Energy Security and Other Multiple Benefits of Energy Efficiency

Combining bank project finance and ESCo model to overcome energy efficiency financial barriers and unlock energy efficiency potential. A case-study.

SAPIENZA
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Energy Security: Challenges and Solutions

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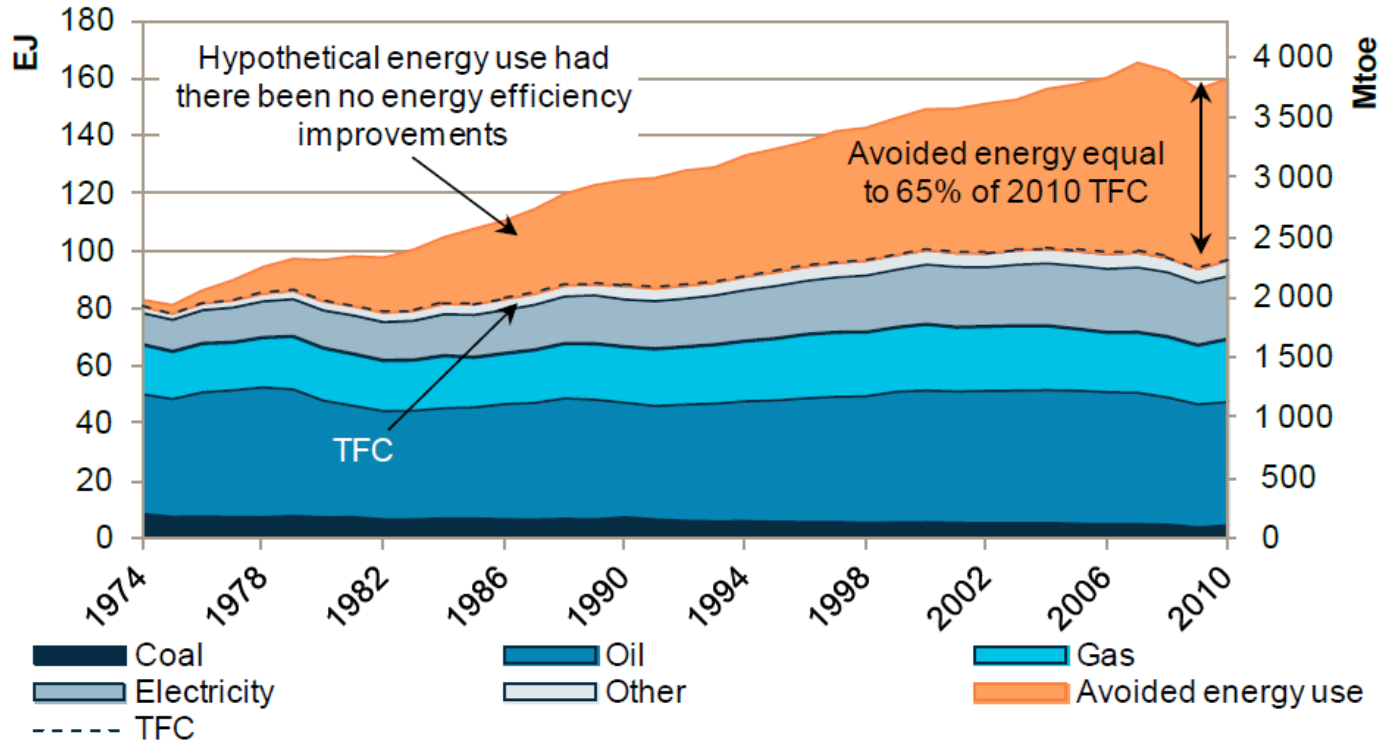
IEA: Energy Efficiency is the «first fuel»

Avoided energy use from energy efficiency in 11 countries is higher than the total annual oil consumption

IEA Calculation
11 IEA Countries
1974 to 2010

Energy efficiency cumulated savings:
1.400 Mtoe
(65% of TFEC in 2010)

Total Oil Consumption in 2010:
1.000 Mtoe



Notes: TFC = total final consumption. The 11 countries are Australia, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom and the United States, those for which sufficient data is available to undertake analysis. "Other" includes biofuels plus heat from geothermal, solar, co-generation and district heating. Co-generation refers to the combined production of heat and power.

