ADVANCING ENERGY EFFICIENCY IN G20 ECONOMIES

Final Report

June 2018

A report from the International Partnership for Energy Efficiency Cooperation (IPEEC) to the G20 Energy Transitions Working Group (ETWG)

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Executive Summary[1]

Under the motto "Building consensus for fair and sustainable development", Argentina's G20 Presidency will address three new themes: the future of work; infrastructure for development, with enhanced engagement with private sector to reduce the infrastructure deficit; and sustainable food future by improving soils and increasing productivity. G20 economies, through the Energy Transitions Working Group (ETWG), are working together to ensure their respective energy transitions towards cleaner, more flexible and transparent systems. In this context, energy efficiency represents an essential pillar to the G20's efforts in facilitating these transitions, in particular in securing a more sustainable energy future in a cost-effective manner.

In 2016, the G20 adopted a long-term voluntary plan for energy efficiency success: the G20 Energy Efficiency Leading Programme ('Leading Programme'). Building on the 2014 Action Plan, this programme strengthens voluntary collaboration on energy efficiency among G20 economies to provide effective support to the design and implementation of national energy efficiency policies and programmes.

This work and their advances were acknowledged in the G20 Hamburg Climate and Energy Action Plan for Growth (CEAP)[2] under the 2017 German G20 Presidency. The CEAP highlighted the importance of strengthening multilateral cooperation to inform national energy efficiency policies, as well as the international institutions that support global energy efficiency collaboration.

Over the past four years, Task Groups have focused on the following:

- Measuring and tackling the energy consumption of Heavy Duty Vehicles (HDV), as a critical element for sustainable economic growth in the global transport sector.
- Dealing with the growing energy challenges posed by network-connected devices, as well as the opportunities for energy savings that such products offer.
- Encouraging greater capital flows for energy efficiency investments in the G20 to unlock the large potential for efficiency improvements.
- Working on effective energy efficiency policies in the buildings sector, with a focus on rating systems and codes to address the energy footprint of this area.
- Encouraging greater energy efficiency uptake in industry by sharing tools and best practices on the use of Energy Management Systems (EnMS).
- Supporting energy efficiency improvements in conventional electricity generation by encouraging the understanding and dissemination of High Efficiency Low Emissions (HELE) technologies.
- Accelerating the deployment of highly efficient products that are driving global electricity demand.

[1] This document has been produced by Ipeec at the request - and under the close guidance - of Argentina´s G20 Presidency 2018. Its contents have been discussed and enriched by the representatives of the G20 membership, but do not necessarily reflect their national or collective views.

[2] The CEAP also referred to the role the Global Alliance for Buildings and Construction (GABC) can play as a voluntary initiative in providing policy recommendations for all actors along the value chain for the development of national building strategies.

- Compiling energy efficiency best practices (BPs) and best available technologies (BATs), for use by policy-makers and businesses, to help accelerate the widespread application of these, and further technological innovations.
- Sharing technical information, enhancing communication and outreach on the issue of energy end-use data and energy efficiency metrics that are required for good policy development, implementation and evaluation.

Building on past achievements, Argentina's G20 Presidency continues to support these collective efforts at a regional and global level. This year also offers a valuable opportunity to consider the inclusion of other critical aspects that contribute to the success of energy efficiency policies, such as behaviour change initiatives.

Behaviour change can act as a bridge among innovation, technological progress, and energy efficiency measures. By filling a gap in countries´ policy cycles – and acting as a "missing link" – it plays and essential role in facilitating the effective adoption of new energy efficiency measures and technologies - thus, delivering greater benefits for consumers and all sectors of the economy. The topic of behaviour change calls for more support and attention by G20 policy-makers. It can help address the challenging 'rebound effect' associated with efficiency gains, and has a role in facilitating the roll-out of smart grids and decentralised energy generation. By building up an energy-efficient culture, further energy savings can be achieved and sustained in the long-run across all productive and non-productive sectors of the economy.

Given the crosscutting nature of behaviour change, G20 economies are encouraged to consider its inclusion as a topic of work of the G20 Energy Transitions Working Group. New efforts in this space could amplify the achievements to date, and yield greater results for international collaboration on energy efficiency more broadly, including those achieved under the Leading Programme.

1- Introduction

In recent years, energy efficiency has gained in importance and visibility internationally. Governments are becoming increasingly conscious of the opportunity and multiple benefits energy efficiency can deliver, especially in progressing towards their domestic and global energy goals. Beyond the well-known economic, social and environmental benefits, energy efficiency also has a critical role to play in the global shift to new energy paradigms. For instance, it can help balance out energy demand and supply, increase power system flexibility, and help integrate intermittent supplies of renewable energy.

However, while energy efficiency investments have grown in recent years in G20 economies, there are still many profitable opportunities to be exploited – and doing so is difficult. Challenges include, among other elements: lack of awareness and prioritisation; small scale and complexity of projects; high transaction costs and long payback periods; competition from supply-side measures and poor institutional capacity.

International collaboration through the G20 is instrumental to overcoming these challenges. It encourages G20 economies to share experiences, work together towards new solutions, and demonstrate leadership as the world's largest economies.

This document provides an update on the implementation of the Leading Programme and also outlines opportunities for a set of G20 voluntary actions aimed at raising awareness on the importance of behaviour change. Annex B outlines some of the essential elements of effective behaviour change initiatives.

Importance of energy efficiency in the regional context

This year's G20 Presidency offers many opportunities for deepening and strengthening regional collaboration on energy efficiency between Latin American countries. Some countries have made important advances in recent years, and are already sharing their experiences and lessons learned with their regional partners bilaterally or through forums such as OLADE (Latin American Energy Organisation), the IDB (Inter-American Development Bank), and the United Nations Economic Commission for Latin America and the Caribbean (UN ECLAC). By moving forward together, these countries can yield the positive benefits of such cooperation. This is true at the regional level, as well as the international one.

In this context, the continued implementation of the Leading Programme is more necessary than ever to move in the same direction, and to successfully accrue the benefits of working together. While Argentina and the Latin American region can learn from other G20 economies, they can also bring to these same countries tremendously valuable experience and lessons learned – for the benefit of greater energy efficiency deployment.

