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Global Green Growth Institute

Policy and Regulatory instruments for Energy Efficiency

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Topics to be covered

- ✓ Accessible savings and benefits of energy efficiency improvements
- ✓ Barriers to energy efficiency that require government action
- ✓ National target setting
- ✓ Regulatory policy instruments available

Energy Efficiency as an Energy Source

Energy Efficiency is frequently the **least-cost resource option** available **for meeting increasing demand for electric power**: *it is much cheaper [and cleaner] to save electricity than to make it.*

EE is also a resource for policymakers to address **rising energy costs, reliability challenges, and greenhouse gas reduction**: *a saved Watt is a cheaper, more reliable and cleaner Watt*.

What is Energy Efficiency ?

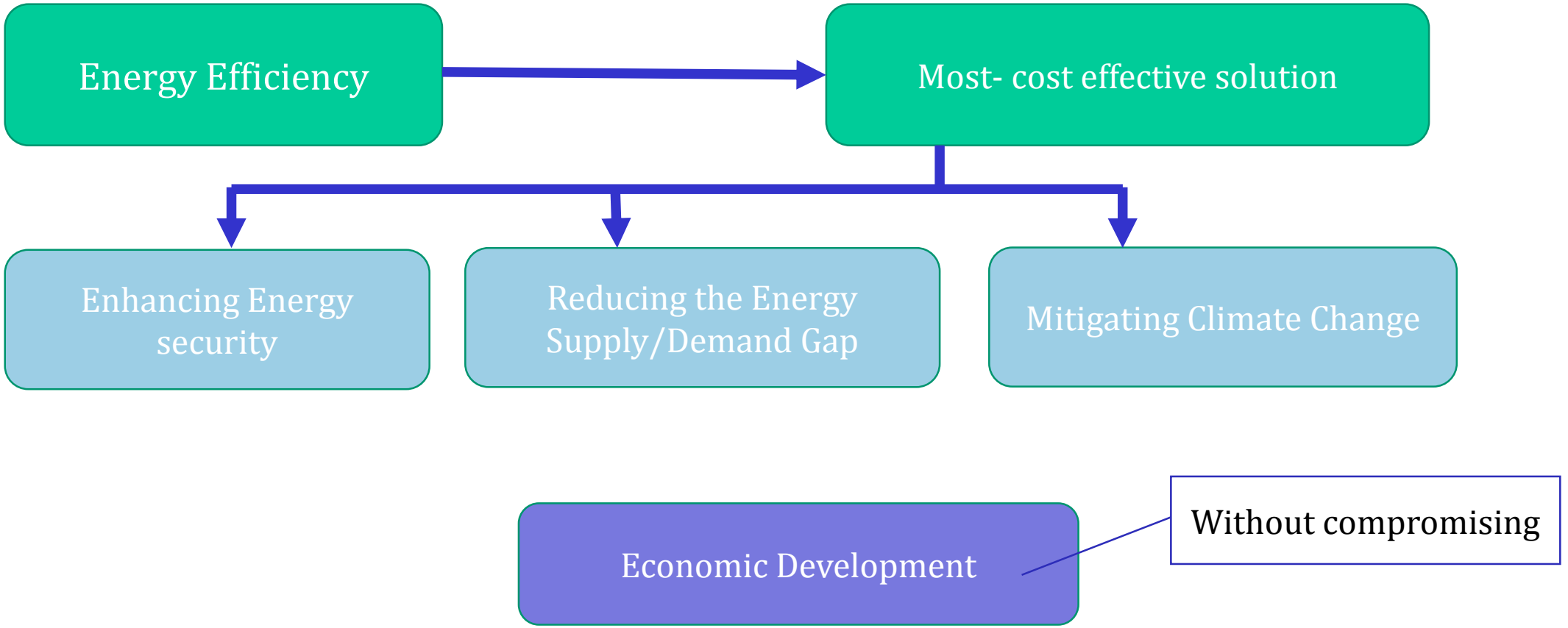
More ***efficient use of energy*** provides the same or better service (heating, lighting, cooling, transport) with ***less energy*** and ***lower cost***.

This differs ***from energy conservation***, which uses less energy but can sometimes result in ***inferior services***.

In Vanuatu, which is overwhelmingly dependent on petroleum fuel imports for modern energy services (transport & electricity in that order), improved energy efficiency results in lower imports & GHG emissions.

EE is
a domestic fuel
('the home-grown fuel')

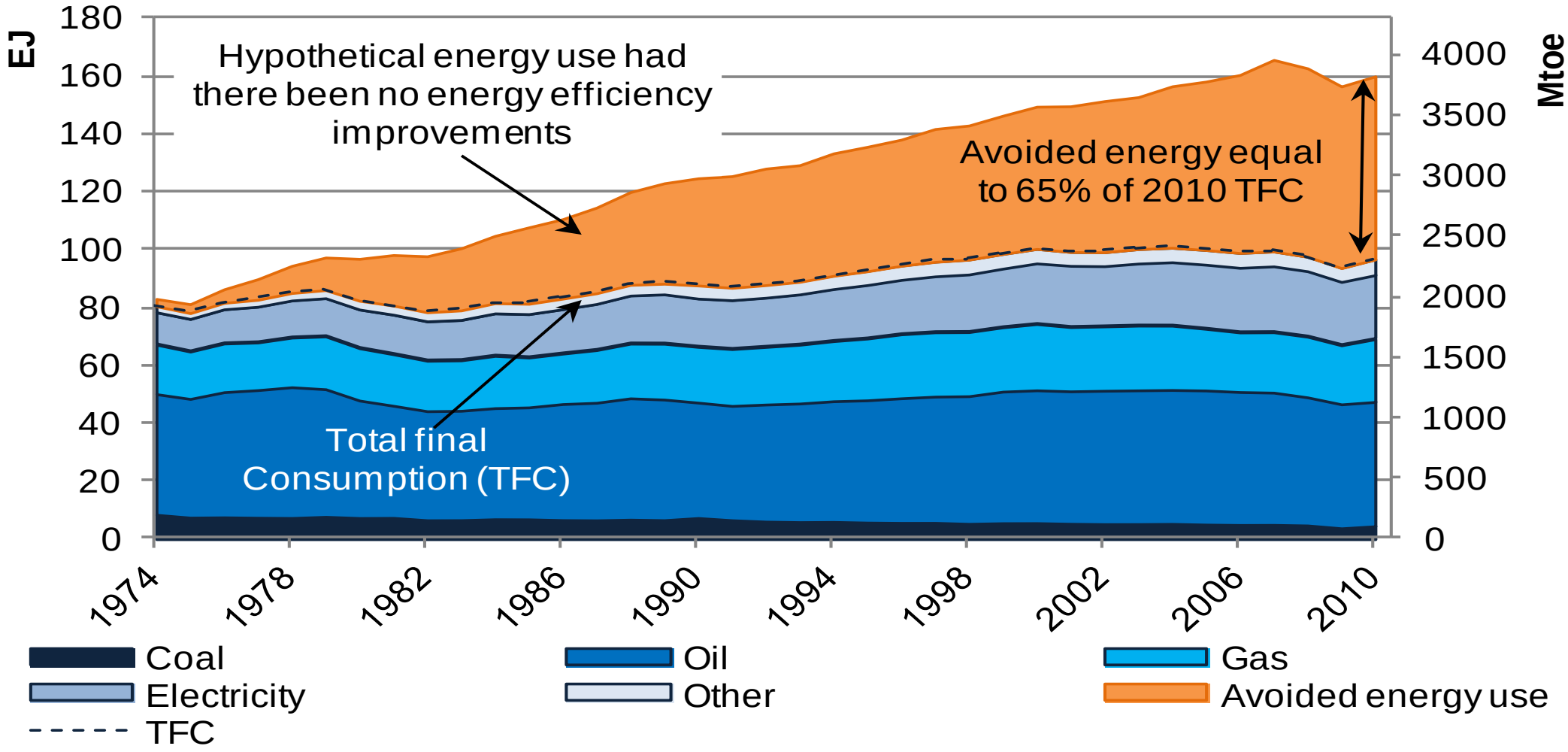
Importance of Energy Efficiency



Why Energy Efficiency?

