ODA-UNESCO Project for Promotion of Energy Science Education for Sustainable Development in Cambodia

Training Seminar Program

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Theme 4
Energy Efficiency

Part I

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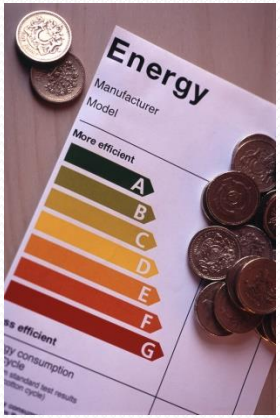
What is Energy Efficiency (EE)?

Energy Efficiency was firstly attracted attention by the economic benefit. Early definition of EE by Lovins (1976): ***using less energy to produce greater economic output***. It is the goal to reduce the amount of energy uses for the same level of activity or products and services. Presently, the beneficial environmental implication from EE is equally stressed.



Images source:
http://www.freeimageslive.co.uk/free_stock_image/energy-rating-jpg
http://captherm.com/improving-efficiency/

Why Energy Efficiency?

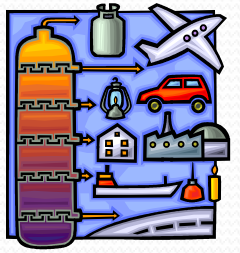
- Energy is extremely important for modern human lifestyle and it becomes critical because:
  - Future energy outlook shows dramatic increase in energy consumption
  - Environmental issues due to fossil fuels consumption
  - Vanishing fossil fuels reserves

- EE have been found and seen as a powerful and cost-effective tool in addressing the energy and environmental issues. ***EE is beneficial both economically and environmentally***!

Why Energy Efficiency?

- Evolution of mankind energy use

Solely relied on the sun, physical power and animals → water power to turn paddle wheels and wind power for transportation and irrigation → Chemical energy stored in materials (wood, charcoal..) → Industrial Revolution of the late 18th Century → Diversify energy resources, especially fossil fuels



Sources:
http://education.jlab.org/jsat/powerpoint/energy_conservation.ppt
Pictures:
http://www.coloradanmagazine.org/wp-content/uploads/2010/05/feature-cambodia-cart-in-rice-field.jpg
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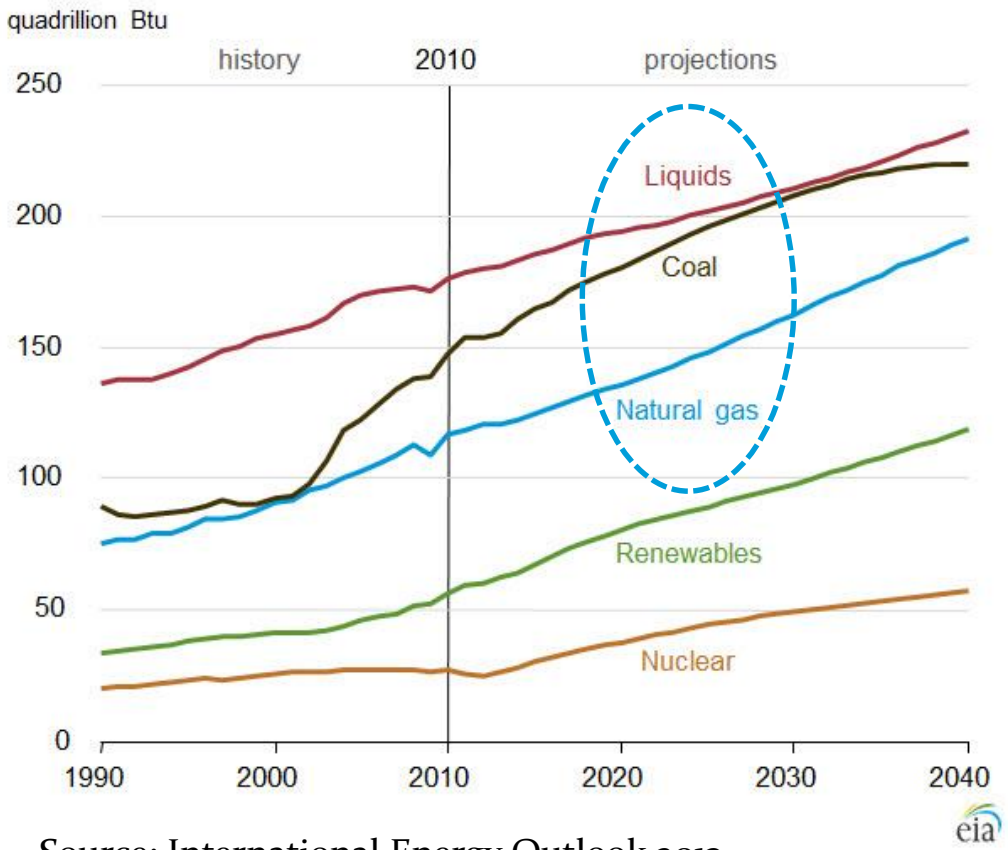
http://www.influx.com.br/blog/2013/10/05/exercicio-expressoes-com-ship-e-boat/

