Overview

➢ Energy efficiency indicators: Why?

➢ Starting from energy balances: benefits and limits of high-level indicators

➢ Beyond the energy balance: energy efficiency indicators

➢ The IEA approach
Energy efficiency indicators: why?
## Indicators: key to set targets and track efficiency progress

### Country Targets on Energy Efficiency

<table>
<thead>
<tr>
<th>Country</th>
<th>Targets on Energy Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei Darussalam</td>
<td>Reducing Energy Intensity (TFC/GDP) to 2035 by 45% based in 2005 level.</td>
</tr>
</tbody>
</table>
| Cambodia           | • Reducing TFC by 20% in 2035 compared to BAU.  
                       • Industry: up to 20% in garment factories and 70% in ice factories  
                       • Residential: up to 50%  
                       • Commercial: 20 to 30%  
                       • Rural Electrification Energy Savings: up to 80%  
                       • Replacement of biomass use 30-50% |
| Indonesia          | • To achieve 1% **energy intensity** reduction per annum.  
                       • Reducing TFC in 2025 by **17% in industry, 20% in Transportation, 15% in household, 15% in commercial building** compared to BAU. |
| Lao PDR            | Reducing TFC 10% in 2030 compared to BAU. |

Source: ASEAN Plan of Action for Energy Cooperation (APAEC)
**Indicators: key to set targets and track efficiency progress**

<table>
<thead>
<tr>
<th>Country</th>
<th>Targets on Energy Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>Reducing <em>Electricity</em> Consumption by 8% in 2025.</td>
</tr>
<tr>
<td>Myanmar</td>
<td>Reducing <em>Electricity</em> Consumption by 20% in 2030.</td>
</tr>
</tbody>
</table>
| Philippines | • Reducing *TFC* by 1% per year until 2040, equivalent with the reduction of one third of energy demand.  
              • Reducing *Energy Intensity* (TFC/GDP) by 40% in 2040 as compared to 2005 level. |
| Thailand    | Reducing *Energy Intensity* (TFC/GDP) by 30% in 2036 compared 2010 level.                   |
| Vietnam     | • Reducing *TFC* by 8% in 2020 as compared to BAU.                                           

**But what indicators?**

Source: ASEAN Plan of Action for Energy Cooperation (APAEC)
Does energy intensity track energy efficiency?

Energy intensity has generally decreased across regions. Using less energy per GDP means “decoupling” economic growth from energy use.

Source: IEA World Energy Balances, 2018
What drives energy intensity trends?

Efficiency progress but also other factors (mainly activity /structural changes)

Source: IEA World energy balances, 2018
Understanding aggregated indicators requires attention

Intensity decreased more in country X, but is it proper to say that Country X has improved more in energy efficiency?

Data source: IEA, Energy efficiency indicators.
Aggregated indicators are sometimes used inappropriately.

Energy intensity (TFC/GDP) changes (1990-2010)

Country X intensity reduction was mostly due to structural changes, while country Y improved more in energy efficiency.

Data source: IEA, Energy efficiency indicators.
How to disentangle efficiency from other drivers?

Drivers of final energy consumption in IEA

- Activity effect
- TFC
- Structure effect
- Efficiency effect

Note: Analysis based on the IEA Energy Efficiency Indicators database (2016 edition). TFC in this analysis covers the following sectors: residential, industry and services, passenger and freight transport. It does not include agriculture, non-energy, and energy supply sectors. The energy consumption decomposed in this analysis represents 90% of TFC in IEA countries in 2015.

How to disentangle efficiency from other drivers?

Drivers of final energy consumption in IEA

End-use data and indicators are the answer

IEA Energy Efficiency Indicators: Essentials for Policy Makers, 2014

© OECD/IEA 2018
PHILIPPINES – Selected Industrial Subsector Intensities

Source: Department of Energy, Philippines Energy Balances Philippines Statistics Authority, National Accounts
Energy Efficiency Indicators

THAILAND – Publications on Energy Efficiency Indicators (Transport)

Starting from energy balances: benefits and limits of high-level indicators
Balances data example

Road Transport is the most consuming.

How do we meter road transport efficiency?