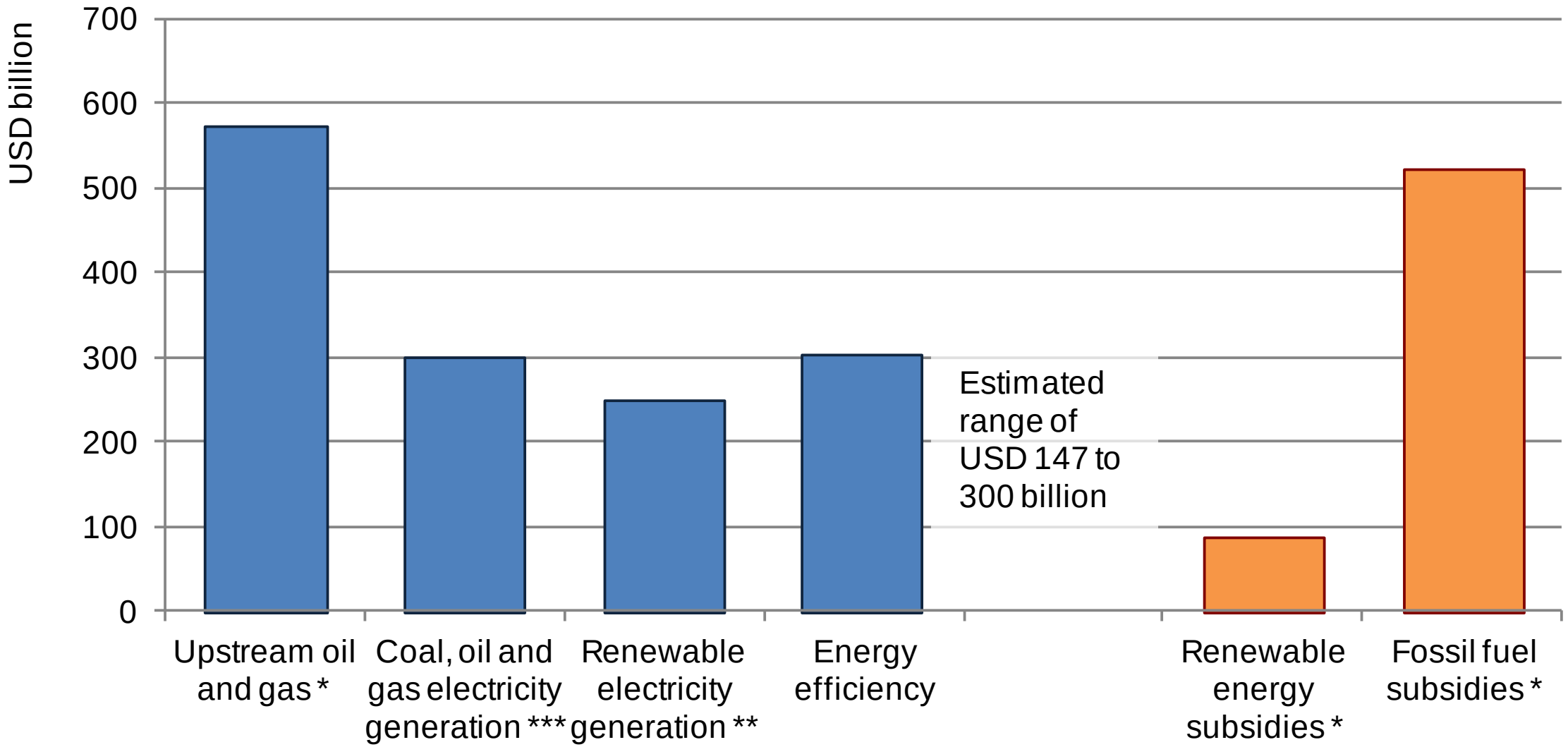
- cheapest energy is that which is not necessary to produce
- EE is in the center of economy and political attention
- EE contributes to fulfilment of main three targets of EU energy policy - ***sustainability, security and competitiveness***
- EE decreases dependence of economy on non-stabile prices of oil and gas
- EE is part of healthy energy and economy policy of state
- It supports local economy and its growth based on innovations
- It increase lifetime of objects and technology equipment
- Decreases operational costs, environmental impact
- Saves money and time

Why the first fuel?



Source: Energy efficiency policy-selling the benefits, Melanie Slade 2014 IEA

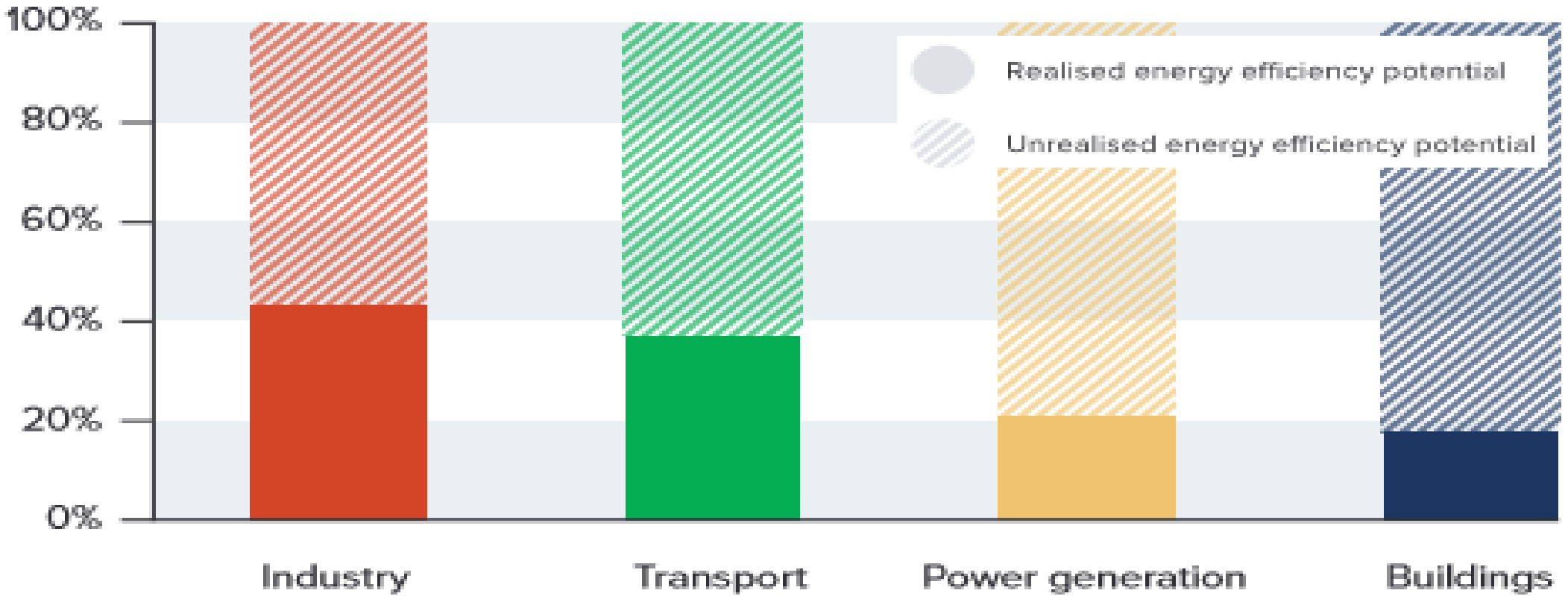
$300 Bn global EE market in 2011



Source: Energy efficiency policy-selling the benefits, Melanie Slade 2014 IEA

Potential

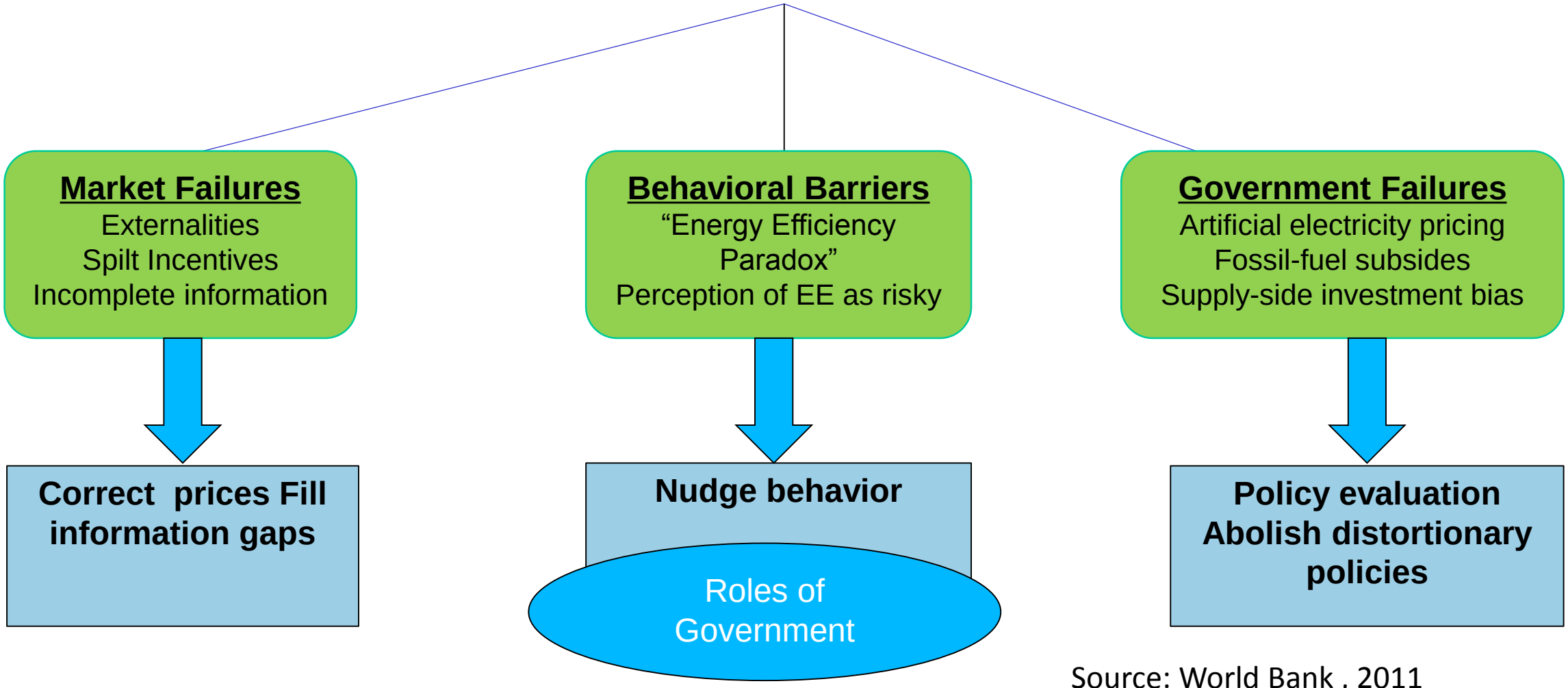
IEA projections to 2035 show that as much as two-thirds of energy efficiency potential will remain untapped unless policies change.