Why Energy Efficiency?

Figure 2. World energy consumption by fuel type, 1990-2040

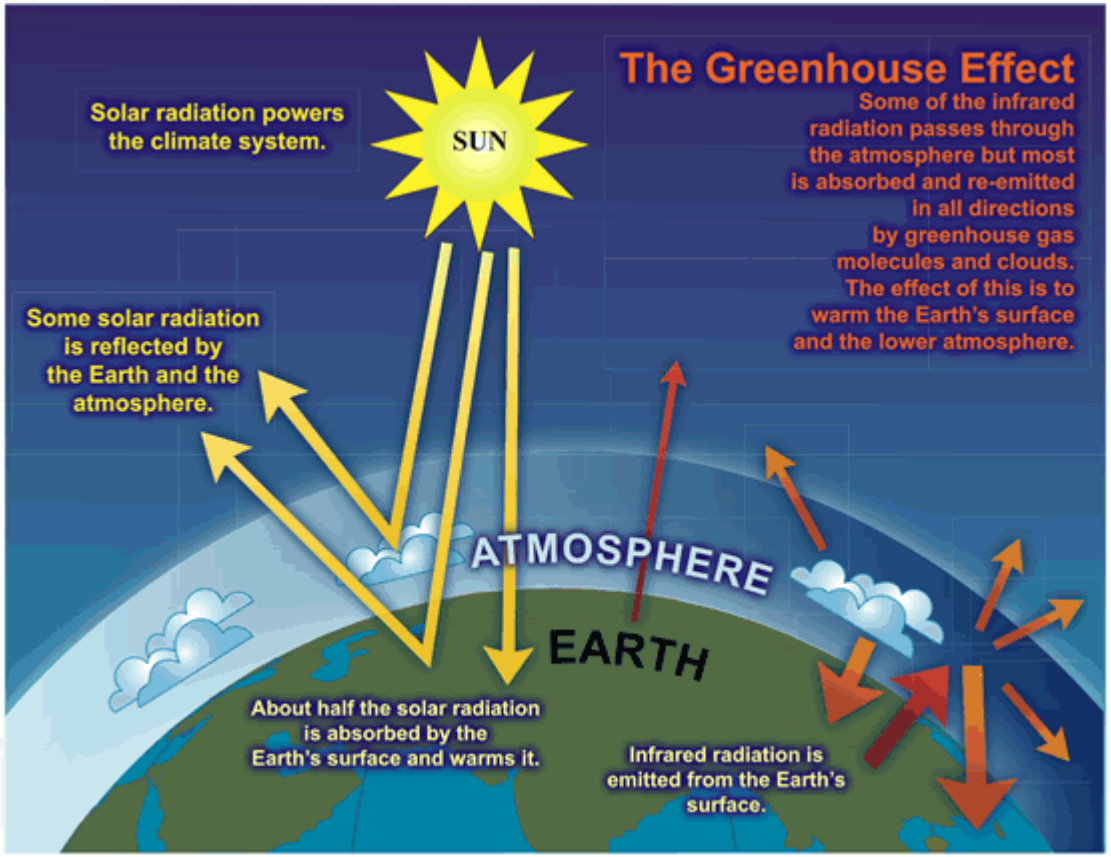


Source: International Energy Outlook 2013

According to IEO2013:

- World energy consumption will grow by **56%** between 2010 and 2040
- **Fossil fuels** remain the largest source of energy, accounted for almost **80%** of supply
- Renewable energy and nuclear power are the world's fastest-growing energy sources
- World industrial sector still consumes over half of global delivered energy in 2040