2- Progress update on the implementation of the Leading Programme

Under the G20 Energy Efficiency Leading Programme, Task Groups have made significant progress to help G20 economies advance energy efficiency policies and programmes. A

description of the Task Groups, as well as their leadership and country participation, is presented in Annex A.

Transport Task Group (TTG)

Impact of the TTG - Diving deep into Heavy Duty Vehicles HDV efficiency standards

HDVs, such as trucks and buses, account for more than one-third of fuel consumption and CO2 emissions in road transport and emit two-thirds of vehicle particulate emissions.

Developing new HDV standards is an intensive and complex process, which requires a combination of new policy tools, skills, and institutional capacity. The TTG's 2018 landmark project, called the Deep Dive, aims to help interested countries to learn about and acquire the necessary tools, skills, and capacity to accelerate the development of robust new HDV efficiency standards.

Through a series of technical webinars (seven to date) and in-person workshops, countries participating in the Deep Dive are learning in detail the steps needed to acquire and adapt existing tools, skills and methods that are required to define and certify minimum HDV efficiency standards.

As the sole G20 initiative focusing on transport, the G20's continued support to this project is instrumental in delivering benefits to the group and beyond, and address the rapidly-growing transport-related energy demand and associated environmental and economic costs.

Implementation update

In 2017, the TTG achieved great progress in its work programme, and:

- Strengthened the group's leadership by securing both the European Commission and the U.S. Environmental Protection Agency (EPA) as co-leads; and expanded its membership with Argentina joining as the latest additional participating country.
- Produced high-quality data to demonstrate the huge energy savings and emissions benefits that are achievable if all TTG member countries implemented world-class HDV standards and clean fuels policies[3].
- Hosted regular policy exchanges, including on Argentina's HDV efficiency programmes, on EU regulatory developments (e.g. EU's Real Driving Emissions programme[4]), or on U.S. policies (e.g. HDV and compliance programmes[5]).
- Launched a new landmark project, called 'Deep Dive to Support HDV Efficiency Standards', which aims to address the important regulatory gaps described above, and thereby enable the accelerated development of world-class HDV efficiency standards in the future (see above).

[3] Through *Impacts Of World-Class Vehicle Efficiency And Emissions Regulations In Select G20 Countries* report and its *Status of policies for clean vehicles and fuels in select G20 countries* report (ICCT, 2017)

[4] The RDE is a new type approval test that uses portable emissions measurement systems. Introduced by the EC in September 2017, new car types must pass RDE before they can be approved for sale in the EU.

[5] The Phase 2 of the HDV programme takes effect after Phase 1 ends in 2018 and will run through 2027.

Networked Devices Task Group/Connected Devices Alliance (NDTG/CDA)

Impact of the NDTG / CDA - Providing guidance on policy best practices for energy-efficient connected devices

It is predicted that in the future almost all electrical devices will be connected to the internet and at the same time, the growing number of smart appliances has a cost on global energy consumption.

In 2015, the NDTG/CDA developed the Voluntary Principles for Energy Efficient Connected Devices to guide policy-makers and manufacturers towards high standards of energy efficiency in the new age of increased connectivity. These Principles provide valuable guidance and a common understanding for policy-makers and industry on key elements of energy-efficient connected devices. Since their finalisation in 2016, the NDTG/CDA has been actively disseminating these among G20 economies and manufacturers to ensure they can use and draw from them to guide their work, and ensure the most energy-efficient outcomes.

Implementation update

Throughout 2017, the NDTG/CDA encouraged globally coordinated action on connected devices, and:

- Expanded the leadership of the group to the government of Canada and the Chair of the IEA-4E EDNA Annex (currently The Netherlands), in addition to the existing co-leads of the UK and the IEA, and explored ways to regain strong momentum to support its work – including through the hosting of a potential workshop in late 2018.
- Promoted the voluntary principles for policy and design best practices developed in 2015, called the 'CDA Voluntary Principles for Energy Efficient Connected Devices', and secured official support from a number of industry groups and governments (see text box below).
- Expanded its online publications library and knowledge database, which provides free and in-depth papers by experts on ways to encourage energy efficient smart devices, called the 'CDA Centre of Excellence'.
- Hosted policy and technical exchanges between government, industry and academia, to inform recommendations to G20 members on connected devices. This happened for example through the organisation of a G20 Networked Devices Workshop in March in Berlin, Germany, and further workshop in Canberra, Australia.
- Developed and aided the implementation of the SEAD 'Connected Efficiency Award' which recognised the most energy efficient communications protocols used within connected devices.
- Facilitated a CEM Roundtable: Digitalisation of the Energy Sector to Enhance Energy Productivity & Renewables Integration. The roundtable discussion brought together CEM government officials, private sector executives and civil society leaders to explore the barriers and solutions related to a productive, "digitalised" energy sector.
- Provided substantial input to the major IEA publication 'Digitalization and Energy' published in November 2017.

Energy Efficiency Finance Task Group (EEFTG)

Impact of the EEFTG - Informing national policies to promote energy efficiency investments

According to the Global Tracking Framework[6] of the Sustainable Energy for All (SEforALL) initiative, USD 560 billion of annual energy efficiency investments are required to double the rate of energy efficiency improvement. The EEFTG aims to enhance these capital flows for energy efficiency investments in G20 economies by helping countries build robust, investment-grade policy and frameworks. For example, the EEFTG´s work and more precisely the 2015 voluntary Energy Efficiency Investment Principles for G20 Participating Countries, helped structure the development framework for new Mexican energy efficiency policies under the mandate of the Energy Transition Law. Thus, as the only Task Group dedicated to boosting energy efficiency investments, countries recently ratified the continuation of this important work through the G20 to ensure that the world's largest economies increasingly shift their capital flows and direct their policies to deliver more energy efficiency investments.