Source: Raising Energy Efficiency Standards to the Global Best, New Climate Economy, IEA 2014

Why then?

Why does so much potential for cost-effective energy savings go unrealized?



Source: World Bank , 2011

Energy – savings potentials

- There is tremendous accessible and profitable energy-savings potential, especially ***in buildings and in developing countries.***
- Government policies must overcome ***market failures, behavioural barriers, and government failures.***
- ***Regulatory instruments*** play an important role and building energy codes are the most important.
- Current oversight and enforcement capacity informs decisions on how to develop and promulgate regulation.
- Complementary policies can serve as compliance tools.
- Developing countries face unique challenges but host enormous potential, which can help avoid “locking-in” inefficient systems and energy costs for building lifetimes.

Governments have several policy options

Information Communication Measures

- **Labeling**
- **Public Awareness and**
- **Information Campaigns**

Regulatory Instruments Standards

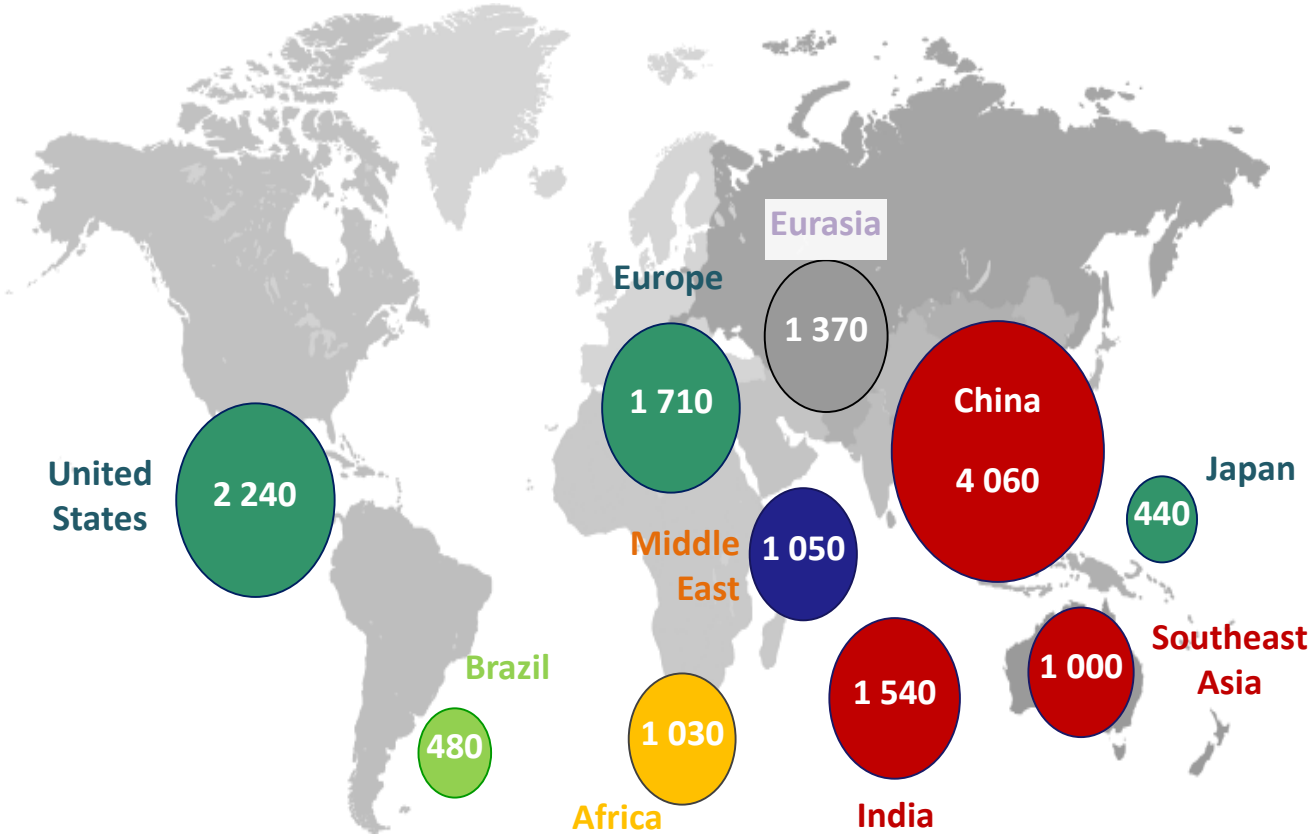
- **Regulations for the**
- **Designated Consumers**
- **Building Codes**

Market-based Instruments

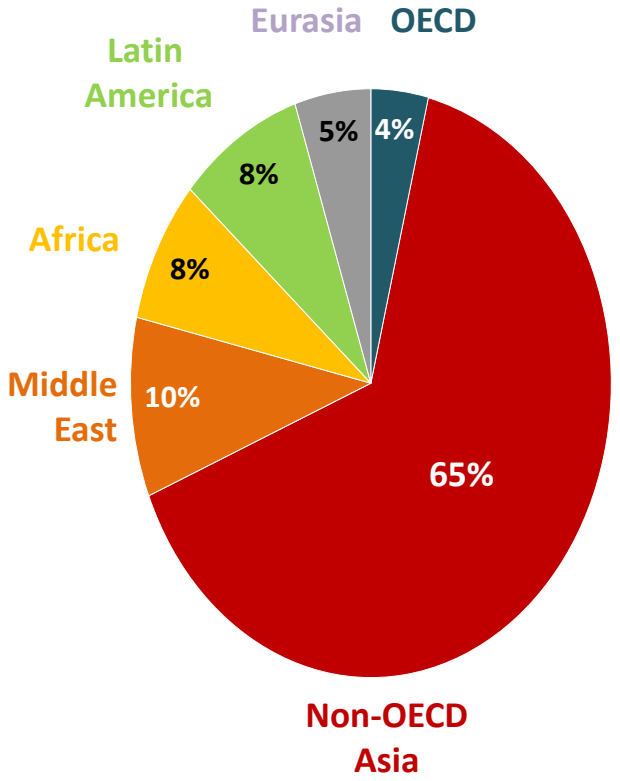
- Price Instruments
- Quantity Instruments

The engine of energy demand growth moves to South Asia

Primary energy demand, 2035 (Mtoe)