We need more detailed data:
- consumption by vehicle type (e.g. cars, buses, trucks)
- activity data (e.g. distance travelled, passenger/tonne-kilometers)

Data source: IEA (2016), World energy balances.
For example, shares of sectors in total final consumption*

* Total Final Consumption excluding Non-energy uses

Key to understand where energy is used and to define policy priorities
And more specific sectoral indicators

Coupling sectoral demand data with socio-economic data
Choosing the most appropriate indicators is essential

Data for IEA 20 (Australia, Austria, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Netherlands, Norway, Slovakia, Spain, Sweden, Switzerland, UK, USA).

* Temperature correction using heating degree days

Data source: IEA, Energy efficiency indicators.
Balances are very useful but do not track end-uses

<table>
<thead>
<tr>
<th></th>
<th>Coal</th>
<th>Crude</th>
<th>Oil Products</th>
<th>Gas</th>
<th>Nuclear</th>
<th>Hydro</th>
<th>Geoth/Solar</th>
<th>Biofules &amp; Waste</th>
<th>Electricity</th>
<th>Heat</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTHER</td>
<td>136.42</td>
<td>0.23</td>
<td>425.87</td>
<td>633.44</td>
<td>-</td>
<td>-</td>
<td>14.37</td>
<td>834.05</td>
<td>820.32</td>
<td>145.22</td>
<td>3036.92</td>
</tr>
<tr>
<td>Residential</td>
<td>76.58</td>
<td>-</td>
<td>222.89</td>
<td>418.55</td>
<td>-</td>
<td>-</td>
<td>6.98</td>
<td>805.42</td>
<td>395.81</td>
<td>97.97</td>
<td>2024.19</td>
</tr>
<tr>
<td>Comm. and public serv.</td>
<td>23.3</td>
<td>-</td>
<td>107.32</td>
<td>173.79</td>
<td>-</td>
<td>-</td>
<td>1.15</td>
<td>16.33</td>
<td>338.31</td>
<td>32.47</td>
<td>692.67</td>
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<tr>
<td>Agriculture/forestry</td>
<td>9.57</td>
<td>0.02</td>
<td>102.97</td>
<td>5.58</td>
<td>-</td>
<td>-</td>
<td>0.16</td>
<td>7.02</td>
<td>36.2</td>
<td>3.36</td>
<td>164.88</td>
</tr>
<tr>
<td>Fishing</td>
<td>0.01</td>
<td>-</td>
<td>5.69</td>
<td>0.02</td>
<td>-</td>
<td>-</td>
<td>0.03</td>
<td>-</td>
<td>0.36</td>
<td>0.06</td>
<td>6.17</td>
</tr>
</tbody>
</table>

**Residential:**
- no breakdown by end-use
  - space heating
  - space cooling
  - water heating
  - lighting
  - cooking
  - appliances
Energy efficiency indicators: stronger data requirements

More easily available data: Energy balances

TRADE-OFF

Aggregated Indicators

End-use efficiency indicators

Process/appliance efficiency indicators

TPES/GDP

TFC/Population

Space heating/square meter

Energy for cars/pkm

Energy/ton steel

Energy/stock refrigerators

data requirement
Beyond the energy balance: energy efficiency indicators

Analyzing energy end-uses
Understanding end-uses across sectors

Energy balances: Sectoral consumption

Energy efficiency: End-use consumption

Efficiency indicators link energy to activity across end-uses

Generic Energy Efficiency Indicator = Energy Consumption = Activity

A given indicator explains how much energy is needed to provide a certain service
Data and indicators for the residential sector

**Energy consumption data:**
- Space heating*
- Space cooling*
- Water heating
- Cooking
- Lighting
- Appliances energy consumption:
  - Refrigerator
  - Freezer
  - Dishwasher
  - Clothes washer
  - Clothes dryer
  - TV
  - Computers

* Temperature corrected, using HDD & CDD

**Activity data:**
- Population
- Number of occupied dwellings
- Residential floor area
- Appliances stock and diffusion

IEA Energy Efficiency Indicators: Fundamentals on Statistics

© OECD/IEA 2018
Example of insights from end use data: residential sector

Example of shares of end-uses on energy consumption

Example of selected energy intensities

IEA Energy Efficiency Indicators: Fundamentals on Statistics
Data and indicators for the transport sector

Energy consumption data:
- Transport segment
  - passenger / freight
- Transport modes
  - road, rail, air, water, etc.