Implementation update

In 2017, the EEFTG pursued its collaborative efforts with other G20 countries, and:

- Published, disseminated[7] and helped countries assimilate the findings of its landmark project, 'the G20 Energy Efficiency Investment Toolkit', which was acknowledged in the G20 Hamburg Climate and Energy Action Plan as 'a set of voluntary options for participating countries to upscale energy efficiency in G20 economies, as an integrated approach to enhancing capital flows towards energy efficiency.' Engaged with government and financial experts through the organisation of and participation in over 20 events, including technical engagement workshops, webinars and meetings (with nearly 3,000 representatives from governments and finance communities around the world).
- Worked with national agencies, international organisations, and high-level groups[8] to align agendas, and ensure ownership by EEFTG member countries of the Toolkit.
- Facilitated exchanges among relevant partners to understand their challenges and offer adapted solutions for greater energy efficiency financing.

Buildings Energy Efficiency Task Group (BEET)

Impact of BEET - Driving the effective implementation of building regulations

The work of BEET is serving as a resource for policy-makers that are looking to design more effective building regulations. It does so by providing: insights into the conditions and practical tools that enable the application and effective implementation of building regulations to existing stocks.

[6] https://www.seforall.org/global-tracking-framework
[7] This included for example presenting the Toolkit at international and national events, including at COP23 in Bonn in November, at the Argentine Second National Energy Efficiency Forum in Buenos Aires in November, and at the One Planet Summit in Paris in December for example.
[8] The G20 Energy Sustainability Working Group and G20 Green Finance Study Group for example.

Implementation update

In 2017, the BEET published a report on Existing Building Energy Efficiency Renovation: International Review of Regulatory Policies (BEET 6)[9]. BEET 6 provides an overview of key regulatory policies that have been used internationally to support the renovation, refurbishment, retrofit, alternations and additions of existing commercial and residential buildings. Among other things, the report found that:

- Other policies - such as communication, training, skills - in addition to renovation ones, must also be implemented to achieve deep energy savings.
- Effective renovation policies include dynamic targets for efficiency improvements that evolve over time.
- Providing financial incentives to reward very deep renovations has proven to be an effective approach, and can help transform markets and drive greater impacts.
- Further research is needed to understand the real impacts of more comprehensive policy packages that begin with ambitious targets, among other assessments.

Energy Management Working Group (EMWG)[10]

Impact of the EMWG - Estimating energy savings achieved through Energy Management Systems (EnMS) to inform policy decisions

Since its formation in 2010, the EMWG has played an instrumental role in progressing industrial and commercial building energy savings in G20 economies. The EMWG shares best practices, lessons learned, and technical resources to support EnMS implementation, using the ISO 50001 standard. Reliable data on ISO 50001 is critical for governments and businesses to make informed decisions on energy management policies but can be challenging to obtain. Thus, the development of a rigorous and internationally accepted methodology to determine the impact of ISO 50001 through the 'Impact Estimator Tool' (IET 50001), is now helping countries and businesses build a stronger case for positioning EnMS and ISO 50001 as a key strategy for meeting the energy goals of G20 economies.

Implementation update

Over the past year, the EMWG has – among other things:

- Successfully sought to increase the uptake of EnMS through a series of awareness-raising activities, including, among others: the recruitment of new partners and commitments to the Energy Management Campaign[11] and the global Energy Management Leadership Awards. At CEM9, the EMWG recognised 50 leading organisations through the awards programme. By implementing an ISO 50001 EnMs, these organisations collectively achieved annual energy cost savings of up to US $383 million and emission reductions of up to 4.3 million metric tons of CO_2—the equivalent of taking 916,000 passenger vehicles off the road.

[9] BEET 6 is the sixth in a series of studies produced by the Task Group. BEET 5, BEET 4 and BEET 3 where presented to the G20 in 2017 and 2016.
[10] The EMWG is a G20 Task Group as well as an initiative of the Clean Energy Ministerial.
[11] The objective of the Campaign is to reach 50,001 global certifications to ISO 50001 by 2020. The Campaign increased its partners to 17 economies, one municipality, eight companies, and four supporting international organisations. The Campaign's goal is on track with expected growth rate. The latest ISO survey reports more than 23,000 certificates to ISO 50001 for 2016. The EMWG expects ISO 50001 uptake to accelerate before 2020—following the growth pattern experienced by other management system standards—and achieve the Campaign's goal. In addition, the EMWG is working with the International Accreditation Forum (IAF) to enhance reporting of ISO 50001 certification data.

- Successfully increased the number of certified ISO 50001 Lead Auditors through the Energy Professionals International certification programme to ensure auditor competency and greater reliability in ISO 50001 certification outcomes[12].
- Released the ISO 50001 Impacts Methodology, which estimates the energy and emissions savings potential from the implementation of ISO 50001, and continued to promote the evaluation tool that uses the methodology, called 'ISO 50001 Impact Estimator Tool (IET 50001)'.
- Hosted a series of policy exchanges to share the latest policy and programme developments with participating governments.

Energy Management Action Network (EMAK)

Impact of EMAK - Creating effective award schemes to promote EnMSs

Promoting awareness and demonstrating the significance of energy management in energy efficiency through information sharing and building network among stakeholders, such as policy-makers and practitioners, are the key mission of the EMAK. For policy-makers and practitioners who need a hand in facilitating their capacity building for their industry and region, it is essential to create specific platforms for sharing proven and innovative practices. EMAK has been providing the platform opportunities to demonstrate successes in energy management practices for global sharing. The previous workshop focused on the award scheme that is one of the important tools for effective capacity building. In practice, policy-makers do not always know how best to create an effective award scheme to reward and promote positive EnMSs, especially if they are developing these for the first time. Yet, EnMSs can be instrumental in achieving energy savings. To address this, In February 2017, EMAK released a report, "Recognised Energy Management Best Practices and Award Programmes for Best Practices" that provides insights on how governments can design and implement impactful energy management award programmes.

Based on a number of national and regional case studies, the report shows that successful, multi-annual award schemes depend on the following key factors:

- Having a valuable brand
- Establishing a sustainable approach to evaluating submissions
- Clearly showcasing the application of energy management best practices
- Having strong promotional activities to share content, such as award ceremonies
- Incorporating follow-up events to realise wider national objectives, for example to promote cooperation between the private and public sectors on energy management.