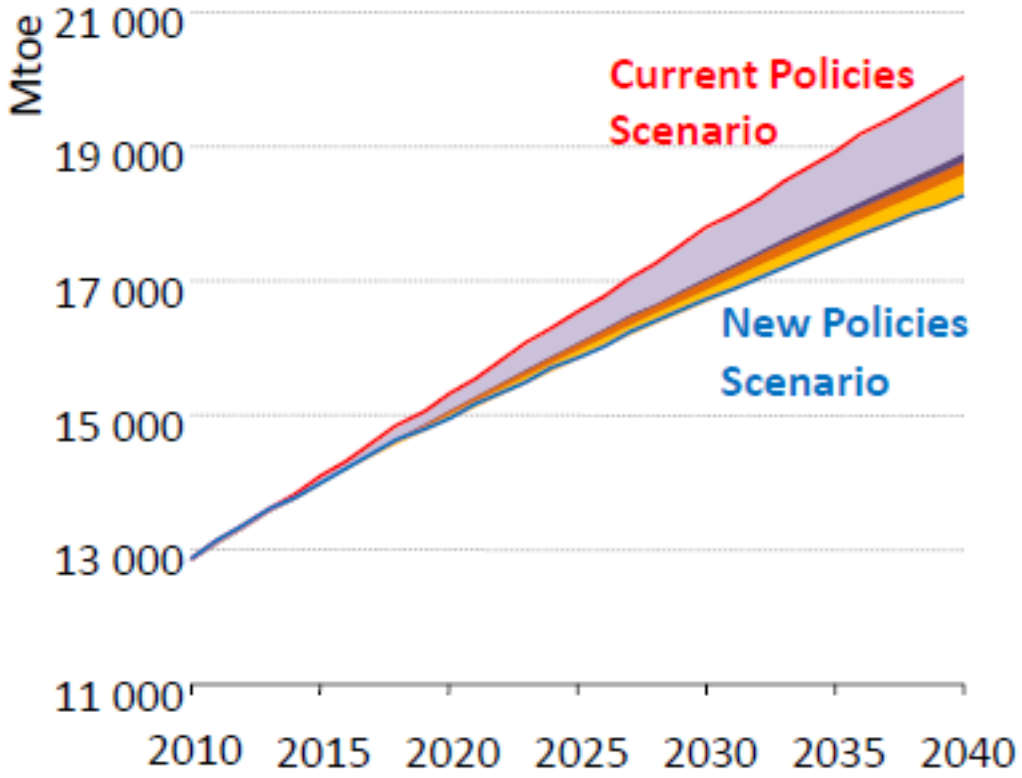


Share of global growth 2012-2035



Source: World Energy Outlook 2013, IEA

Energy Efficiency for future energy Demand Growth

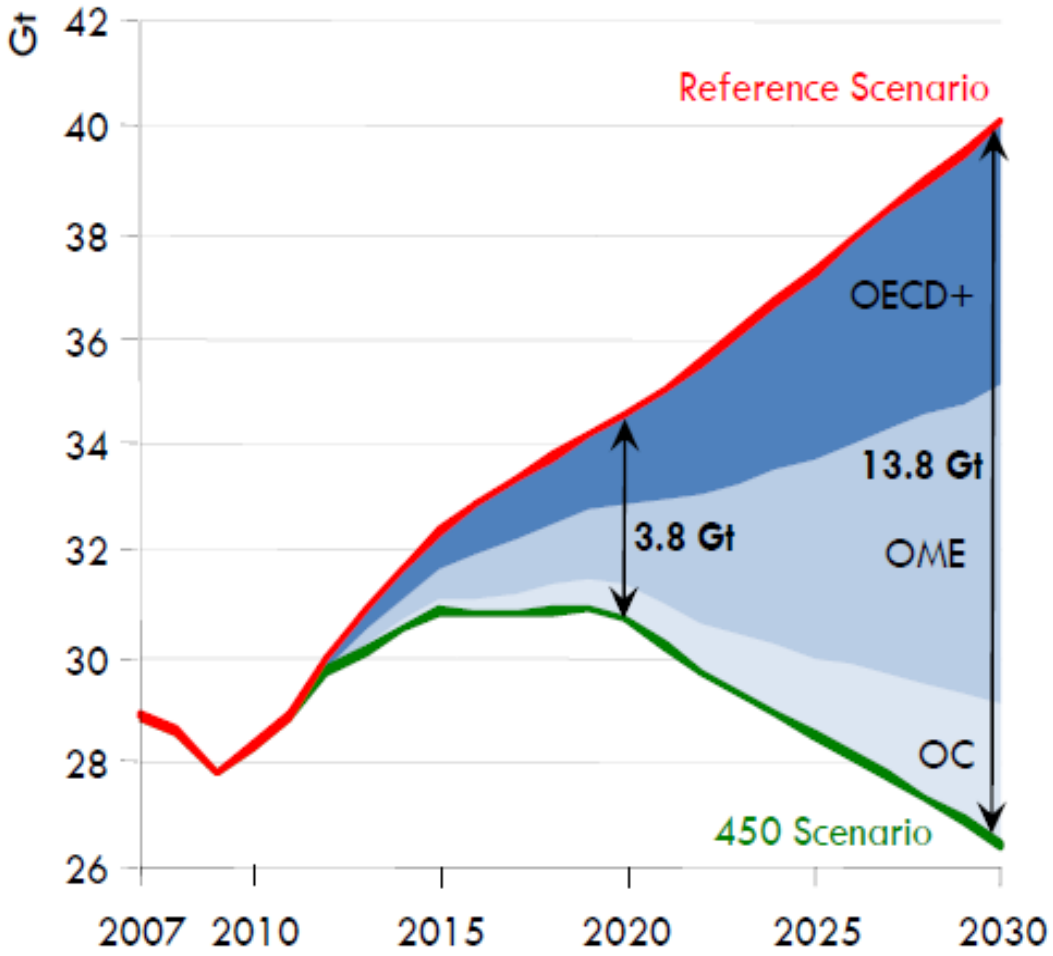


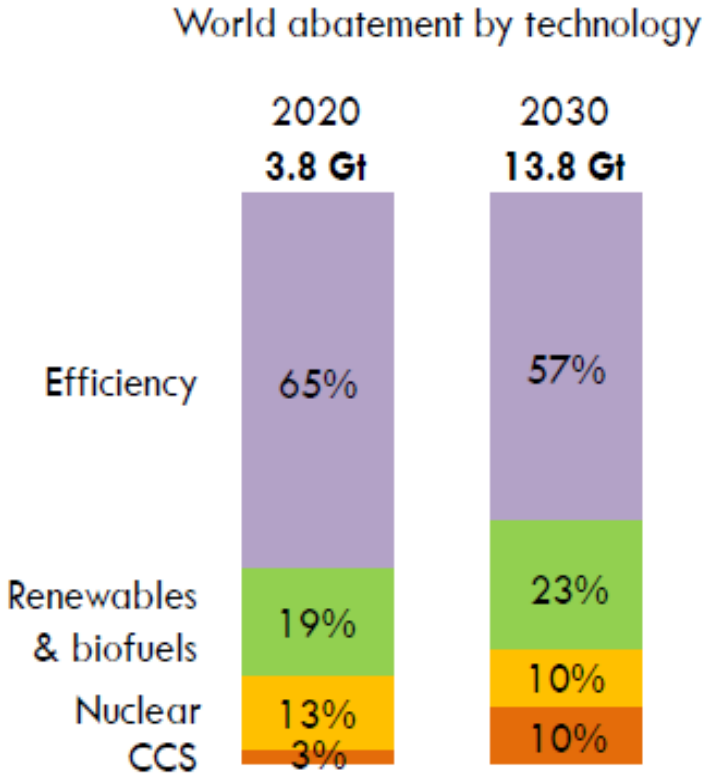
Energy savings in 2040	
Efficiency in end-uses	62%
Efficiency in energy supply	7%
Fuel and technology switching	11%
Reduced energy service demand	21%
Total (Mtoe)	**1 750**