Why Energy Efficiency?



http://www.uniglobepreferred.co.uk/site/viewhome.asp?aid=27060&sit=89&vty=ARTICLE&tid=16720&sessionid=

Human induced climate change

Increase CO_2 and other GHG in Atmosphere

Greenhouse Effect

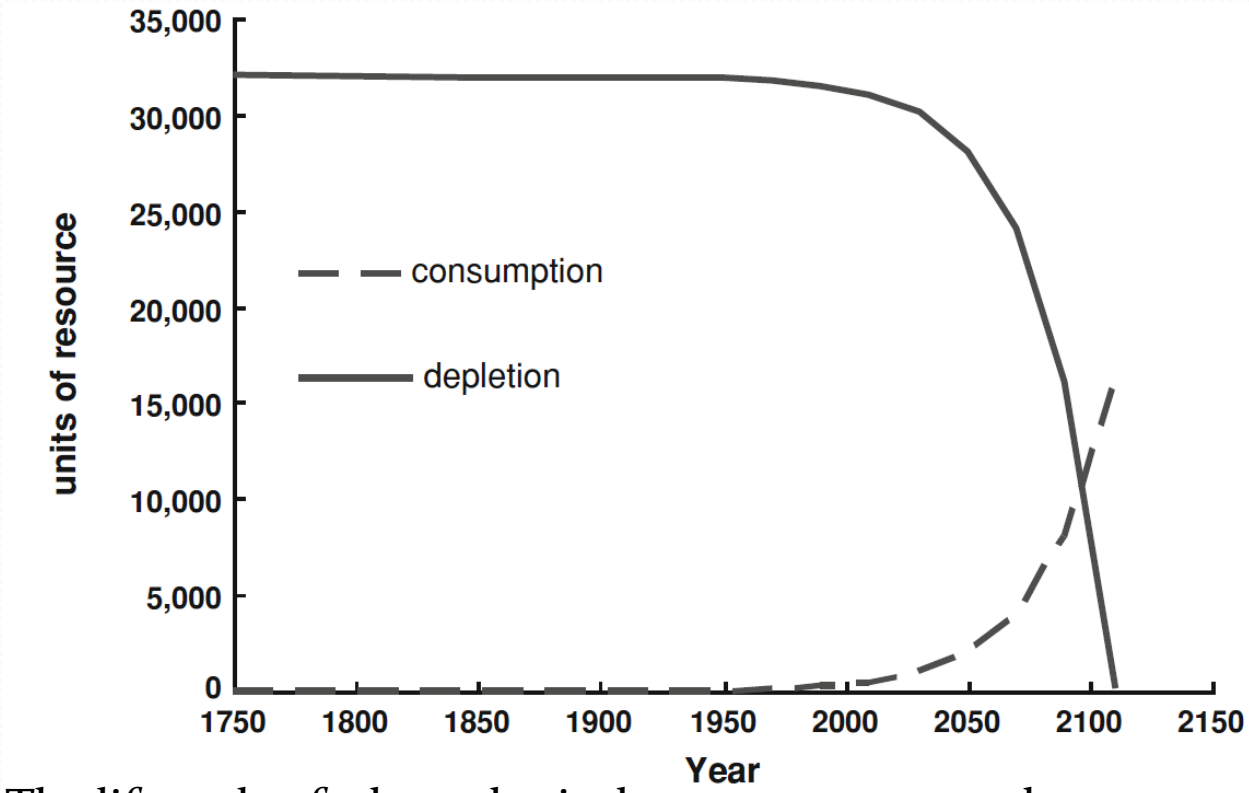
Global Warming

Glacier meltdown

More sever weather events

Rising sea level

Why Energy Efficiency?