By considering these practical elements, the report encourages policy-makers to take action that would accelerate the development of their own award programmes, and ensure that these support their government's energy management goals in an impactful manner.

[12] This happened through the Energy Professionals International (EPI) ISO 50001 Lead Auditor Certification Programme developed jointly by EMWG governments and UNIDO, and rolled out in Mexico, the U.S., and Turkey to date.

Implementation update

In 2017, the Task Group:

- Agreed to hosting a 9th EMAK workshop in partnership with Brazil in 2018.
- Held the 8th EMAK Workshop in Jakarta, Indonesia, in February 2017.The event was co-hosted by the government of Japan and the ASEAN Center for Energy, with the support of Indonesia's Ministry of Energy and Mineral Resources. 90 participants convened to exchange best practices and learn how award programmes can support the uptake of energy management systems in the industry and buildings sectors.
- Published a report on the workshops' main findings in April. Among other conclusions, the report outlines key elements for designing and implementing award schemes and is a valuable resource for policy-makers looking to develop their own award programmes
- Released and disseminated a two-page digest of workshop recommendations to help communicate outcomes to policy makers and other stakeholders.

High-Efficiency Low-Emissions (HELE)

Impact of HELE - Supporting the transition to a low carbon future

Coal currently accounts for about 37 % of global electricity generation and its capacity may grow in coming decades, in particular in emerging economies where it is considered an affordable, stable and abundant source of energy[13]. In areas where coal is used as the primary energy source, greater deployment of HELE technologies can support the transition to a low carbon future. Thus, some countries that have more advanced experience in this area can support others, and the purpose of the HELE Task Group is to facilitate such policy and technical exchanges among participants.

Implementation update

In 2017, HELE focused on supporting energy efficiency improvements in conventional electricity generation by:

- Facilitating discussions aimed at improving countries' understanding of HELE technologies[14] and other environmental equipment that can help reduce air pollution and that contribute to lowering national emissions. For example, HELE jointly organised a technical tour of one of its plants (Isogo Thermal Power Plant, Yokohama, Japan) with the International Energy Agency's Working Party on Fossil Fuels in July 2017[15].
- Developing and disseminating best practices in operation and maintenance, including those that integrate approaches that make use of the possibilities that the Internet of Things offer.

[13] World Energy Outlook, IEA, 2017
[14] These may include for example the Ultra Super Critical and Integrated Gasification Combined Cycle technologies.
[15] Participants from over 20 countries examined some of the most advanced clean coal technologies in the world, including Ultra-Super Critical technology with the world's highest steam condition. This technology generated energy efficiency gains of 43% and associated emissions reductions of 17% in the power plant, highlighting the contribution HELE technologies can make to climate change mitigation.

Super-efficient Equipment and Appliances Deployment initiative (SEAD)[16]

Impact of SEAD - Progressing efficient cooling globally through Advanced Cooling Challenge Campaign

Electricity demand for air conditioning is huge – and getting bigger every day. For example, the additional electricity demand generated by new in-room air conditioners (ACs) purchased between 2010 and 2020 is projected to grow to more than 600 billion kilowatt-hours globally by 2020. This growth poses a challenge to electricity grids already struggling to satisfy existing demand. To address this issue, the Advanced Cooling Challenge was launched in 2016. This campaign urges governments and industry to develop and deploy super-efficient, smart, climate-friendly and affordable cooling technologies at scale. Since its launch, the Challenge has mobilised over 30 participants - including governments, NGOs, manufacturers, distributors, retailers and consumer organisations- to make commitments that will leverage USD 1.4 billion to advance efficient cooling globally. The commitments range from development and sale of highly efficient ACs with low- global warming potential (GWP) refrigerants, to procurement and use of higher efficiency ACs in new buildings and retrofits.

To provide a snapshot of the market for ACs in participating countries, the Challenge collaborated with the IEA and the Lawrence Berkeley National Laboratory to develop the Global AC Market Tracker. This tool aims to monitor the deployment of efficient ACs worldwide and provide global market information on cooling products to assist policy-makers in procurement and policy decisions.

Through programs and campaigns such as the Advanced Cooling Challenge, SEAD is helping governments tackle and evaluate the impact of their policy actions to address the most pressing energy issues of rapidly developing economies. As increased access to efficient and affordable cooling bears far-reaching implications beyond environmental impacts, SEAD is helping G20 economies advance other climate, economic, health and development goals.

Implementation update

In 2017, SEAD continued to advance energy efficiency in the appliances sector. Notably, the Task Group has:

- Drawn attention to ambitious energy efficiency opportunities and solutions, through its awareness raising campaign for lighting[17], and awards for industrial and outdoor lighting, as well as connected devices (in partnership with the CDA, see above)[18].
- Through its awareness raising campaign[19], worked to increase the uptake of highly efficient ACs in key countries to address the rapidly growing demand for ACs, to limit the strain they place on electricity grids, and to reduce the risks of costly power shortages.

[16] SEAD is a G20 Task Group, as well as an initiative of the Clean Energy Ministerial.
[17] The Global Lighting Challenge has surpassed its goal by 4 billion, reaching cumulative global sales of over 14 billion high- efficiency, high-quality, and affordable advanced lighting products
[18] The Global Efficiency Medal for Industrial and Outdoor Lighting, as well as the Connected Efficiency Award (developed with the CDA and IEA 4E's Electronic Devices and Networks Annex (EDNA)).
[19] Through the Advanced Cooling Challenge.

- Launched a nation-wide project in India[20], a major G20 economy, to gather robust energy consumption data from households to inform accurate baselines and consumption patterns across climate zones, which will serve as essential information to increase the ambition and strengthen the need for future national efficiency standards.
- Facilitated sharing of policy best practices and technical expertise among G20 economies, by providing technical analysis and assistance to key countries. This included working with India and Indonesia21 to support the development and update of efficiency standards for ACs, working with APEC partners to train policymakers on quality assurance and procurement tools[22], as well as hosting the SEAD Policy Exchange Forum (SPEx), a virtual collaboration forum that addresses a range of appliance efficiency topics.