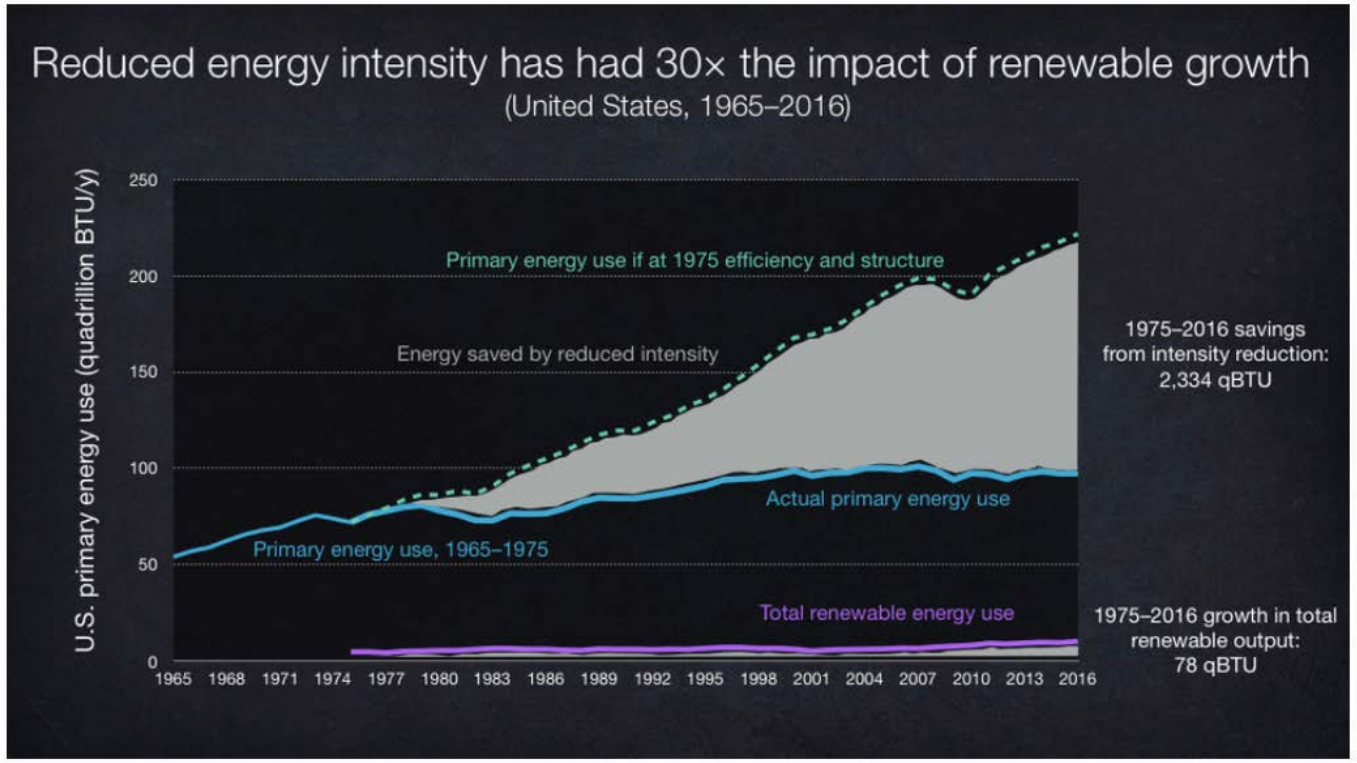
Source: IEA indicators database.

RMI: Energy Efficiency is the «first fuel»

Avoided energy use from energy efficiency covers more than half of the US total annual energy consumption

The energy savings due to the increase in energy efficiency accumulated from 1975 to 2016 cover **more than half of the total annual primary energy consumption** of the USA in the year 2016

1975-2016 savings from intensity reduction (*2334 qBTU*) have an impact more than **30 times greater than the growth of renewables** in the same period (*78 qBTU*)



Rocky Mountain Institute analysis from U.S. Energy Information Administration annual data.