Energy efficiency is crucial to moderate future energy demand growth

Source: IEA (2011) *World Energy Outlook*, OECD/IEA, Paris

Role of Energy Efficiency In mitigating Climate Change



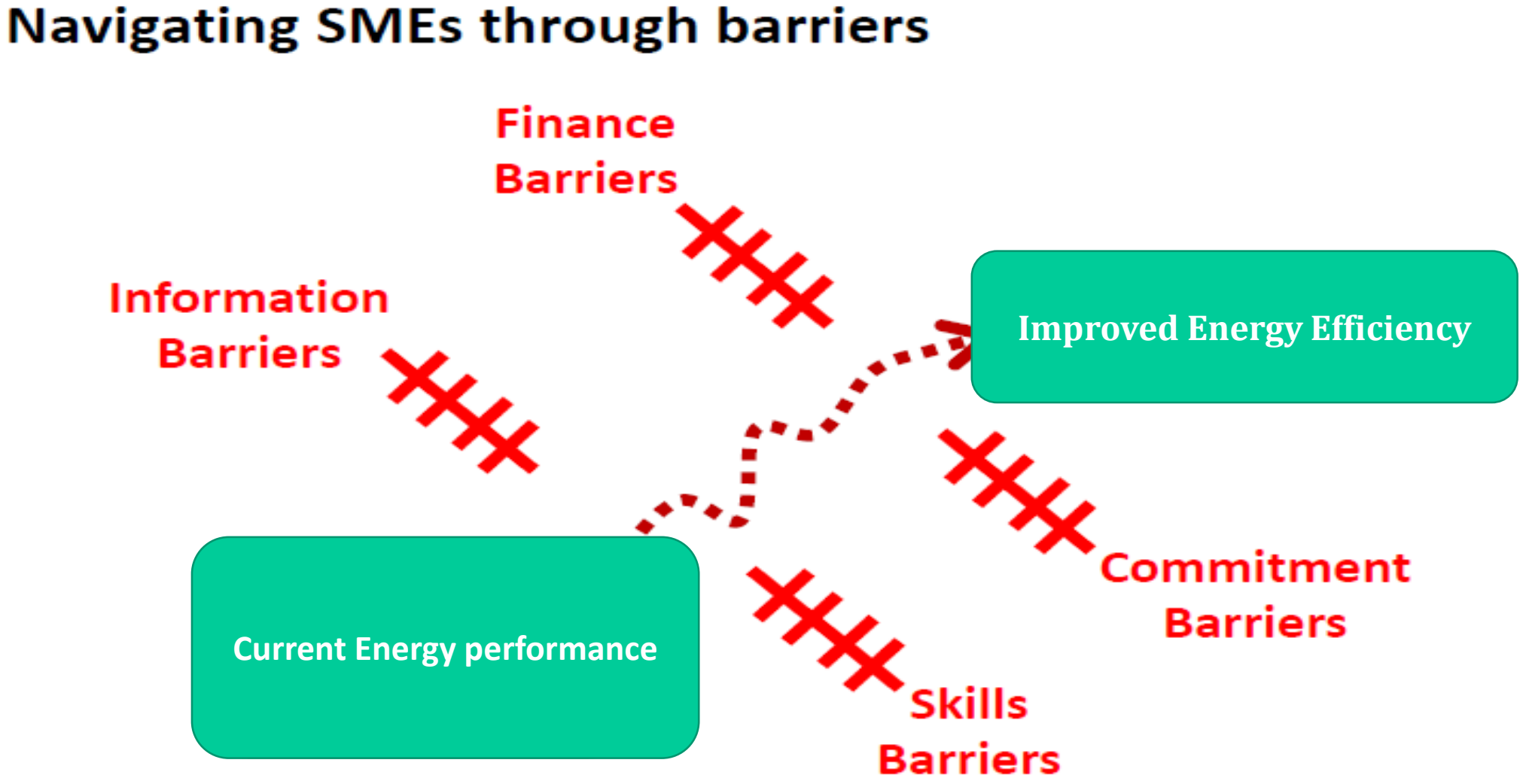


Source: IEA (2011) *World Energy Outlook*, OECD/IEA, Paris

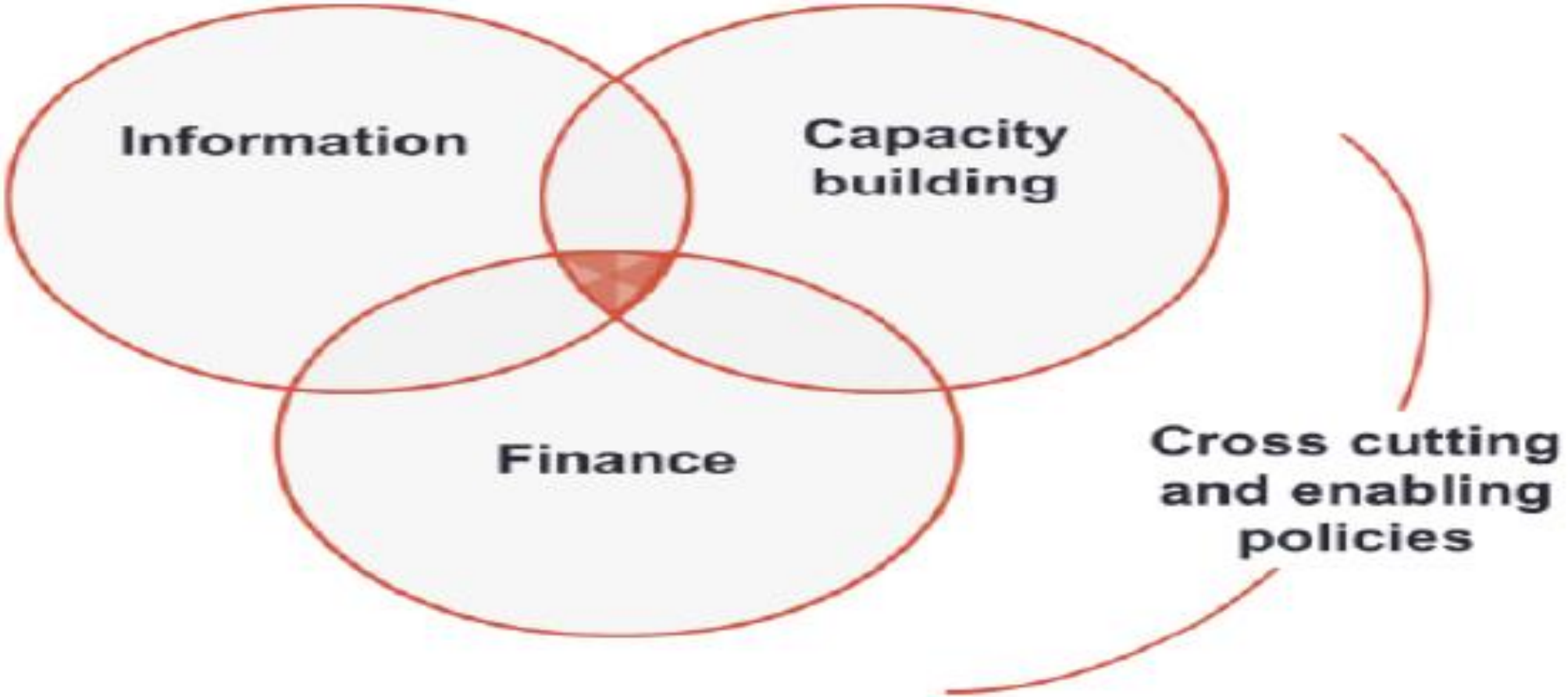
Discussion

What are the key barriers to energy efficiency in Vanuatu?

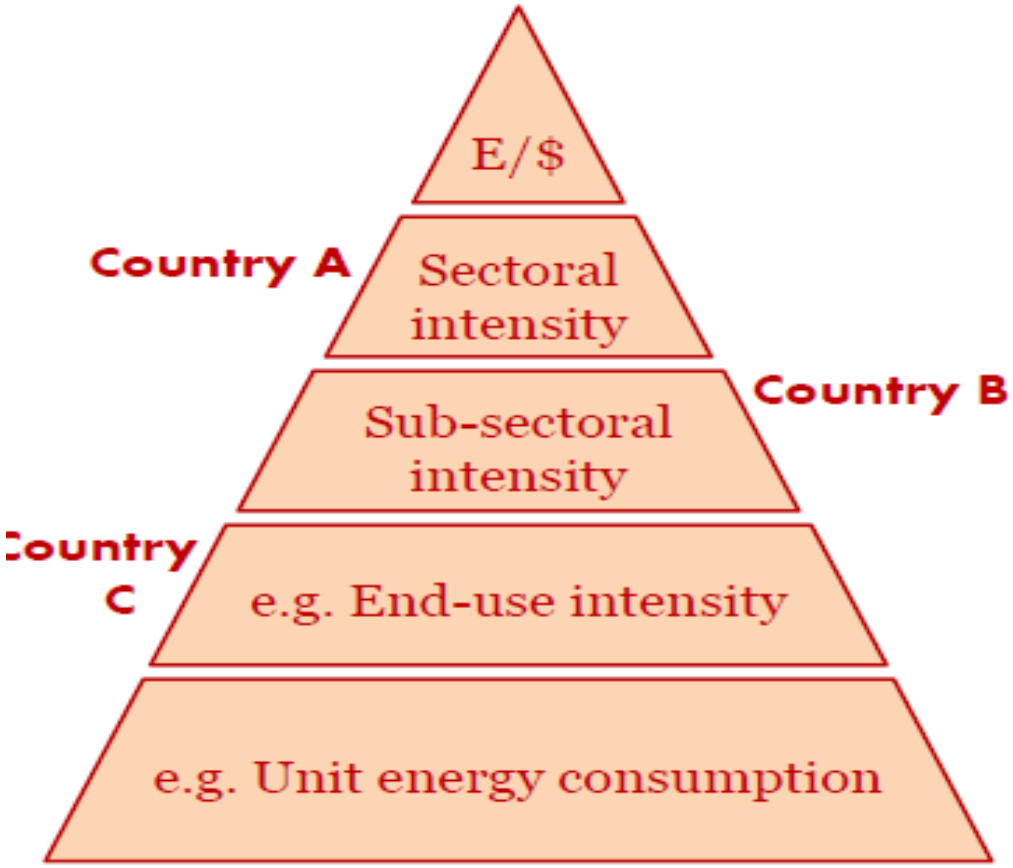
EE barriers


Navigating SMEs through barriers
Finance Barriers
Information Barriers
Improved Energy Efficiency
Commitment Barriers
Current Energy performance
Skills Barriers

Use a combination of measures Barriers



Steps needed in developing countries



Development/strengthening of

- End-use data gathering procedures
- Full energy balance
- Identification of available activity data, surveys for additional data
- Capacity and tools for data validation and filling data gaps
- Understanding of policy messages conveyed by indicators
- Framework for selecting the most effective policy instrument
- Policy implementation framework (success factors or policy metrics)

Source: IEA 2011

Module 1
Energy audit methodology and tools

What is energy auditing?

"An energy audit is developing an understanding of the specific energy using patterns of a particular facility."

Discussion

- **How to collect the data for indicators?**

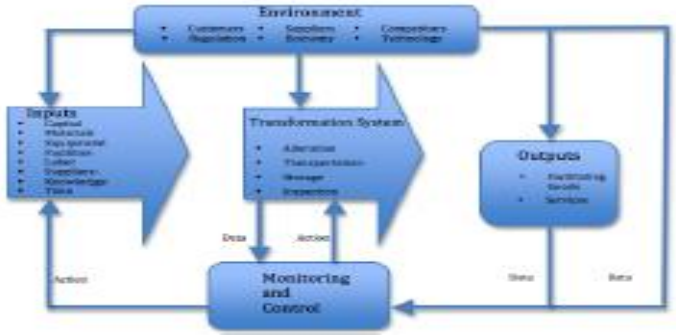
Methodologies to collect data

- Administrative sources

- Surveys

- Metering and measuring

- Modelling



Energy Efficiency Indicator Use

- Historical trend analysis
- Benchmarking
  - Cross-country comparisons
  - Comparison with best practice
- As input to economic and technological models
- To design policy and monitor progress overtime
- To focus policy attention and effort

7 Priority Areas

Cross-sectoral

1. Energy efficiency data collection and indicators
2. Strategies and action plans
3. Competitive energy markets with appropriate regulation;
4. Private investment in energy efficiency
5. Monitoring, enforcement and evaluation of policies and measures

Buildings

6. Mandatory building energy codes and minimum energy performance requirements
7. Aiming for net zero energy consumption in buildings
8. Improving the energy efficiency of existing buildings
9. Building energy labels or certificates
10. Improved energy performance of building components and systems

Appliances and Equipment

11. Mandatory MEPS and labels for appliances and equipment
12. Test standards and measurement protocols for appliances and equipment
13. Market transformation policies for appliances and equipment

Lighting

14. Phase-out of inefficient lighting products and systems
15. Energy efficient lighting systems

Transport

16. Mandatory vehicle fuel efficiency standards
17. Measure to improve vehicle fuel efficiency
18. Fuel-efficient non-engine components
19. Improved vehicle operational efficiency through Eco-driving and other measures
20. Transport system efficiency

Industry

21. Energy management in industry
22. High efficiency industrial equipment and systems
23. Energy efficiency services for small and medium enterprises
24. Complementary policies to support industrial energy efficiency

Energy Utilities

25. Energy utilities and end-use energy efficiency

IEA 2012

Energy Efficiency Data Collection and Indicators

- **Why?**
  - Understand where energy is consumed and support decision-making
  - To set targets and to monitor impacts
  - To forecast energy use across sectors & end uses
- **What?**
  - Energy Balances
  - Energy consumption per sector
  - Energy consumption per unit of activity
  - IEA's Energy Efficiency Indicators Template (available online)
- **How?**
  - Plan / Funding / Budget / Human Resources
  - Surveys / Inter-Governmental & Private-Public Collaboration

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Module 2
Intervention design and potential savings calculation

Decomposition Analysis

… how to get started? Energy equations

$$\text{generic energy efficiency indicator} = \frac{\text{energy consumption}}{\text{activity}}$$

$$\text{energy consumption} = \text{generic energy efficiency indicator} \times \text{activity}$$

$$\text{Total energy consumption} = \text{generic energy efficiency indicator} \times \text{Sub-sector or end use activity} \times \text{Sub-sector or end use share of total activity}$$