Top Ten Energy Efficiency Best Available Technologies (BATs) and Best Practices (BPs) Task Group (TOP TENs)

Impact of TOP TENs - Supporting bilateral trade and technology deployment

Accelerating the deployment of energy efficient technologies is critical to energy efficiency improvement globally. However, purchasers do not always know what technologies are most efficient in their sector, especially outside their own country.

The TOP TENs Task Group, through its domestic lists, is helping bridge this information gap and in doing so facilitate the deployment and trade of energy-efficient technologies.

For instance at a recent U.S.-China bilateral meeting, both countries discussed national developments and their respective TOP TENs domestic lists. This provided an opportunity to understand how some specific U.S. technologies – in this case, advanced lighting solutions and innovative energy management and information systems - could be applied in the Chinese context – for example, in new commercial buildings - for greater energy savings.

This example of U.S.-China cooperation through TOP TENs, illustrates how the Task Group can help inform policy makers and industry on efficient technologies that are available not only domestically, but also internationally. Thus, they contribute to the wider deployment of energy efficient best practices and technologies for greater savings.

Implementation update

The first round of TOP TENs analyses led in 2016 targeted the industry sector. In 2017, the scope of the work was then extended to industry, buildings, transportation and public service sector as well as on increased outreach activities. More specifically, this involved:

- Encouraging greater awareness of the information produced by the Task Group, by promoting BATs and BPs lists in multilateral, bilateral, and domestic forums. For example, this included developing communication materials addressed to policy-

[20] Together with and in support of the Bureau of Energy Efficiency.
[21] Through a capacity building workshop and standards development support to policymakers and test laboratories in Indonesia.
[22] On the use of qualified product lists to support procurement programmes and reduce trade barriers for LED lighting products.

makers and companies to help them better understand the purpose of the lists, encourage the more effective use of these, as well as to monitor their impact.
- Updating the methodologies for analysing technologies, including modifying criteria and corresponding weighting systems to ensure highest degrees of accuracy.
- Working towards the elaboration of a strategy for developing international BAT and BP lists, as well as international sector-specific technologies lists.

Energy End Use Data and Energy Efficiency Metrics (EUDEEM)

Impact of EUDEEM – Using data in policy processes

EUDEEM provides a platform to G20 economies to ensure the processes for developing, implementing and evaluating new policies, and to draw the benefits of international collaboration, which is essential to making international comparisons, and tracking of global progress possible and meaningful.

Implementation update

In 2017, countries focused on advancing the establishment of the initiative, including through discussions on the terms of reference, resources, and potential future activities. This led to countries hosting the second workshop of the initiative on the margins of the first meeting of the Energy Transitions Working Group (22 February 2018, Buenos Aires). At this workshop, participating countries of the workshop and international organisations confirmed their strong interest in a knowledge-exchange platform and other possible longer-term deliverables. These could include for example, establishing a common framework for data and indicators – with the overall objective of enhancing data for energy efficiency policy and strengthening data knowledge across leading countries despite differing energy demand patterns and trends. Participants also presented recent updates in their respective end-use data collection and metrics work, and shared views on areas where information exchange would be beneficial. Following this, France and the IEA have been developing a consultation with all countries to identify areas of priority for collaborative actions.

New initiatives

In addition to the above, other initiatives were introduced into the Leading Programme in 2016, including the **District Energy Systems** (DES) and the **Energy Efficiency Knowledge Sharing Framework** (KSF). The DES initiative aims to facilitate collaboration between countries on understanding how the issue of district cooling and heating can help achieve greater energy savings. The KSF work aims to facilitate policy exchanges between countries on a range of energy efficiency supply and demand topics. The KSF was discussed during the 7th Asian Ministerial meeting of the International Energy Forum (IEF) in November 2017 and the 16th International Energy Forum Ministerial hosted by India in April 2018. Ministers encouraged stakeholders to pool efforts in globally integrated frameworks to accelerate energy efficiency gains across the full energy sector spectrum and leverage the IEF Energy Efficiency KSF in close collaboration with governance platforms in Asia, and international organisations[23] to further enhance energy productivity

[23] Such as the International Partnership for Energy Efficiency Cooperation, the IEA, the International Energy Charter, OPEC, SEforAll, and United Nations bodies.

in Asia and the wider world economy. It was suggested that the KSF could also be based on the successful model of collaboration on energy data transparency by the Joint Organisations Data Initiative (JODI)[24]. In the meantime the IEF is advancing dialogue on energy efficiency in its programme including in meetings with the European Union and other key organisations.

The DES and KSF are both in the process of being established.

3- Opportunity for G20 action: Behaviour Change and Energy Efficiency

During the past decades, theories of "Behaviour change" have been providing insights on how new paradigms can emerge. In the energy policy field, energy efficiency provides a useful example of how new behavioural paradigms need to be materialised in order to sustain long-term energy savings.
According to these theories, the adoption of innovations (i.e supporting greater energy efficiency gains) happens through a five-step decision-making process, including awareness, interest, evaluation, trial, and adoption. This process spans over a given period of time, and its success depends on the implementation of important supporting actions such as formal education, outreach and communication initiatives.

Behaviour change has an essential role in ensuring the success of energy efficiency actions in the long-run and of G20 economies' energy transitions more broadly. Beyond this, policy efforts and advances in G20 economies can also have positive flow-on effects on other countries of the region and more globally.

Building on the existing valuable national and international behaviour change initiatives, the G20 economies can work together under the Leading Programme to share policy best practices, undertake joint technical analyses, and engage in peer-to-peer collaboration, as well as in any other activities of interest to members. Collectively, they can progress towards a better understanding of the factors underpinning people's decisions, and nudge these for greater energy efficiency outcomes.

Given the broad nature and complexity of the topic, it will be important to define the most pressing and relevant areas for G20 collaboration on behaviour change issues. Thus, G20 economies are invited to provide initial insights on priority issues, and to meet under the Argentina's G20 Presidency to settle the contours of collaboration[25].

[24] IEF coordinates the Joint Organisations Data Initiative with APEC, Eurostat, GECF, IEA, OLADE, OPEC and the UNSD as JODI Partner organisations.
[25] These insights are being collected through a survey circulated to members between May and June. The results, that are still being analysed, will feed into the planned workshop to inform this new initiative.