ROCKY MOUNTAIN INSTITUTE

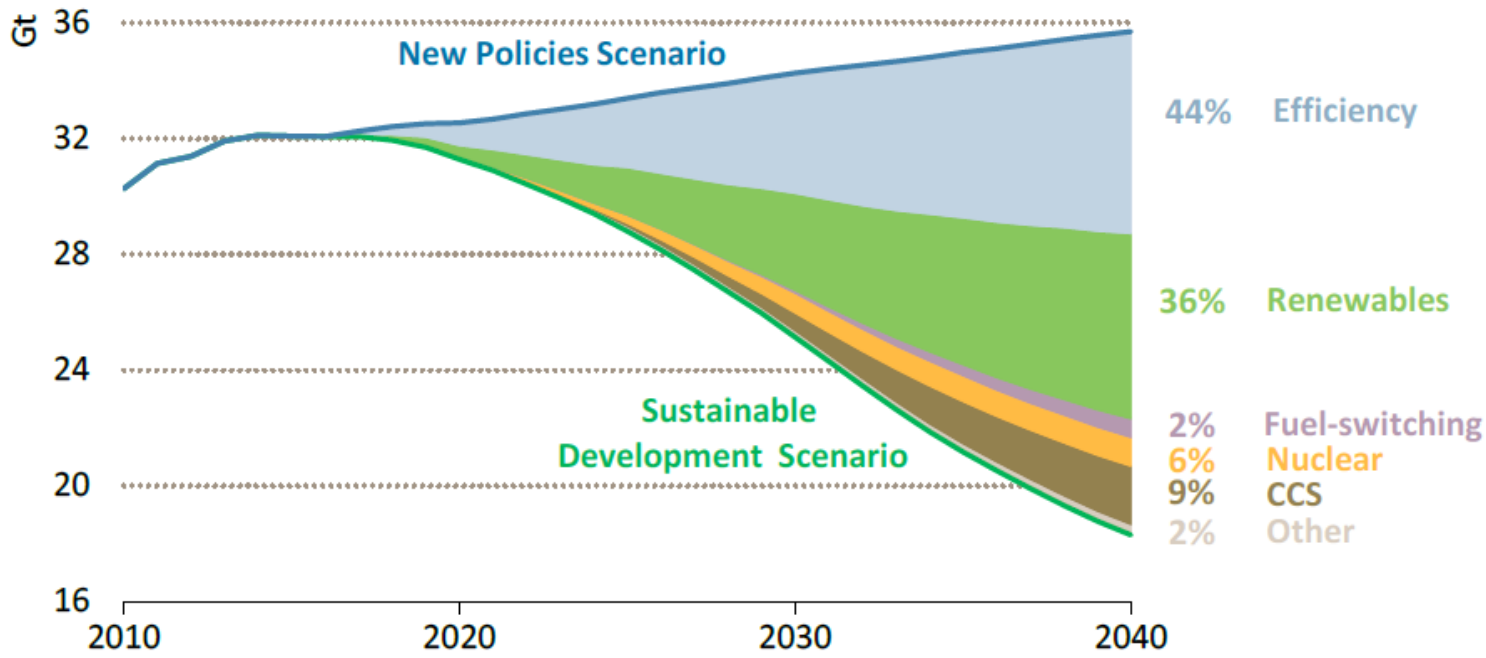
Energy efficiency is the main lever to decarbonize the energy system

In a «2º C» scenario, 40% of the total CO2-eq emissions savings must come from Energy Efficiency

Energy Efficiency's contribution to limiting climate change will be strongest as part of a package of measures, including increasing the supply of renewable energy.

IEA WEO 2017 has shown that when combined with other measures, efficiency will realise **over 40% of the carbon emissions reductions required** to meet global climate change mitigation goals, the largest single contribution.

