

Why discuss energy efficiency targets?

A target drives action towards improved efficiency by providing the basis and motivation for a government to establish energy efficiency policies and programmes.

Categories of energy efficiency target

<p>ENERGY INTENSITY A reduction in energy consumption per unit of activity, such as GDP</p>	<p>+ A commonly used metric because data are usually available. Easy to understand</p> <p>- Achievement influenced by economic activity and structural change. Not always linked to energy use reduction</p>	<p>ENERGY PRODUCTIVITY An increase in activity per unit of energy consumed</p>	<p>+ Resonates well with some stakeholders</p> <p>- Achievement influenced by economic activity and structural change. Not always linked to energy use reduction</p>
<p>ENERGY CONSUMPTION A reduction in energy consumption relative to a base year, projection or benchmark</p>	<p>+ Aligned with environmental benefits of energy efficiency such as emissions reduction</p> <p>- Achievement influenced by economic growth and structural change</p>	<p>ENERGY ELASTICITY A reduction in the ratio of energy consumption growth to activity growth</p>	<p>+ Allows for target development in the absence of reliable, detailed data or forecasts</p> <p>- Not a commonly used metric and can be difficult to understand</p>
<p>POLICY PROGRESS An increase in the impact of energy efficiency policies</p>	<p>+ Encourages strong policy leadership</p> <p>- Difficult to measure</p>	<p>TRANSACTIONAL An increase in the uptake of energy efficient goods or services</p>	<p>+ Encourages an increase in sales of energy efficiency products and services</p> <p>- Achievement not always linked to energy use reduction</p>

Important considerations

<p>Definition of energy use</p> <p>Will the target be based on Total Primary Energy Supply or Total Final Consumption?</p>	<p>Measurement</p> <p>Will the target be measured against a historical base year, projection or benchmark?</p>	<p>Coverage</p> <p>Will the target cover the entire economy or just specific sectors or regions?</p>	<p>Top down or bottom up</p> <p>Will the target be developed through a combination of regional or local targets?</p>
<p>Relationship to other policies and targets</p> <p>How will the target interact with other policies or targets?</p>	<p>Timeframe</p> <p>How long is given to achieve the target?</p>	<p>Enforcement</p> <p>Will compliance be mandatory?</p>	<p>Tracking</p> <p>What systems will be in place to evaluate progress towards achieving the target?</p>

Key recommendations

A target should be **ambitious**, **realistic**, and **accompanied by a supportive and credible framework** to drive action towards achievement.

A target should be **understandable**, **clearly communicated**, and **transposed into actions** for specific geographic regions or economic sub-sector.

Why set an energy efficiency target?

Energy efficiency targets spur the development and implementation of efficiency strategies and policies. Governments have a number of reasons for developing energy efficiency targets, which now includes actions to meet Nationally Determined Contributions (NDCs) under the Paris Agreement. This IEA Energy Efficiency Insight Brief provides an overview of the types of energy efficiency target and some of the factors that should be taken into consideration during their development.

Of the 162 NDCs submitted by national governments as part of the Paris Conference of Parties in December 2015, 143 mention energy efficiency, although few indicate any additional policy measures or contain national targets.

A target provides the basis and impetus for a government to establish policies, programmes or mechanisms that are intended to drive action towards improved energy efficiency. Credible energy efficiency targets serve several functions:

- **Compel action** – encourage governments and economic sectors to achieve certain outcomes.
- **Track progress** – policies and measures can be monitored and evaluated with the target in sight.
- **Increase financing** – clear message is provided to investors that energy efficiency is a priority.

Energy efficiency is difficult to measure, as population, economic activity, policies and other factors all drive changes in energy use. Targets have nonetheless been established in many countries – not only to achieve energy savings but to gain the multiple benefits that energy efficiency generates.