4- Conclusions and next steps

The Task Groups of the Leading Programme continue to play a key role in advancing energy efficiency policies in G20 economies. By progressing their existing activities and consolidating their work, they help to:

- deepen cooperation among G20 economies on the implementation of best practices
- provide technical assistance to interested economies for the development of policy frameworks and roadmaps
- facilitate ongoing dialogue between governments, industry and other key stakeholders.

At the high-level G20 Energy Efficiency and Renewables Forum and during the first meeting of the Energy Transitions Working Group (February 2018) members held exchanges on the topic of Behaviour Change. These helped raise awareness among G20 economies on the impact and importance of actions of individuals, businesses and communities in saving energy and to helping develop new habits and culture that support an efficient and rational use of energy. Based on these, members agreed to undertake new work on Behaviour Change at the G20 level, and to collectively define the objectives, issues and modalities of such collaboration through a scoping workshop to be held during Argentina's G20 Presidency. A report back on progress on the Behaviour Change initiative alongside broader reporting on the implementation of the Leading Programme would be valuable under the 2019 Japanese G20 Presidency, if they consider it appropriate.

Annex A

Descriptions and country participation in the Task Groups of the G20 Energy Efficiency Leading Programme

Transport Task Group (TTG)

Heavy Duty Vehicles (HDVs), such as trucks and buses, account for more than one-third of fuel consumption and CO2 emissions in road transport and emit two-thirds of vehicle particulate emissions. Yet, HDVs make up less than 10% of the vehicle fleet worldwide. As G20 economies account for more than 80% of worldwide HDV sales, the standards set for HDV efficiency and emissions in G20 economies largely dictate how the global sector will evolve. Yet, as these standards are not uniform across the G20, there is an important opportunity to expand the adoption of world-class HDV standards. The TTG seeks to accelerate the adoption of such standards in G20 economies through enhanced policy support and technical exchanges. The United States and the European Commission lead this work, with the support of the International Council on Clean Transportation and the Global Fuel Economy Initiative.

Networked Devices Task Group/Connected Devices Alliance (NDTG/CDA)

It is predicted that in the future almost all electrical devices will be connected to the internet. With device connectivity come significant opportunities for societal improvement, including energy savings from what is called "intelligent efficiency"- that is, the ability to operate systems of connected devices efficiently. At the same time, the growing number of smart appliances has a cost on global energy consumption. To develop innovative solutions to this challenge, the NDTG/CDA brings together more than 350 governments, experts and industry representatives to work on the energy efficiency opportunities provided by connected devices. Canada and the UK lead this work, with support from the International Energy Agency.

Energy Efficiency Finance Task Group (EEFTG)

In 2016, energy efficiency investments increased by 9% to USD 231 billion, according to recent IEA analysis (IEA, 2017). However, this is by far not enough to achieve our global energy targets. According to the SEforALL Global Tracking Framework, USD 560 billion of annual energy efficiency investments are required to double the rate of energy efficiency improvement. The EEFTG aims to enhance these capital flows for energy efficiency investments in G20 economies by helping countries build robust, investment-grade policy and frameworks. It also serves as a forum for G20 policy makers to share best practices in policies and financial instruments through peer-to-peer workshops and direct engagement with members of the private and public finance community, industry and international organisations. This EEFTG is led by France, Mexico with the support of the International Energy Agency, Organisation for Economic Co-operation and Development, the European Bank of Reconstruction and Development, United Nations Environment Programme Finance Initiative, Sustainable Energy for All initiative and the CEM's Clean Energy Solutions Center.

Buildings Energy Efficiency Task Group (BEET)

Buildings have a significant energy impact and already represent 30% of the global final energy consumption. If new policies and regulations are not substantially and quickly implemented, the energy consumption of buildings will continue to grow steadily through

2060 - making it one of the largest sources of energy consumption world-wide. In the recent years, there has been a positive trend towards a decoupling of buildings energy use and national economic growth – in part driven by technology progress and regulatory advances. International collaboration can accelerate this, and facilitate the exchange of information among countries. The G20 Buildings Energy Efficiency Task Group fills this purpose, by acting as a collaborative platform for countries to research, inform and support the development and implementation of effective building energy efficiency policies, with a core focus on building rating systems and building codes. Australia and the United States lead BEET.

Energy Management Working Group (EMWG)

The industrial and commercial buildings sectors represent large consumers of energy worldwide. Adopting Energy Management Systems (EnMS), using a standard such as ISO 50001, can help achieve greater savings in the industrial, commercial building, and public sectors. As a technically rigorous and globally relevant tool, such standards provide reliable means to plan, manage, measure, and continuously improve the energy performance of organisations. If half of global industrial and commercial energy were managed under ISO 50001 by 2030, it would save approximately 6,500 million metric tons (Mt) of CO_2. The role of the Energy Management Working Group is to facilitate the dialogue between policy-makers and industrial stakeholders, and encourage G20 economies to adopt the standard in the most robust and consistent way possible. Given that G20 economies make up a large portion of the sector globally, exchanges through G20 EMWG members can have an important impact in spurring greater savings, worldwide. The United States and Canada lead the EMWG initiative with support from the United Nations Industrial Development Organisation (UNIDO).

Energy Management Action Network (EMAK)

EMAK was established in 2009 as a forum for discussing policy issues related to energy management and sharing best practices of each country, region, and industry. It is based on a network of policy makers responsible for promoting energy management policies and industry stakeholders focused on real-world applications of energy management systems.

Since 2009, EMAK has organised numerous workshops and webinars for the purpose of sharing experiences on the design and implementation of energy efficiency policies and programmes among a variety of stakeholders, including central and local governments, industry, private banks and research institutions. Japan is the lead country for EMAK.

High-Efficiency Low-Emissions (HELE)

Coal currently accounts for about 37 % of global electricity generation and its capacity may grow in coming decades, in particular in emerging economies where it is considered an affordable, stable and abundant source of energy. In areas where coal is used as the primary energy source, greater deployment of HELE technologies can support the transition to a low carbon future. Thus, some countries' more advanced experience can benefit others and the purpose of the HELE Task Group is to support such policy and technical exchanges among participants, under Japan's leadership.