Global carbon dioxide (CO2) emissions reductions in the IEA WEO 2017 New Policies and Sustainable Development Scenarios



Energy efficiency has to contribute -120 EJ in 2040 to limit climate change

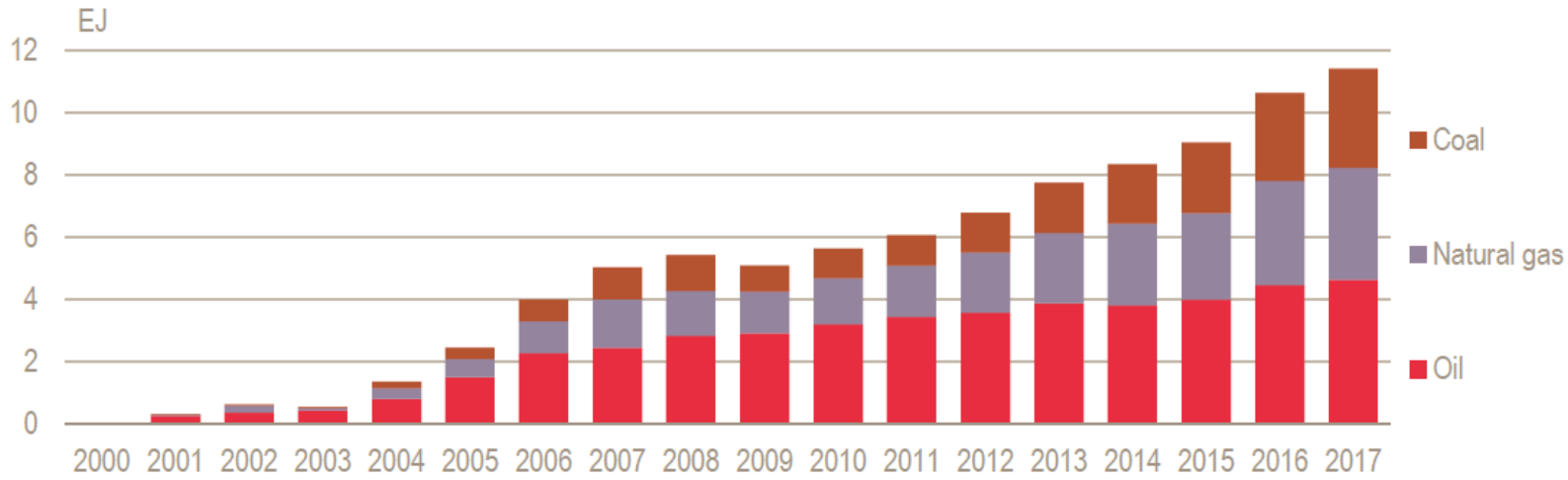
Energy efficiency is crucial for Energy Security and it has Multiple Benefits

Technical energy efficiency and structural changes of the economy are the key to reduce fossil fuels imports

Energy Efficiency's **multiple benefits**:

- Energy Security
  (long-term and short-term, regional scale and national scale)
- Decarbonization
- Pollution prevention and health
- Energy access
- Economy
  (resources optimization, cost reduction, public budget, etc.)
- Society
  (job creation, productivity, modernization, digitization, etc.)

Reduction in fossil energy imports in IEA countries and major emerging economies due to efficiency improvements since 2000 by fuel