Generalised 3-factor energy equation

$$E = \sum_i^n A \cdot \frac{A_i}{A} \cdot \frac{E_i}{A_i} = A \cdot \sum_i^n (S_i \cdot I_i)$$

i subsector or end-uses within a given sector

Aggregate activity A
value-added for manufacturing industry and services; population in the household sector; or as passenger-kilometres and tonne-kilometres, respectively, for the passenger and freight transport sectors

Sectoral structure S
mix of activities within a sector and further divides activity into industry sub-sectors, measures of residential end-use activity or transportation modes

Energy intensity I
energy use per unit of activity

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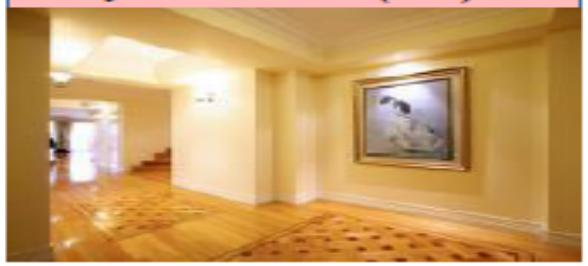
Selected * indicators for the residential sector

energy efficiency indicator = energy / activity

# of dwellings

floor area (m²)



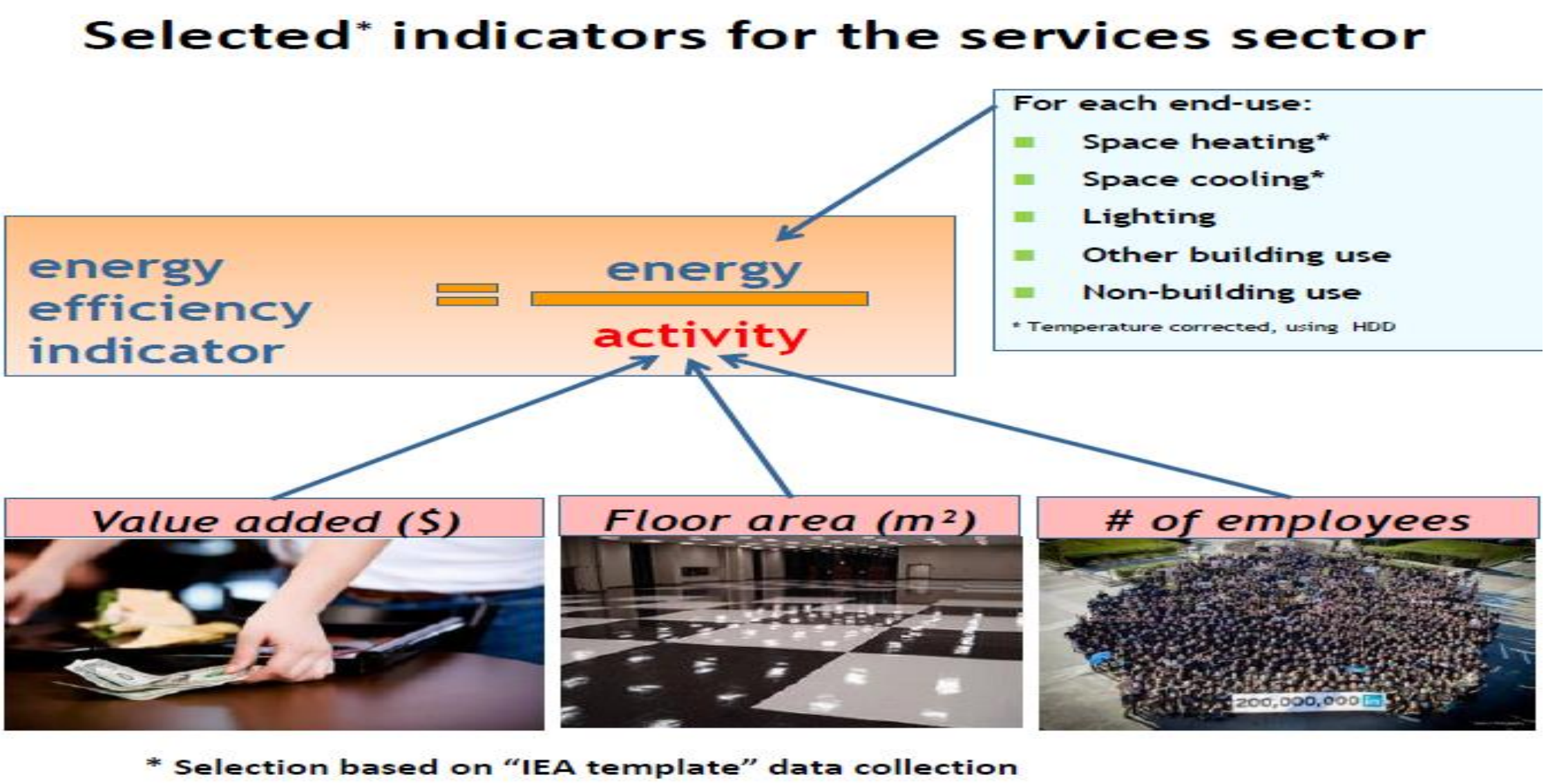
For each end-use:

- Space heating*
- Space cooling*
- Water heating
- Cooking
- Lighting
- Appliances (energy use, stock, diffusion)
  - Refrigerator
  - Freezer
  - Dishwasher
  - Clothes washer
  - Clothes dryer
  - TV
  - Computers