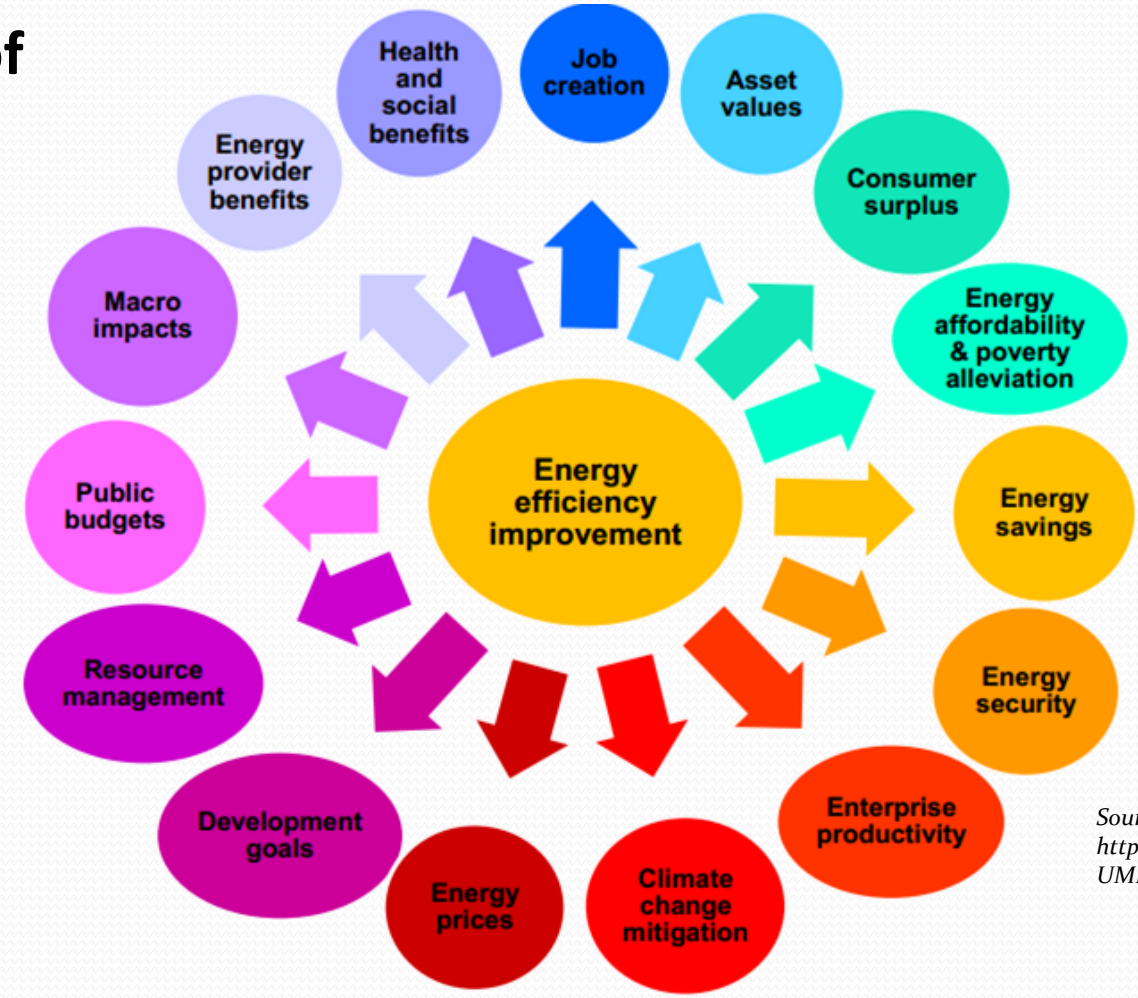


The life cycle of a hypothetical energy resource, whose consumption doubles every 20 years since 1950
Source: Efstathios (2012)

High rate of fossil fuel consumption will accelerate the depletion of these energy resources. The figure is just a **hypothetical** resources of finite total amount, equal to 32000 units. It is clear that the resources will be exhausted in the future and the most significant drop in the proven reserves occurs in the last 20 years of its use.

Why Energy Efficiency?

Benefits of Energy Efficiency



Source: http://eemo.gov.mu/English/DOCUMENTS/EFFICIENCY.PPT

Why Energy Efficiency?

- Benefits of EE, Scope of Cambodia
  - Narrow the gap between supply and demand of electricity
  - Allow businesses, including industries cutting down utility cost and able to offer more competitive products and services.
  - Potentially improve productivity and capacity of local industries because of knowledge transfer from experts to the owners and with introduction and implementation of more effective production processes and high technology tools and equipment.