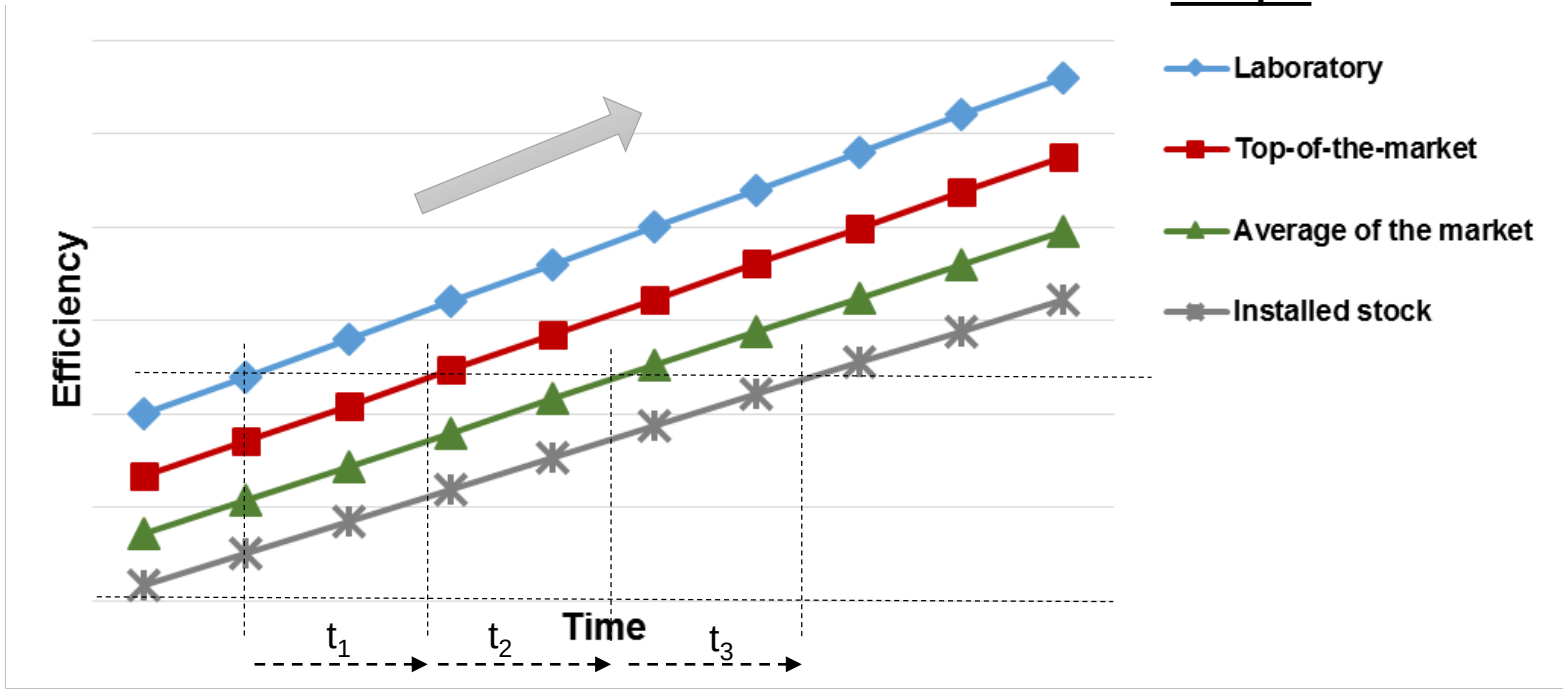


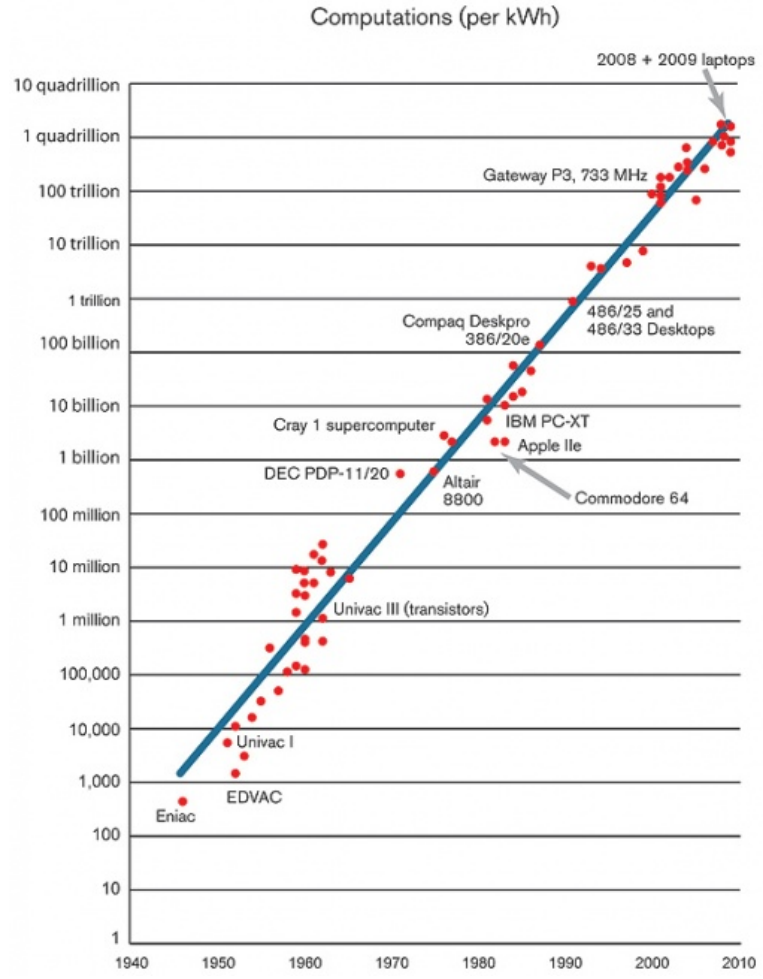
Note: Countries covered are IEA countries plus China, India, Brazil, Indonesia, Russian Federation, South Africa and Argentina.