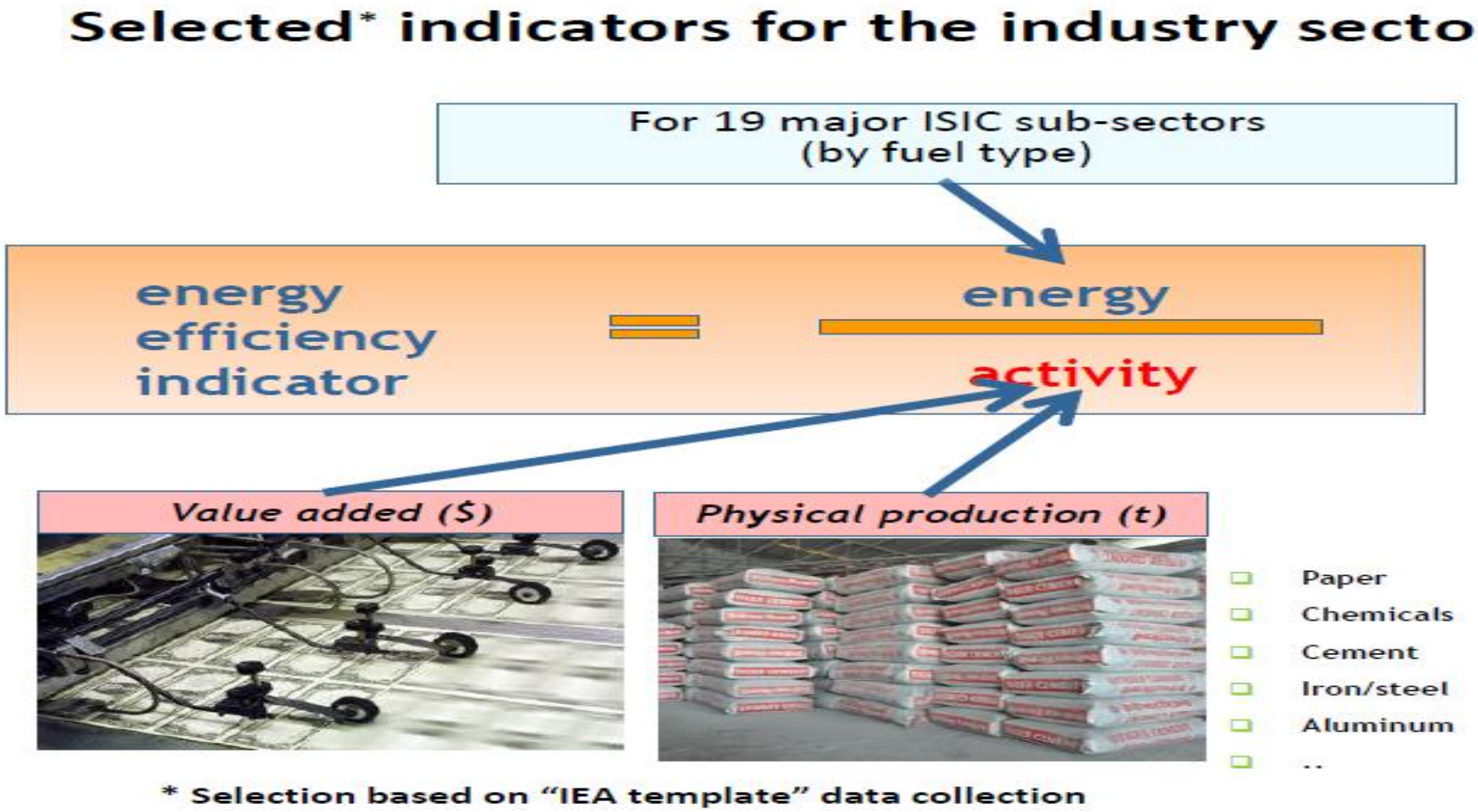
* Temperature corrected, using HDD

* Selection based on "IEA template" data collection

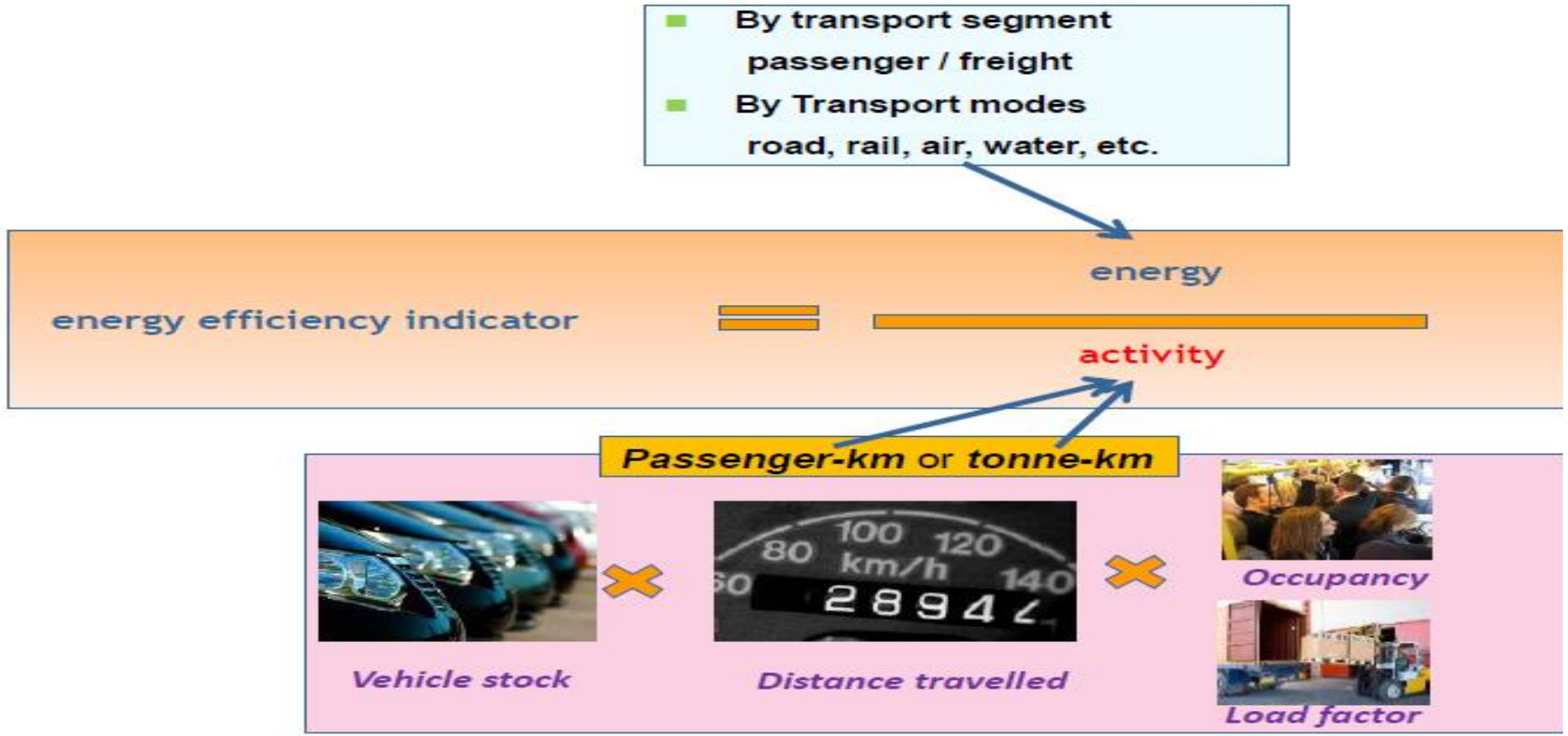
Selected * indicators for the services sector



Selected * indicators for the industry sector



Selected * indicators for the transport sector



* Selection based on "IEA template" data collection

What can be developed depends on availability of data

	What data are available
Industry	Energy use + Physical production by sub-sector (iron/steel, paper, etc.)
Residential	Energy by end-use (space heating appliance, etc.) Households, dwellings, floor area, degree-days, appliance stocks,…
Services	Energy by end-use
Transport	Energy use and activity data (pkm/tkm) by segment (passenger/freight) and mode (road, air,…) by vehicle type

Toward the Goals and Action Plan

National target setting

Purpose of Targets

- **Set direction for Energy future**
- **Increase awareness of Energy Efficiency**
- **Build Political and Public consensus**
- **Mobilize stakeholders**

Examples of Energy Efficiency Targets

Targeted rate of Energy Savings or efficiency improvement

Country	Sector	Nature of Target	Target	Target Year (s)
Croatia	Final consumers	Energy Savings	14%	2016 (base 2008)
Mexico	Buildings	Energy Savings	16%	2030 (base 2009)
	Appliances/ lighting		52%	
	Industry		12%	

Targeted Specific volume of energy savings (GWh or Mtoe)

Country	Sector	Nature of Target	Target	Target Year (s)
New Zealand	Transport	Energy Savings (volume)	20 PJ/Year	2015
Philippines	Overall	Energy Savings (volume)	150 Mtoe	205-14

Targeted rate of decrease Energy Intensity

Country	Sector	Nature of Target	Target	Target Year (s)
Indonesia	Overall	Energy Intensity reduction	1%/ year	2025
China	Industry	Energy intensity reduction	8%	2020

Guidelines for Determining Target

- ❑ Establish a target-setting process
- ❑ Balance stringency with achievability
- ❑ Frame targets to be simple to monitor
- ❑ Avoid overlapping and competing targets

Guidelines for Achieving Targets

- ✓ Ensure enabling frameworks are in place
- ✓ Ensure adequate resources are committed
- ✓ Clearly communicate and document

EE targets setting

- Define DSM/EE options for major sectors
- Evaluate saving potential, feasibility and **cost-effectiveness**
- Define policy scenarios
- Establish policy targets for priority sector
- Review institutional structure for implementing EE
- Review financing options for DSM/EE
- Develop an integrated strategic framework
- Develop action plan for implementation

Preliminary data analysis

- ✓ Organize historical data
- ✓ What are the patterns and trends?
- ✓ Calculate the Energy/Demand Intensity
- ✓ Correlate consumption with weather/occupancy

Strategies

- ✓ Identify and remove barriers to cost-effective efficiency investments
- ✓ Assess opportunities for energy efficiency improvements and focus on most cost-effective
- ✓ Set clear objectives and timelines
- ✓ Ensure coherence with energy, environmental/climate and economic strategies
- ✓ Adoption of new and emerging technologies

Action Plan

- Concrete activities and projects
- Cost estimates
- Potential funding sources
- Timeframes
- Suitable implementing bodies for each recommended activity/project
- Estimated impacts

Discussion Questions

- Why Energy Efficiency: What can it deliver?
  - The benefits

- How do governments promote energy efficiency?
  - The barriers
  - The policy

- How do governments deliver energy Efficiency policy?
  - Governance
  - Evaluation

Conclusion

- Energy efficiency is crucial to reduce energy consumption as well as promote competitiveness and increased productivity
- Systematic energy management is one of the most effective approaches to improve energy efficiency
- Package of policies like regulation, standards, incentives etc. are needed to tap saving potential
- Much can be learnt best practices and mistakes in other countries

Now we know what the Energy Audit is!

So How??

How to design?

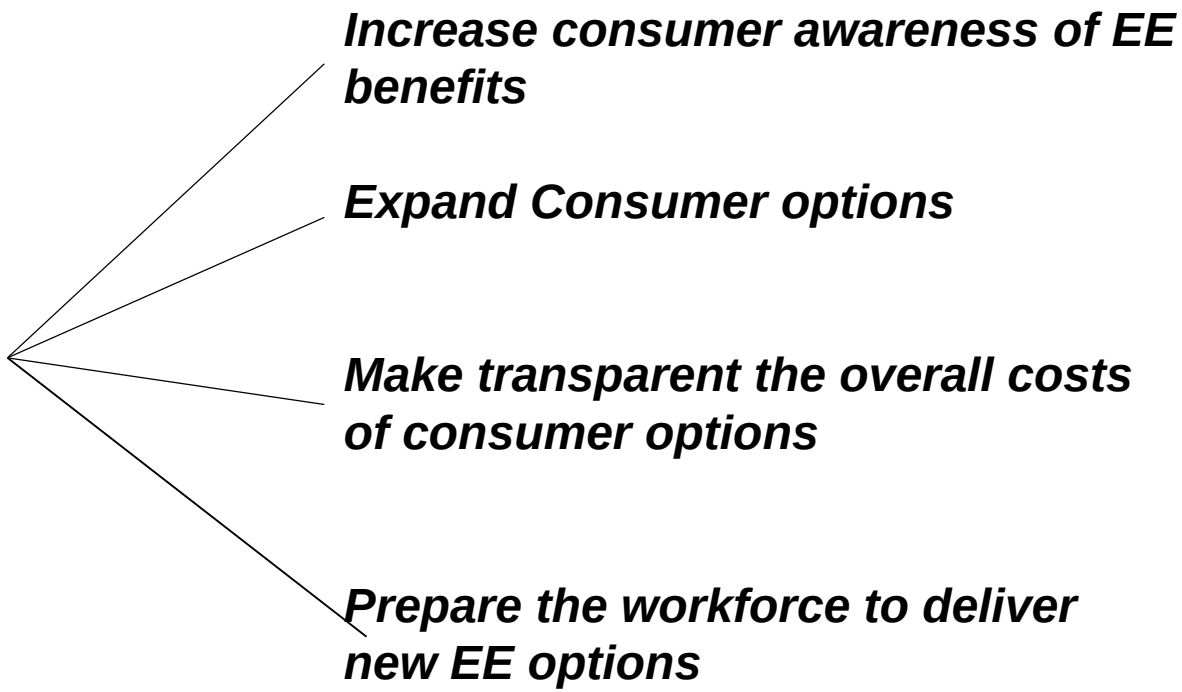
How to analyze?