Energy Efficiency Potential

Technical Potential

- how much saving *technically possible*, without *considering the cost (generally resulting in enormous cost but irrelevant)*
- *e.g. replace all existing equipment with most efficient one instantly*

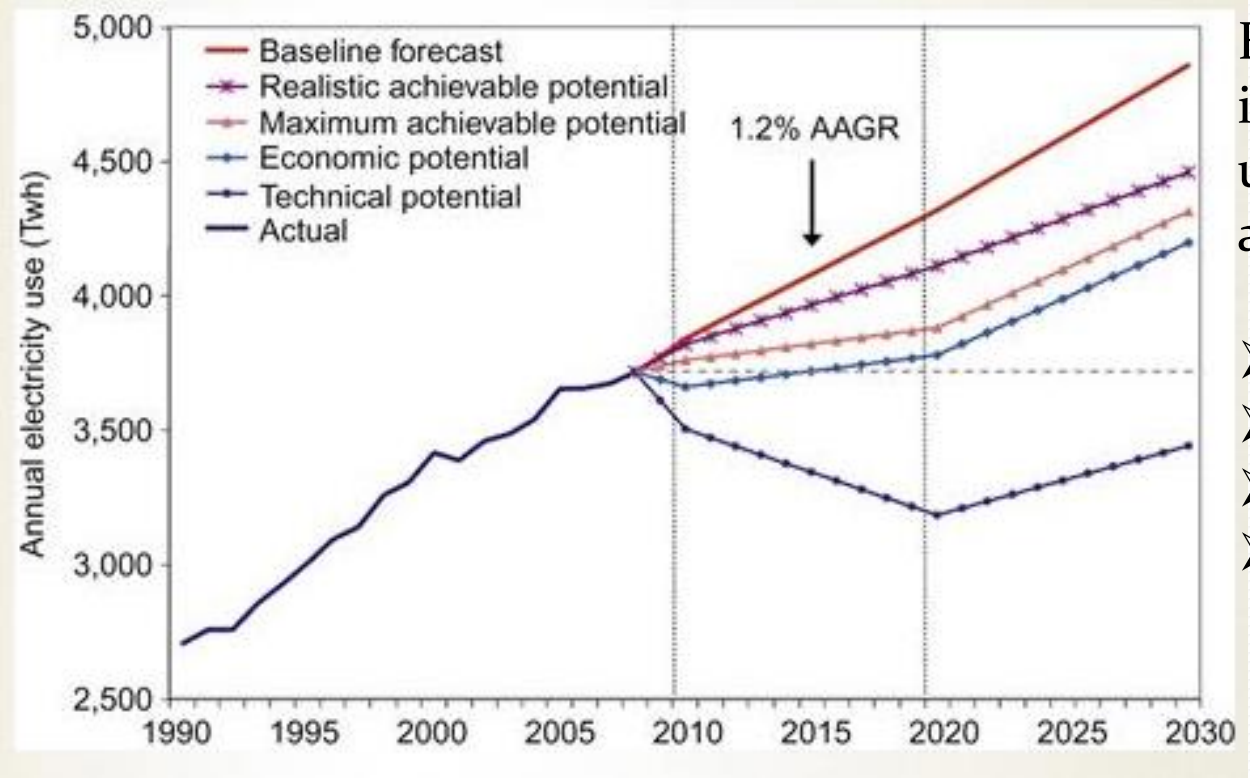
Financial Potential

- Considering the cost to replace existing appliances and it must be economically justified with the expected saving.

Achievable Potential

- Taking into account more factors causing the decrease of level of realization of economically justified EE measure.
- *e.g. difficulty to convince the replacement of working appliances with more efficient ones before it becomes broken.*