Avoided energy use from energy efficiency has driven a strong reduction in fossil energy imports in IEA countries and other major economies

Energy efficiency increases “naturally”

But policies/actions are needed to accelerate the increase in energy efficiency





The time to pass from the laboratory to the “top-if-the-market” technology (t_1), or to the market average (t_1+t_2), or to the installed stock (t_1+t_2+t_3) can be reduced through appropriate policies/actions (*incentives, mandatory standards, tax credit, labeling, etc.*)

Some barriers hinder the increase of energy efficiency

Energy efficiency is not the “core-business” of energy consumers, this is the main obstacle

Lack of **Knowledge, Information, Education/Training**
(citizens, operators, public/private managers, contractors, etc.)

Lack of **Financial Resources**
- no-core investments
- opportunity cost of capital
- limited access to outside finance
- no guaranteed performance/payback

Impact over **Operations**
- business interruption
- retrofitting/life cycle integration of EE
- procurement management, business organization

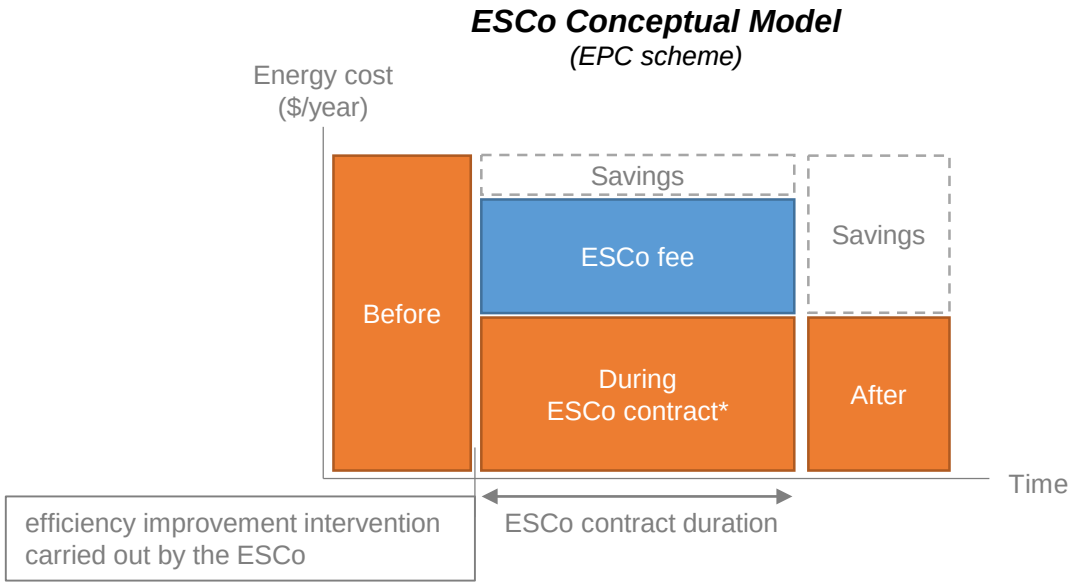
“Hedonic” **Behavior**
(more about waste of energy than energy inefficiency)