Target categories and examples

There are several categories of energy efficiency target. The choice of target category depends on factors including, but not limited to, available data, knowledge and expertise:

Target Categories:

ENERGY INTENSITY A reduction in energy consumption per unit of activity, such as GDP	ENERGY PRODUCTIVITY An increase in activity per unit of energy consumed	ENERGY CONSUMPTION A reduction in energy consumption relative to a base year, projection or benchmark
ENERGY ELASTICITY A reduction in the ratio of energy consumption growth to activity growth	POLICY PROGRESS An increase in the impact of energy efficiency policies	TRANSACTIONAL An increase in market penetration of energy efficient goods or services

Energy intensity and energy productivity

An energy intensity target involves a reduction in energy use per unit of activity, usually gross domestic product (GDP). An energy productivity target involves an increase in activity per unit of energy. Intensity is a common metric – China for example established an intensity target as part of its 13th Five-Year Plan. Productivity targets have been set by Australia and the United States. While conceptually similar, there are differences in how intensity and productivity targets can be communicated and interpreted, as countries will aim to reduce intensity, but increase productivity.

The 13th Five-Year Plan for National Economic and Social Development of the People's Republic of China includes a target to reduce energy intensity to 44% below 2005 levels by 2020, with a 15% reduction between 2015 and 2020.

Australia's National Energy Productivity Plan, adopted in 2015 by the Council of Australian Governments, provides a framework and an initial economy-wide work plan to deliver a 40% improvement in Australia's energy productivity, defined as economic output (GDP) per unit of primary energy use by 2030.

Source: IEA (2016) *Energy Efficiency Market Report 2016*. COAG Energy Council (2015) *National Energy Productivity Plan*, <https://scer.govspace.gov.au/workstreams/energy-market-reform/national-energy-productivity-plan/>, accessed 7 October 2016.

Structural change in an economy influences achievement of intensity or productivity targets. It is also not certain that these targets will drive a decrease in energy use, as it is possible for intensity or productivity to improve but for overall energy use to increase.

Energy consumption

An energy consumption target is a change in energy consumption relative to a base year or projection. This type of target has been established in many European countries following the Energy Efficiency Directive.

The Energy Efficiency Directive requires European Union member states to implement and provide proof of measures that will result in primary and final energy consumption being 20% lower in 2020 than would have been the case under a business-as-usual projection. Germany's National Action Plan on Energy Efficiency is an example of a national level policy that emphasises that targets adopted under its 2010 Energy Concept will remain in force, with a target of 20% reduction of primary energy use by 2020 and a 50% reduction target for 2050 with a baseline year of 2008.

The "Clean Energy for All Europeans" Package adopted on 30 November 2016 by the European Commission included amendments to the pre-existing Energy Efficiency Directive. These amendments contained an energy savings target for the EU of a 30% reduction of projected primary energy consumption in 2030, based on baseline projections performed in 2007.

Sources: Bundesministerium für Wirtschaft und Energie (BWE) (2014), *National Action Plan on Energy Efficiency*, www.bmwi.de/English/Redaktion/Pdf/nape-national-action-plan-on-energy-efficiency,property=pdf,bereich=bmwi2012,sprache=en,rwb=true.pdf, accessed 3 October 2016. BWE (2010), *Energiekonzept*, www.bmwi.de/BMWi/Redaktion/PDF/E/energiekonzept-2010,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf, accessed 3 October 2016. European Commission (2012), *Energy Efficiency Directive*, <https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficiency-directive> (accessed 3 October 2016).

An energy consumption target can be linked to emissions reduction targets. However, achieving the target may not be a result of improvements in energy efficiency alone, as changes in economic

activity, population and economic structure can also reduce energy demand. If the target is based on a reduction in demand compared with a base year, it can conflict with goals regarding economic growth, particularly in developing countries. This is why many countries have set energy consumption targets on the basis of a reduction in projected energy demand, thereby allowing room for some increase in energy use associated with economic growth.

The 13th Five-Year Plan for National Economic and Social Development of the People's Republic of China sets a cap on energy consumption in China of 3 500 million tonnes of oil-equivalent.

Source: IEA (2016), *Energy Efficiency Market Report 2016*.

Energy elasticity

An energy elasticity target is a specified change in the ratio of growth in energy use to growth in activity. It is intended to represent a decoupling of energy demand and economic growth. An elasticity target can be suitable for countries that want to improve energy efficiency but have a lack of disaggregated data on energy use and are not able to develop detailed projections.

An elasticity target is less easy to communicate and understand than consumption, intensity or productivity targets. Also, its achievement is influenced by changes in economic activity and structure, thereby masking a lack of progress on energy efficiency.