Super-Efficient Equipment and Appliances Deployment initiative (SEAD)

Global electricity consumption is expected to grow by 60% by 2030, driven in part by the expanding use of appliances, equipment, lighting and other devices that contribute to improved material comfort and quality of life. The associated rise in energy consumption

poses challenges to G20 economies that have to balance out economic growth, adverse environmental impacts, and grid overload, or even power outages. Energy efficiency policies for appliances, such as minimum energy performance standards, are proven and cost-effective methods for lowering energy costs for consumers and increasing the resilience of economies, while at the same time driving innovation and reducing greenhouse gas emissions from electricity production. If all SEAD member governments were to adopt current policy best practices for product energy efficiency standards, the energy equivalent of 650 mid-sized power plants could be saved in 2030. Due to the nature of these traded goods, collaboration among G20 economies on these products and their efficiency performances can yield significant results. The United States, India and the European Commission are the country co-leads for SEAD, with the support of CLASP and the Lawrence Berkley National Lab (LBNL).

Top Ten Energy Efficiency Best Available Technologies (BATs) and Best Practices (BPs) Task Group (TOP TENs)

Sharing information on existing energy efficiency environmental technologies and practices, which are recognised as 'best-in-class', can help accelerate their widespread application and further technological innovations. The TOP TENs Task Group, led by China and Australia, aims to achieve that by helping policy makers and businesses make informed decisions regarding the deployment of energy saving solutions that are practical, cost-effective and scalable. It does so by identifying, showcasing and promoting the best available energy efficient BATs and BPs for select sectors - at a domestic and international level.

Energy-End Use Data and Energy Efficiency Metrics (EUDEEM)

To ensure the processes for developing, implementing and evaluating new policies is as sound as possible, it is essential to have quality data. Thus, G20 economies are collaborating through the EUDEEM initiative to learn from their respective experiences with the collection, analysis and use of such data in policy-making processes. The initiative is led by France with the support of the International Energy Agency. Other G20 economies that have expressed interest in the **initiative** through participation to workshops and consultations include: Argentina, Brazil, China, Germany, Indonesia, Italy, Korea, Japan, Mexico, the United Kingdom, and the United States.

District Energy Systems (DES)

Cooling currently accounts for a large share of the electricity consumption in various G20 countries. Peak cooling demand is expected to continue on the path of high growth, creating a major strain. When certain conditions are met (in particular, high cooling load and density, and diversity of end-uses), district cooling (DC) is a proven cost-effective solution to reduce energy consumption and peak load demand. The same applies to district heating (DH). The objective of the Task Group is to encourage DC/DH deployment, focusing on countries' experiences in DC/DH (institutional framework, regulation, barriers and options to greater DC/DH deployment, national strategies, public procurement practices).The work will be co-led by Kingdom of Saudi Arabia, China and Russia, as G20 Members, with close support of Singapore, as a permanent guest of the G20.

Energy Efficiency Knowledge Sharing Framework

Given the wealth of energy efficiency experience among G20 members, the G20 proposes a framework for a platform that facilitates knowledge sharing on energy efficiency

policies, best practices and national experiences with policies, technologies, and innovation on both the supply and demand sides - an Energy Efficiency Knowledge Sharing Framework that would be hosted under the International Energy Forum (IEF), and led by Saudi Arabia. It aims to collaborate with other relevant International Organisations, including IPEEC, IEA and OPEC among others, and Agencies to give greater visibility to the energy efficiency policies of the G20 as well as other countries and contribute to strengthen their institutional capacity and international collaboration.

	TTG	NDTG/CDA	EEFTG	BEET	EMWG	EMAK	HELE	SEAD	TOPTENs	EUDEEM	DES	KSF
G20 countries												
Argentina	✔		✔		✔			✔		✔		
Australia	✔	✔	✔	✔	✔	✔	✔	✔	✔			
Brazil	✔		✔	✔				✔		✔		
Canada	✔	✔	✔	✔	✔	✔		✔	✔			
European Union	✔	✔	✔	✔	✔	✔		✔				
France		✔	✔	✔					✔	✔		
Germany	✔	✔	✔	✔	✔	✔		✔				
India	✔		✔	✔	✔	✔	✔	✔				
Indonesia				✔	✔	✔	✔	✔				
Italy	✔			✔								
Japan	✔	✔		✔	✔	✔	✔		✔			✔
Mexico	✔	✔	✔	✔	✔	✔		✔		✔		
People's Republic of China	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔	
Republic of Korea		✔	✔	✔	✔	✔		✔	✔			
Russian Federation	✔		✔	✔			✔	✔			✔	
Saudi Arabia											✔	✔
South Africa	✔		✔	✔	✔	✔	✔	✔				
Turkey		✔		✔			✔					
United Kingdom	✔	✔	✔	✔				✔				
United States	✔	✔	✔	✔	✔*	✔		✔	✔			
G20 guest countries												
Netherlands		✔										
Singapore		✔		✔							✔	
Spain		✔						✔				
Chile					✔			✔				

* US leadership currently under review

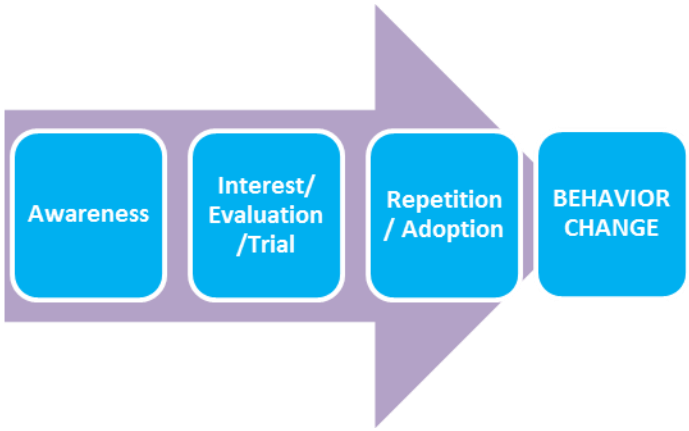
Table 1: G20 economies participation in the Task Groups of the G20 Energy Efficiency Leading Programme

Annex B

What is Behaviour Change?