Energy Efficiency Potential

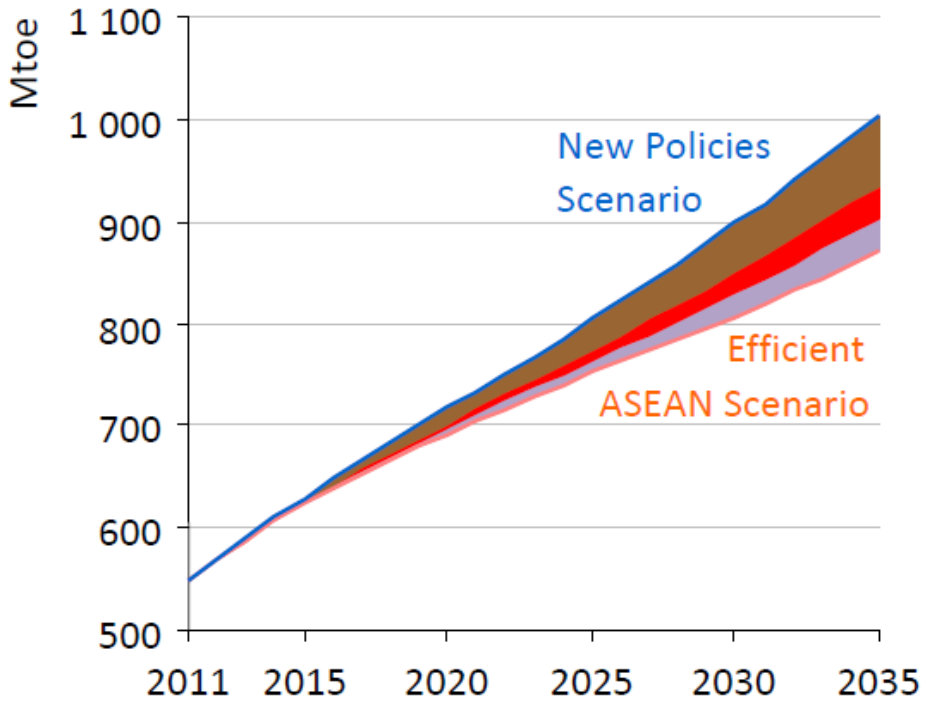


EE potential in the US, in billion KWhrs under different assumptions:

- Realistic achievable
- Max achievable
- Economic potential
- Technical potential

Source: Fereidoon P. S., Energy Efficiency Towards the End of Demand Growth 2013
Based on: EPRI, Jan 2009.

Energy Efficiency Potential



Savings in 2035		
Coal	100	Mtce
Oil	0.7	mb/d
Gas	28	bcm

Economically viable EE measures can cut ASEAN's energy use in 2035 by almost 15%, more than the current energy use of Thailand!

Source: OECD/ IEA 2013

Approaches to EE

Source: http://eemo.gov.mu/English/DOCUMENTS/EFFICIENCY.PPT

Passive EE

- The use of more efficient appliances to perform same function with less input energy
  - *e.g. High efficiency lighting, motor, heat pump ….*

Active EE

- Intelligent use of energy to achieve the same result but less energy spent
  - *e.g. Automation and control to insure optimal functioning of processes*

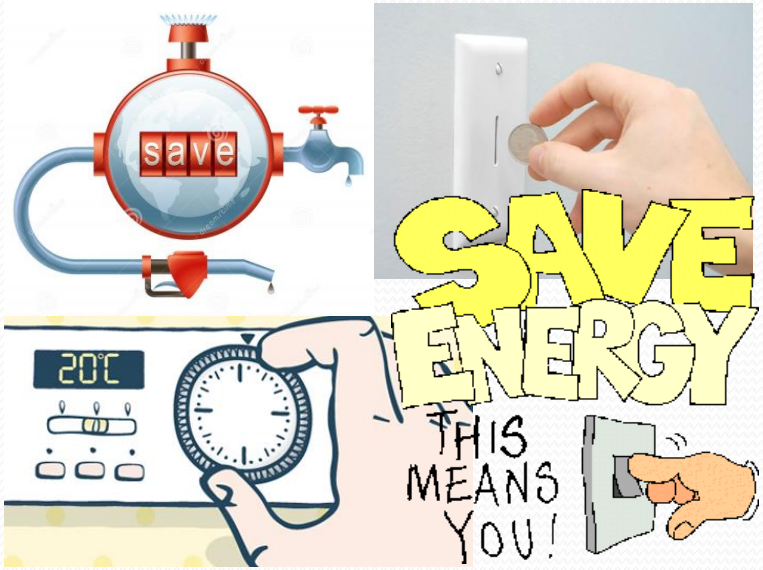
Approaches to EE

Source: http://eemo.gov.mu/English/DOCUMENTS/EFFICIENCY.PPT

- Both EE approaches are needed and they complement each other

  Active EE is needed to maximize and sustain the saving obtained from Passive EE actions

People awareness and behavioral change are the starting point



Images source:
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Thank you for your attention