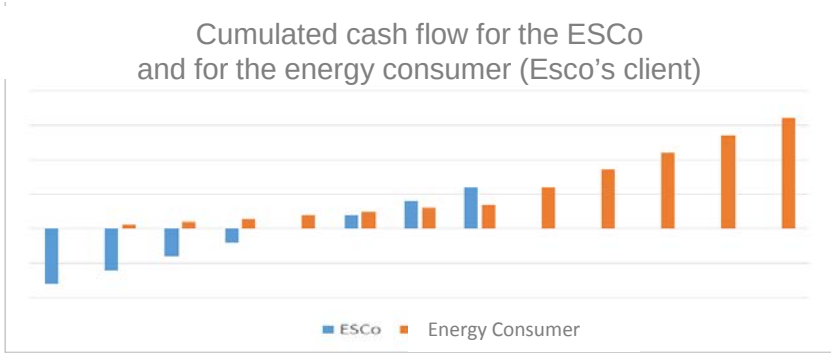
An (apparently) simple model to overcome some barriers to energy efficiency

Outsourcing to Energy Service Companies (ESCO): a Way to Externalize Energy Efficiency Activities and Risks

The ESCO provides the energy efficiency intervention plus a full-service O&M at its own cost and risk, guaranteeing any perfromance during all the service period (5-8 years):

- **Zero investments**/equity for the energy consumer
- **ESCO Fee < Guaranteed Energy Savings**
- Shared Benefits of Energy Savings
  + Modernization/Digitization/Renewal/Retrofitting «for free»
- No uncertainties about O&M costs and performances, neither about pay-back time (**guaranteed performances**)
- Technical Activities and Risk **Externalization** (audit, design, tenders, contractors management, etc.)
- **New services** (es. Demand Response, flexibility, DG, etc.) linked to EE enabled by the presence of an ESCo/aggregator