In "Diffusion of Innovations" (1963), Everett Rogers outlines how new ideas and technologies are adopted, and presents a process through which any given novelty is taken up by a group or individual. Among other things, this process is heavily dependent on human capital: the innovation or new idea needs to be widely adopted by individuals and groups in order to sustain itself and last over time. It involves five decision points (i.e. steps/stages), that span over a given period of time and rely on various communication channels. These stages include: awareness, interest, evaluation, trial, and adoption[26] - noting that an individual might reject an innovation at any time during, or after this adoption process.

The same theory and five-stage process has also been used under the concept of "behaviour change". A synthesised scheme of this five-stage process is presented below.



In order to achieve the desired behaviour change, individuals or groups must transit through each one of these stages in a sequential order. During the initial stage of 'Awareness', the individual – who is possess no information on the issue or idea - is exposed to it for the first time. During this stage, the individual becomes acquainted with the issue/idea, and starts to gather and receive more information related to it. This is then followed by the stage of 'Interest, Evaluation and Trial´ during which the individual becomes more interested in the issue/idea, and actively seeks further information and details to determine (i.e. evaluate) its usefulness. If the evaluation is positive, then the individual will most likely try the new idea. Through such repeated trials, he/she will refine his/her evaluation of the issue, and will reach a final decision with regards to issue/idea, which in a positive case, will lead to him/her continuing to use it on a lasting and self-sustained basis - by adopting it. In fine, a given existing behaviour has been changed or a new one has been created.[27]

[26] In other later editions of Diffusion of Innovation, the author has changed the wording utilised to name each five stages to: knowledge, persuasion, decision, implementation, and confirmation. However, the descriptions of these stages have remained similar.
[27] It is to note that an individual might reject an innovation at any time during or after the behaviour change process, creating challenges of different caliber for the new idea /issue to be established.

For this process to unfold, it must also be supported by formal education, outreach and communication efforts, as key elements underpinning any behaviour change initiatives.

Behaviour change in the context of Energy Efficiency issues in Argentina

One of the objectives of the Undersecretary of Energy Efficiency and Savings of the Ministry of Energy and Mining of the Government of Argentina is to promote the rational and efficient use of energy, as well as to generate an understanding and technical capacity within the general public with regards to energy efficiency issues. These objectives are also aligned with the Government´s goals related to the protection of non-renewable resources, the reduction of energy services costs, as well as the mitigation of environmental problems associated with the production, transportation, distribution and consumption of energy. To achieve its objectives, the Undersecretary has developed a suite of programmes and measures aimed at generating an alternative approach to the use of energy, and at establishing a different relationship with natural resources. These programmes and measures highlight the importance of the process through which behaviour change can occur, as presented above.

Developing effective energy efficiency policies – that take into account behaviour change – can generate multiple benefits, such as:

- reduction of greenhouse gas emissions;
- increased energy security;
- lower energy bills in the residential, industrial and service sectors;
- enhanced competitiveness in the industrial and services sector;
- reduced consumption of transport fuels; as well as
- healthy consumption habits by individuals and groups and a sustained culture of responsible citizenship with regards to the use of energy.

In an international context where energy efficiency has gained stronger interest, Argentina is encouraging its citizens to adopt consumption patterns that lead to an efficient, rational and responsible use of energy – which will be back by some important structural changes and reforms that are expected to deliver greater energy efficiency gains. Thus, the Government is now poised to encourage and facilitate multilateral collaboration on this topic, starting with discussions among G20 economies, to advance internationally this important agenda.

Key elements for effective behaviour change campaigns

For a behaviour change initiative to be effective in achieving its desired results, some key elements must be considered and, ideally included in the design of the campaign. These are: outreach and communication, education, policy, technology/investment and incentive system.

Outreach and Communication

With regards to outreach and communication in the area of sustainable development, behaviour change is often defined as a process of creating awareness on a given

environmental issue. This happens by providing relevant information and motivational mechanisms – with the objective of generating a desired behavioural change. To achieve this, different communication strategies and channels are used, technical information is made accessible to the general public, and key messages are tailored to specific target sectors. All of this helps foster a supportive attitude towards a new habit/technology, or issue. In this sense, outreach and communication represent the backbone activities of effective behaviour change initiatives, and for them to fulfill their strategic role of "agents of change", outreach and communication strategies, programmes, funds and implementation plans are a must.

Education

Formal education on environmental and energy issues is key to generate effective and lasting behavioural changes with regards to sustainable development. It is a fundamental tool to promote a cultural transformation based on the responsible consumption of natural resources and generate greater environmental awareness supporting the rational and efficient use of energy. Along with mass communication and outreach actions, formal education on environmental and energy issues can help develop lasting cultural changes that favour long-term sustainable consumption of energy resources. Formal education also requires well-funded plans and programs in order to be able to perform its role in the behaviour change process and cultural transformation.

Energy policy and planning

Conscious and deliberate planning of energy policies is of vital importance considering the broad regulatory, economic and social ramifications - among others - of energy issues. Ensuring that the institutional frameworks underpinning energy planning remain supportive of technological progress and of the inclusion of new innovations is just as important. In addition to this, behaviour change also calls for policy consistency throughout time.

Technology and investment

Technological evolution at any stage of the energy production chain, as well as at its consumption end point (e.g. appliances, transport, equipment, building materials and techniques, etc.) have a significant influence in the way our societies behave and evolve over time. This is true also in the energy field, in particular with regards to resources available. Energy efficiency can benefit from technological progress, which can offer solutions to difficult energy challenges, such as how to meet growing energy demand in an affordable, sustainable and secure way. Achieving such technological advances requires financial support at all stages of research, development and deployment.

Incentive schemes

Various incentive schemes exist to promote the responsible use of energy and yield the associated benefits. These generally target individuals and other stakeholders with the aim of encouraging a more effective use of energy resources available. While this is a challenging issue to address, there are many successful experiences to draw from, that not only generate energy savings but also lead to changes in consumption habits and behaviour change.