How to calculate the savings?

Information & Communication Measures

Labeling ---------- Public Awareness Campaigns ---------- Training

Objective of information and communications methods



Labeling Schemes

Labeling ---------- **Public Awareness Campaigns** ---------- **Training**

- **Reduces information barriers**
- Performance labels (comparative labels) convey the relative energy efficiency of a product

  --Typically expressed as a sliding scale

  -- Mandatory (more effective) or voluntary

  -- Usually conferred/ verified by government-sanctioned entity
- **Endorsement labels applied to "top performing" products**

  -- Typically voluntary

Labeling Schemes

Labeling ---------- **Public Awareness Campaigns** ---------- **Training**

- **Benefits of labeling schemes**

--Consumers can easily compare product costs

-- Draws consumer attention to EE as financial criterion for purchasing decisions

-- Gives manufactures incentive to improve products' EE and introduce new, efficient products to distinguish themselves from competitors

- **Common practice to start with refrigerators and air conditioners and then move to other products**

Public Awareness Campaigns

Labeling ---------- Public Awareness Campaigns ---------- Training

- Labels ⟹ information
- Awareness campaigns ⟹ encouragement
- Public awareness campaigns let consumers know about particular opportunities to save energy and money by making smart choices
- Changes in consumer behavior can achieve upwards of 20% energy savings through small changes in conservation habits, lifestyle, and purchasing decissions

Public Awareness Campaigns

Five stages of effective public awareness campaigns

1. Context	Policy objectives, regulatory framework, energy prices, consumer patterns, market structure, barriers to EE
2. Planning	Setting goals aligned with policy, choosing target groups, choosing outreach tactics, resource allocation
3. Implementation	Act upon the plan; coordinate with partners and stakeholders; initial launch is critical
4. Monitoring	Detect problems and facilitate corrective action
5. Evaluation	Collect data via baseline, monitoring, and ex-post surveys; evaluate, report and disseminate results

Policy Evaluation and Improvement

Evaluation is "the process of determining and documenting the results benefits, and lessons learned from an energy efficiency program."
(USA EPA)

Evaluation is not easy. One must measure energy that was not used, which is very difficult to gauge from macro-economic statistics.
-E.g. increased industrial output can easily conceal successful efficiency improvements

Questions to be answered through evaluation of various elements of the policy instrument

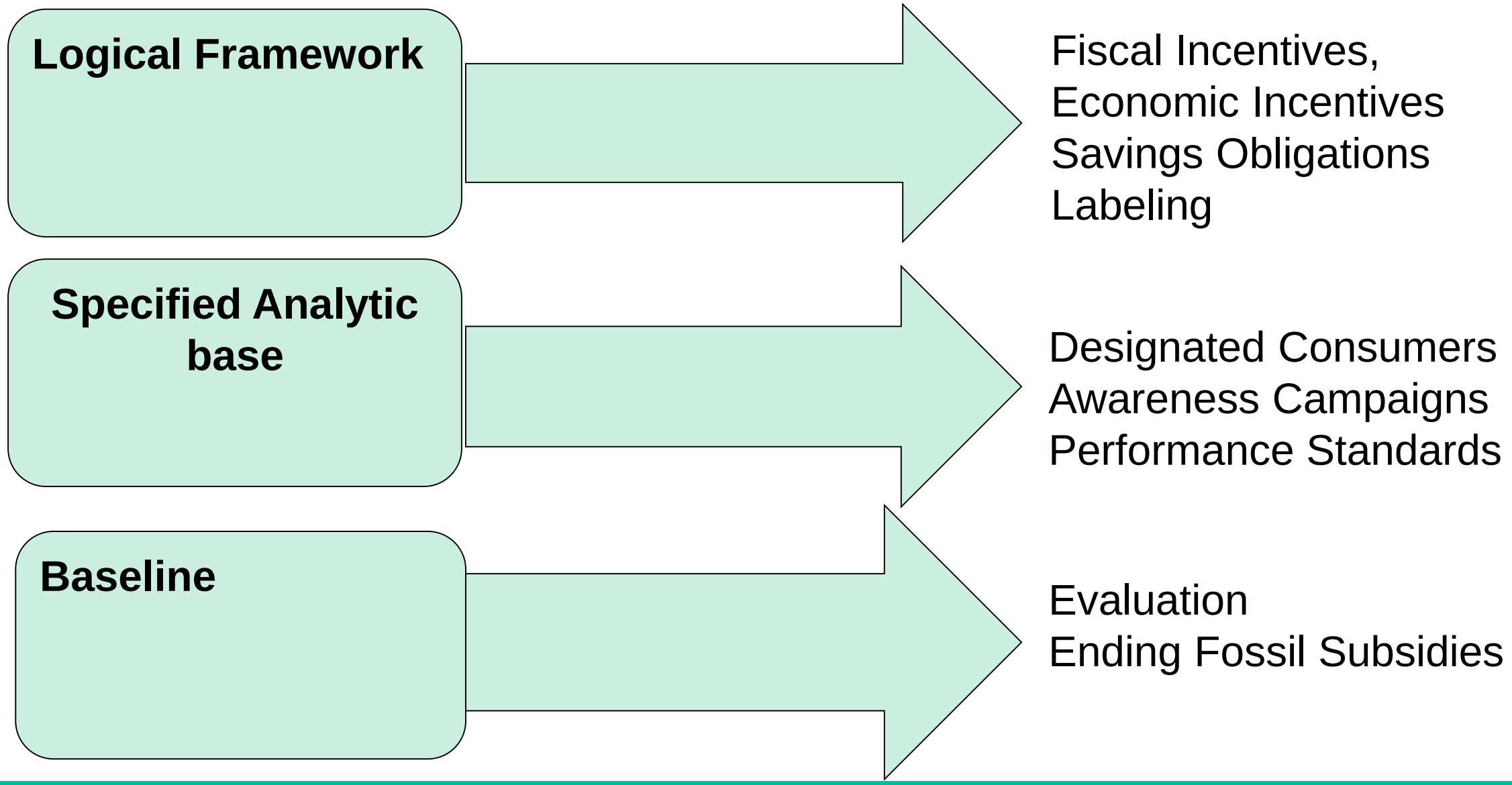
Impact Evaluation
Market Evaluation
Process Evaluation
Cost-Effectiveness Evaluation

Key Components of EE Policy Evaluation

Logical Framework	▪ Stating the relationship between the policy/program and desired outcome
Specified Analytic base	▪ For measuring the success of the policy/program
Baseline	▪ Against which results will be evaluated
Evaluation Strategy	▪ With a level of effort commensurate with the evaluation objective
Results Expressed	▪ In terms of energy savings, emissions reduction, or other standard measures of impact
Calculates Value-For-Money	▪ Benefit-cost or cost-effectiveness analysis

Source: IEA, 2010

Complementary Policies



References

- IEA (2010) Energy Efficiency Governance
- World Energy Council (WEC) (2010) Energy Efficiency: A Recipe of Success
- World Energy Council –ADEME (2010)
- Innovative Communication Campaign Packages on Energy Efficiency
- CLASP website, WWW.clasponline.org
- World Bank (2012) Green Growth: A path to Sustainable Development

Discussions

For each of the following instruments, please write responses in the corresponding boxes that instrument has been implemented (or attempted) in Vanuatu.

Instruments		Write responses in this section only if the corresponding instrument HAS been implemented in Vanuatu.				Write responses in this section only if the corresponding instrument HAS NOT been implemented in Vanuatu		
		Briefly describe the key components of the instrument and how it has been implemented	What have been the main challenges and how have these been addressed?	What have been the main outcomes?		What would be the main benefits of implementing the instrument in Vanuatu?	What would be the main challenges to address?	How would you address these challenges?
Minimum Energy Performance Standards								
Regulations for Designated Consumers								
Building Energy Codes								

Discussions

Choose any information-based or market-based instrument currently active in Vanuatu. Research the instrument's history of implementation. How is the success of this instrument monitored and evaluated? (If there is no evidence of monitoring and evaluation, propose a basic methodology for monitoring the instrument's success over time). Given the information available, how would you evaluate the success of the instrument? How would you recommend improving the instrument and the system in place for monitoring and evaluation?

Discussions

Let's say that you are put in charge of ***designing and implementing a public awareness campaign in your country*** (or your sub-national jurisdiction). Your mandate is to influence consumer behavior to save energy and cost. You have a limited budget, so you need to focus the campaign on the consumers and the behaviors/decisions which can deliver the most cost-effective energy savings.

A. Which consumers and which behaviors/decisions would your campaign target and why?

B. What tactics would your public awareness campaign use to achieve the greatest effect?

C. Would you use different tactics to target different consumer groups. Why?

D. How would you monitor and evaluate the success of your campaign?

Discussions

For each of the following instruments, please write responses in the corresponding boxes if that instrument has been implemented (or attempted) in Vanuatu.

	Instruments		Write responses in this section only if the corresponding instrument HAS been implemented in Vanuatu.				Write responses in this section only if the corresponding instrument HAS NOT been implemented in Vanuatu.		
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Information & Communication	Labeling schemes								
	Public awareness and information campaigns								
	Training programs								
Market-based instruments	Economic incentives (subsidies, soft loans)								
	Fiscal incentives (tax credits, deductions, exemptions)								
	Energy savings obligations								

Thank You

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