Activity data:
- Vehicle stocks
- Passenger-kilometers
- Tonne-kilometers

IEA Energy Efficiency Indicators: Fundamentals on Statistics
Example of insights from end use data: transport sector

Shares by mode/vehicle type on energy consumption, country Y

Selected energy intensities, country Y

IEA Energy Efficiency Indicators: Fundamentals on Statistics
Data and indicators for the industry sector

**Energy consumption data**
- (major ISIC sub-sectors):
  - Chemical
  - Iron and steel
  - Non-ferrous metals
    - Aluminum
  - Non-metallic minerals
    - Cement
    - Clinker
  - Pulp and paper
    - Pulp
    - Paper
  - .... etc.

**Activity data:**
- Value added
- Physical production

IEA Energy Efficiency Indicators: Fundamentals on Statistics
Data and indicators for the industry sector

Example of shares of industry subsectors on energy consumption

Example of selected energy intensities

*IEA Energy Efficiency Indicators: Highlights 2017c*
The IEA approach
Addressing the challenge: the IEA experience

- Agreed by member countries in 2009 (IEA Ministerial)

- Developed with international community of experts, based on historical work on indicators (Odyssee, LBNL, etc.)

- A user-friendly Excel questionnaire (available online)

- Collects energy consumption and activity data

- Covers four sectors: residential, services, industry, transport

- Publication and database: Energy efficiency indicators Highlights
The end use data collected and disseminated by the IEA

<table>
<thead>
<tr>
<th>Country</th>
<th>Sector</th>
<th>End use</th>
<th>Energy product</th>
<th>Energy indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Residential</td>
<td>Space heating</td>
<td>Oil</td>
<td>Per capita energy intensity (GJ/cap)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Space cooling</td>
<td>Natural Gas</td>
<td>Per dwelling energy intensity (GJ/dw)</td>
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<tr>
<td></td>
<td></td>
<td>Water heating</td>
<td>Renew. &amp; waste</td>
<td>Per floor area energy intensity (GJ/m²)</td>
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<tr>
<td></td>
<td></td>
<td>Cooking</td>
<td>Heat</td>
<td>Per unit equipment energy intensity (GJ/unit)</td>
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<td></td>
<td>Lighting</td>
<td>Electricity</td>
<td>Per services employee energy intensity (GJ/employee)</td>
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<td></td>
<td></td>
<td>Appliances</td>
<td>Other</td>
<td>Per VA energy intensity (GJ/USD PPP 2010)</td>
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<td></td>
<td></td>
<td>Other</td>
<td></td>
<td>Per physical output energy intensity (GJ/t)</td>
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<tr>
<td></td>
<td>Services</td>
<td>Space heating</td>
<td>Oil</td>
<td>Fuel intensity (liters/100 vkm)</td>
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<tr>
<td></td>
<td></td>
<td>Space cooling</td>
<td>Natural Gas</td>
<td>Passenger-kilometer energy intensity (MJ/pkm)</td>
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<td>Lighting</td>
<td>Renew. &amp; waste</td>
<td>Tonne-kilometer energy intensity (MJ/pkm)</td>
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<td>Other</td>
<td>Heat</td>
<td>Vehicle-kilometer energy intensity (MJ/pkm)</td>
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<td>Industry</td>
<td>Textiles</td>
<td>Electricity</td>
<td>Other</td>
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<td>Chemicals</td>
<td>Other</td>
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<td>Basic metals</td>
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<td>Transport</td>
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Energy Efficiency Indicators Highlights

https://webstore.iea.org/energy-efficiency-indicators-2017-highlights
IEA tools to support indicators development

➢ Fundamentals on statistics:
  to provide guidance on how to collect the data needed for indicators
  ▪ Includes a compilation of existing practices from across the world
  ▪ [https://goo.gl/Y8QD1G](https://goo.gl/Y8QD1G)

➢ Essentials for policy makers:
  ▪ to provide guidance to develop and interpret energy efficiency indicators
  ▪ [https://goo.gl/agcNg2](https://goo.gl/agcNg2)
IEA e-learning courses: capacity building on energy efficiency data

• Energy Efficiency Indicators: Fundamentals on Statistics

• Energy Efficiency Indicators: Essentials for Policy Making
The IEA mission on data

• To collect and disseminate reliable and relevant data to inform policy-making

https://webstore.iea.org/energy-efficiency-indicators-2017-highlights

• We hope that you join our efforts!