The **National Energy Policy** adopted by the Indonesian government in its National Energy Plan in 2014 includes a target of decreasing energy elasticity as a function of GDP to below one by 2025.

Source: IEA (2016), *Policies and Measures Database*, www.iea.org/policiesandmeasures/energyefficiency/, accessed 7 October 2016.

Transactional

Transactional targets seek to increase the uptake of energy efficient goods or services and are beneficial in driving targeted efficiency action. However, they only capture part of the energy efficiency market and as such are often a subset of a broader national energy efficiency target.

Japan's 4th Strategic Energy Plan specified two transactional targets:

- To increase the penetration of high-efficiency lighting to 100% of sales by 2020 and 100% of the stock by 2030; and
- To increase the sales share of next-generation vehicles to 50-70% by 2030

Source: Ministry of Economy, Trade and Industry Japan (2014), *Strategic Energy Plan*, www.enecho.meti.go.jp/en/category/others/basic_plan/pdf/4th_strategic_energy_plan.pdf, accessed 7 October 2016.

Policy progress

Policy is a major driver of energy efficiency improvement. This includes measures such as minimum energy performance standards for appliances or obligation schemes for utilities. Therefore, policy progress targets such as increasing the share of energy use covered by policy or increasing the impact of efficiency policy measures can be effective. However, assessing the impact of policies requires good data and rigorous analysis.

It is also possible to establish an aspirational energy efficiency target, which may be more qualitative in nature. An example is the Indian Energy Conservation Act, which is outlined in Annex 1 along with other examples of energy efficiency targets adopted by national governments.

Mexico's National Energy Strategy and National Programme for the Sustainable Use of Energy includes a target of increasing the share of final energy consumption covered by regulation from 46% in 2012 to 51% in 2018.

The European Union's Energy Efficiency Directive requires member states to ensure that energy suppliers and distributors make energy savings of 1.5% per year, as a result of obligation schemes or alternative measures.

Sources: Secretaría de Gobernación (2014), Programa Nacional para el Aprovechamiento Sustentable de la Energía 2014-2018, www.gob.mx/cms/uploads/attachment/file/224/PRONASEpendt.pdf, accessed 3 October 2016.

European Commission (2016), Proposal for a directive of the European parliament and of the council amending Directive 2012/27/EU on energy efficiency, http://ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v16.pdf, accessed 2 December 2016.

Key recommendations for target development

An energy efficiency target should be ambitious in order to drive action. However, it should also be realistic and accompanied by a supportive and credible framework to drive action towards its achievement.

The credibility of the target will affect how stakeholders respond to its imposition but it must be ambitious enough to drive an appropriate level of response

Stakeholder perceptions of credibility will also be based on factors such as how the target was developed and the government's record in setting and achieving other targets. Therefore, the target should be easy to understand. This will ensure that it can be clearly communicated and transposed into targets for specific geographic regions or economic sectors.

An understandable target allows stakeholders to determine how they will be affected

Other considerations for target development

Definition of energy use

For energy consumption, intensity, productivity and elasticity targets, energy use can be measured as Total Primary Energy Supply (TPES) or Total Final Consumption (TFC). TPES captures all energy supply available for use in the country, including that used for electricity generation, while TFC shows the energy that is actually used in buildings, industry and transport. This means that efficiency improvements in power generation and transmission or the use of some forms of renewable energy will lower TPES. For TFC, only demand-side actions will drive progress.



Measurement

For energy savings, consumption, intensity or productivity targets, an important consideration is whether improvement is measured against an historical base year, projections of future energy use or an established benchmark. If selecting a base year, it is important that the energy use or economic activity in that year be a suitable basis for an ambitious but achievable target. Projections require good data and analytical capabilities. Targets based on benchmarks use competition as a means of motivating action, with an example being Energy Star in the United States where voluntary targets for energy efficiency within buildings and industry can be set, with the aim to be more efficient than the national average. The selected benchmark should represent a sufficiently ambitious improvement on current levels.

Coverage

An efficiency target can cover the entire economy or just activities at a sector or sub-sector level. As can be seen in Annex 1, national governments prefer economy-wide targets, with subsidiary targets often established to drive actions at a sector or sub-sector level.

