but that early action is key to deliver greater savings – and climate change mitigation – in the long term. The UNFCCC facilitative dialogue in 2018 and the formal collective review in 2023 are therefore key milestones.

## Annex A: Energy efficiency in G20 NDCs

Country	Emissions reduction target	Mention of energy efficiency	Mention of energy efficiency in buildings	Mention of energy efficiency in industry	Mention of energy efficiency in transport	Mention of energy efficiency target	Implementation strategy or framework (in the NDC or otherwise)
Argentina	● Cap on net emissions: 483 MtCO <sub>2</sub> -eq., 2030	None					
Australia	● 26-28%, 2005-30	● Existing policies					
Brazil	● 37%, 2005-25	●		● New standards	● New standards	● 10% efficiency gains in the electricity sector by 2030	●
Canada	● 30%, 2005-30	● Funding	●	●	●		● Pan-Canadian Framework on Clean Growth and Climate Change
China	● Peak emissions; reduce GHG intensity by 60-65%, 2005-30	● Multiple mentions, economy-wide, cities, financing	●	●			● 13 <sup>th</sup> Five-Year Plan
European Union	● 40%, 1990-2030	● Existing policies	●				● 2030 Climate and Energy Framework
France	● EU	●	●				● EU
Germany	● EU	●	●				● EU

## Meeting climate change goals through energy efficiency

Energy Efficiency Insights Brief

Country	Emissions reduction target	Mention of energy efficiency	Mention of energy efficiency in buildings	Mention of energy efficiency in industry	Mention of energy efficiency in transport	Mention of energy efficiency target	Implementation strategy or framework (in the NDC or otherwise)
India	● Reduce GHG intensity by 33-35%, 2007-30	● Multiple mentions, existing policies	● Including appliances	●	●	● Energy intensity	●
Indonesia	● 29%, BAU 2030	●					
Italy	● EU	●	●				
Japan	● 26%, 2013-30	● Multiple mentions including power generation	● Including lighting, appliances and energy management systems	●	●		
Korea	● 37%, BAU 2030	●	●	●	●		
Mexico	● 25-40%, BAU 2030	None					● General Law on Climate Change, Energy Transition Law
Russia	Not yet ratified						
Saudi Arabia	● Up to 130 MtCO <sub>2</sub> -eq., 2030	● Three main economic sectors plus power generation (combined-cycle)	●	●	● New standards		



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Energy Efficiency Insights Brief

Country	Emissions reduction target	Mention of energy efficiency	Mention of energy efficiency in buildings	Mention of energy efficiency in industry	Mention of energy efficiency in transport	Mention of energy efficiency target	Implementation strategy or framework (in the NDC or otherwise)
South Africa	● Peak (2020-25), plateau (2030) and decline (after 2030)	● Improvements in the buildings and power generation sectors	● Appliances and equipment, Lighting	●			
Turkey	● Up to 21%, BAU 2030	●	● Regulations	● Financial incentives	●		
United Kingdom	● EU	●	●				● 2008 Climate Change Act including 2050 target and five-yearly carbon budgets
United States	● 26-28%, 2005-25	● Updating standards	●				

### About IEA Energy Efficiency Insights Briefs

To complement its detailed analytical and capacity building work, the IEA periodically publishes short Energy Efficiency Insights Briefs that seek to highlight current trends and developments relating to energy efficiency policy, markets, investment and technology. The Insights Briefs are intended to provide readers with a succinct overview of these issues, in order to inform and advance consideration within government, business and academia. The IEA welcomes any feedback or suggestions on future Insights Briefs that might be of interest via [energy.efficiency@iea.org](mailto:energy.efficiency@iea.org).

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<sup>i</sup> IEA (2016) *Energy Efficiency Market Report 2016*, IEA, Paris, [www.iea.org/eemr16/files/medium-term-energy-efficiency-2016\\_WEB.PDF](http://www.iea.org/eemr16/files/medium-term-energy-efficiency-2016_WEB.PDF).

<sup>ii</sup> Ibid.

<sup>iii</sup> IEA (2017) *Energy Efficiency Market Report 2017*.

<sup>iv</sup> See <https://globalabc.org/>.

<sup>v</sup> Evans, M. (2017) *Building Energy Efficiency and the Nationally Determined Contributions*, NDC Partnership, [www.ndcpartnership.org/sites/default/files/NDCP\\_Expert\\_Perspectives\\_Building-Efficiency\\_v3.pdf](http://www.ndcpartnership.org/sites/default/files/NDCP_Expert_Perspectives_Building-Efficiency_v3.pdf).

<sup>vi</sup> IEA (2015) *World Energy Outlook Special Report on Energy and Climate 2015*, [www.iea.org/publications/freepublications/publication/weo-2015-special-report-energy-climate-change.html](http://www.iea.org/publications/freepublications/publication/weo-2015-special-report-energy-climate-change.html).

<sup>vii</sup> Ibid.