Top down or bottom up

The process of establishing a target contributes to its credibility. In a top-down approach, an economy-wide target is set first, with individual economic sectors or geographic regions determining actions to achieve it. This ensures clear national direction but might not consider the ability of sectors or regions to achieve the target. For a bottom-up approach, sector or regional targets are set first and aggregated to a national target. This provides sectors or regions with greater ownership of targets, which may improve chances of achievement but may also extend the time and cost of development.

Relationship to other policies and targets

An important consideration is how an energy efficiency target relates to other policies and targets. Target and policy development in isolation leads to sub-optimal outcomes, particularly if actions to achieve one target conflict with another. However, there are ways to reduce conflict. For example, by setting a target based on TPES, the increased use of renewable energy can contribute to its achievement, reducing potential conflict between energy efficiency and renewable energy targets.

Timeframe

Targets with shorter timeframes tend to be more realistic, with a defined set of actions to ensure achievement. Medium and longer timeframes provide space for more ambitious targets and for appropriate actions to be developed and implemented. However, they are subject to change depending on technological, socio-economic and political factors.

Enforcement

The threat of a penalty for failure to achieve a target provides a strong legal driver for action, but is more challenging to implement and track. Voluntary targets, or targets for which penalties for non-compliance are not applied, provide less of a legal driver and may be viewed as less credible.

Tracking

Targets, in particular those developed through a bottom-up approach or with a longer timeframe, may require significant data collection to track progress. Therefore, the preparedness of national statistical and reporting systems should be kept in mind when developing a target.

Conclusions

It is fundamental that targets fit national planning, context and goals. A government needs to know what form of target is most suitable for its specific economic situation. The decision to set a target should be based on a step-by-step approach. This starts by taking stock of the policies and monitoring tools already in place and the data that is available, followed by modelling or scenario planning to determine the desired efficiency improvement, in line with other targets.

Annex 1: Examples of national energy efficiency targets

Country	Policy name	Overview	Coverage	Base year	Target year	Quantitative metric	Reference
Energy intensity							
China	The 13 th Five-Year Plan for National Economic and Social Development of The People's Republic of China	A 15% reduction in energy intensity	Economy-wide	2015	2020	Ratio of primary energy consumption to economic output (GDP)	
Thailand	Thailand Energy Efficiency Development Plan	A target to reduce energy intensity by 30% in 2036 compared with that in 2010	Economy-wide	2010	2036	Ratio of final energy consumption to economic output (GDP)	Energy Policy and Planning Office (2015) <i>Thailand Power Development Plan 2015-2036</i> .
Energy productivity							
Australia	National Energy Productivity Plan	An energy productivity target of 40% improvement between 2015 and 2030	Economy-wide	2015	2030	Ratio of economic output (GDP) to primary energy use in petajoules (PJ)	
United States	Accelerate Energy Productivity 2030	Double Energy Productivity by 2030	Economy-wide	2010	2030	Ratio of economic output (GDP expressed in real terms, deflated to 2005 USD) to primary energy use (mmbTU)	Alliance to Save Energy (2015) <i>Accelerate Energy Productivity 2030</i> .
Energy consumption							
European Union	Energy Efficiency Directive 2012/27/EU	20% energy efficiency target for 2020, achieved through member states with defined targets either in primary energy use or final energy consumption in addition to required actions such as carrying out renovations on at least 3% of central government-owned buildings by floor area. Note: Energy intensity improvements would also be allowed at member state level. Nevertheless, all member states need to report absolute levels of primary and final energy consumption in 2020.	EU-wide, Economy-wide		2020/ 2030	Primary energy consumption relative to projected consumption under business-as-usual projections for 2020 and 2030	

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Country	Policy name	Overview	Coverage	Base year	Target year	Quantitative metric	Reference
Energy consumption							
France	National Energy Efficiency Action Plan	Reduction of final energy consumption to 131.4 Mtoe (excluding international air travel) and primary consumption to 219.9 Mtoe in 2020 (excluding non-energy use and international air travel).	<i>Economy-wide</i>		2020	Final energy demand in tonnes of oil-equivalent (toe)	Legifrance (2005) <i>LOI n° 2005-781 du 13 juillet 2005 de programme fixant les orientations de la politique énergétique.</i>
Germany	Energy Concept	20% reduction of primary energy consumption by 2020 and 50% by 2050	Economy-wide	2008	2020/ 2050	Primary energy consumption relative to baseline year	
United Kingdom	National Energy Efficiency Action Plan	Final energy consumption of 129.2 Mtoe, equal to 18% reduction in final energy consumption relative to 2007 business-as-usual projection	Economy-wide		2020	Final energy demand in tonnes of oil-equivalent (toe)	Department of Energy and Climate Change (2014) <i>UK National Energy Efficiency Action Plan.</i>
European Union	“Clean Energy for all Europeans” Package	A proposal of a binding 30% energy efficiency target for 2030	Economy-wide		2030	Primary energy consumption in 2030 relative to the projected 2030 primary energy use relative to baseline projections performed in 2007	
Brazil	National Energy Efficiency Plan	10% reduction of total consumption to be reached in 2030 against projected growth in the electricity sector (equivalent to 106 TWh savings), plus targets on refrigerator replacement, reducing non-technical losses in industry, transport and buildings	Electricity sector		2030	Percentage reduction in energy consumption (equivalent to a reduction in electricity generation)	Ministério de Minas Energia (2011) <i>Plano Nacional de Eficiência Energética, Ministério de Minas Energia.</i>

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Country	Policy name	Overview	Coverage	Base year	Target year	Quantitative metric	Reference
Energy consumption							
Korea	Second Energy Master Plan	Final energy consumption reduced 13% below business as usual levels	Economy-wide		2035	Final energy demand in tonnes of oil-equivalent (toe)	Ministry of Trade, Industry and Energy (2014), <i>Korea Energy Master Plan – outlook and policies to 2035</i> .
South Africa	National Energy Efficiency Strategy	An overall reduction in forecast final energy demand in 2015 (based on 2000 levels) of 12%. This includes targets for industry and mining (15%), commercial and public buildings (15%), residential (10%) and transport (9%)	Economy-wide		2015	Final energy demand in petajoules (PJ)	Department of Minerals and Energy (2005) <i>Energy Efficiency Strategy of the Republic of South Africa</i> .
Energy elasticity							
Indonesia	National Energy Policy (Government Regulation No. 79/2014)	A decrease in energy elasticity a function of GDP to below one by 2025	Economy-wide		2025	Ratio of the rate of change of total primary energy supply to the rate of change of GDP	
Policy progress							
Mexico	National programme for the sustainable use of energy (PRONASE)	Increase the amount of final energy consumption covered by regulation from 46% in 2012 to 51% in 2018	Economy-wide	2012	2018	Percentage of final energy use covered by regulation	Gobierno de México (2016) <i>Estrategia de Transición para Promover el Uso de Tecnologías y Combustibles más Limpios</i> . Secretaría de Energía (n.d.) <i>Estrategia Nacional de Energía 2013-2027</i> .
Policy progress							
European Union	“Clean Energy for all Europeans” Package	Member States must ensure that energy suppliers and distributors achieve energy savings of 1.5% per year, as a result of policies such as obligation schemes or alternative measures.					

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Country	Policy name	Overview	Coverage	Base year	Target year	Quantitative metric	Reference
Transactional							
Japan	Strategic Energy Plan	Goals to make facilities and equipment more efficient, optimal use of energy and increasing the visibility of energy consumption data	Industrial, commercial, residential and transport sectors	2013	2030	Goals and other transactional targets are forecast to drive a 13% reduction in energy demand by 2030	
		Improving uptake of highly efficient lighting equipment (e.g. LED and organic EL lighting)	Business and households sector		2020 (flow) 2030 (stock)	Ratio of efficient lighting products to previous products available for purchase (flow) and ratio of efficient lighting products to previous products installed and in operation (stock)	
		Increasing the ratio of next-generation vehicles to all new vehicles	Transport sector		2030	Ratio of next-generation vehicles to all new vehicles	
Others							
India	Energy Conservation Act of 2001 (amended 2010).	Qualitative target of reducing energy intensity through standards and labelling, building codes, DSM, capacity building and human resource development	Economy-wide		2018	N/A	United Nations Framework Convention on Climate Change (n.d.), <i>India's Intended Nationally Determined Contribution</i> .

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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.