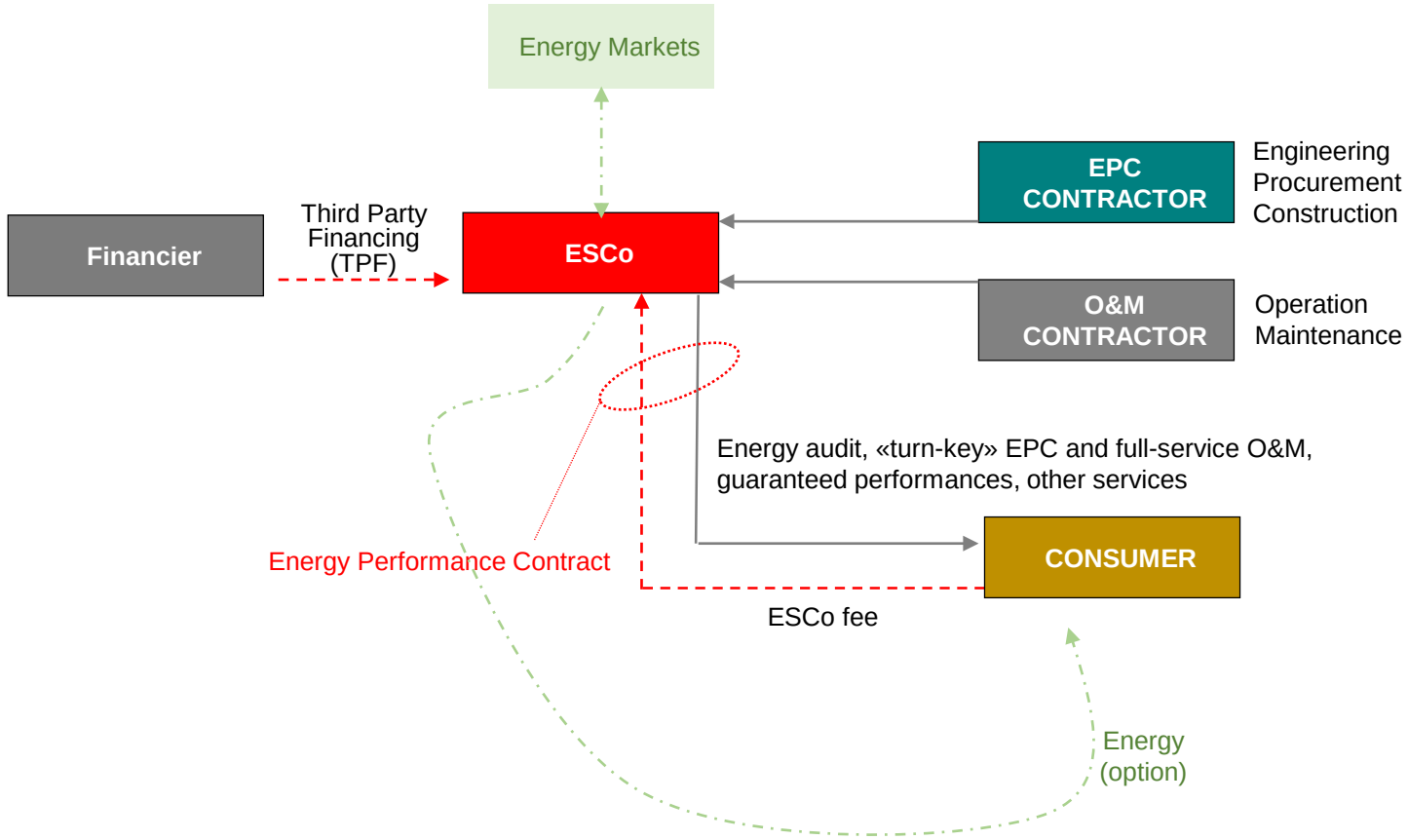




Typical scheme of an energy efficiency project in ESCo model

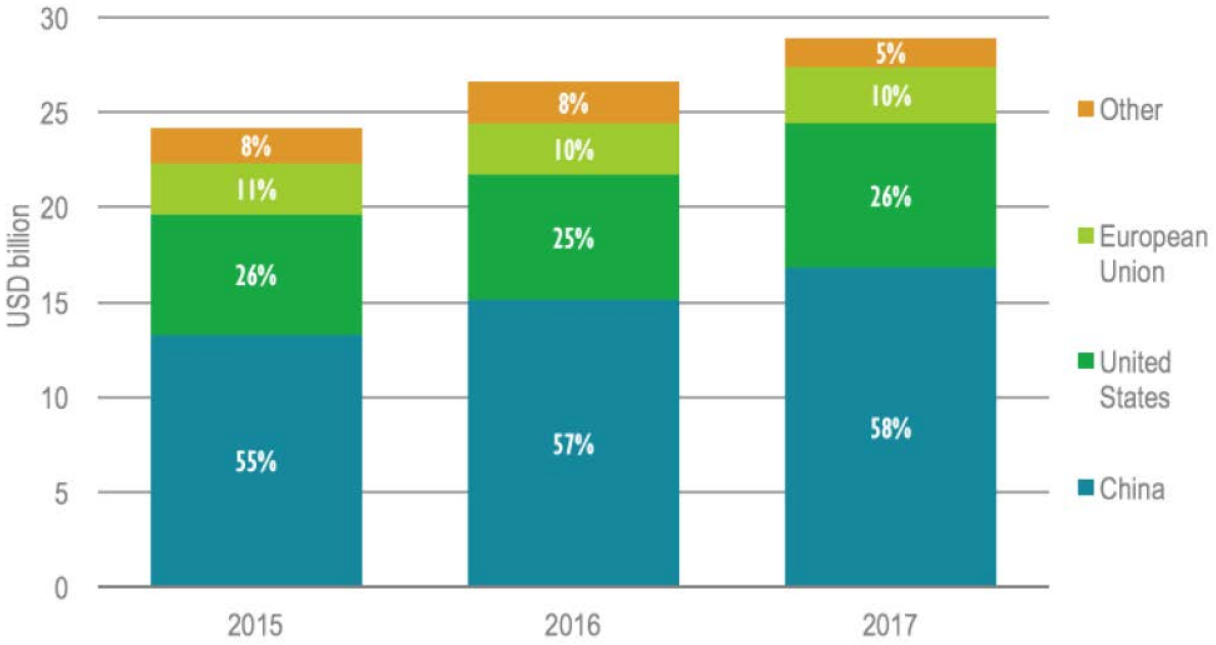
Energy Performance Contract is the most important aspect of an ESCo project

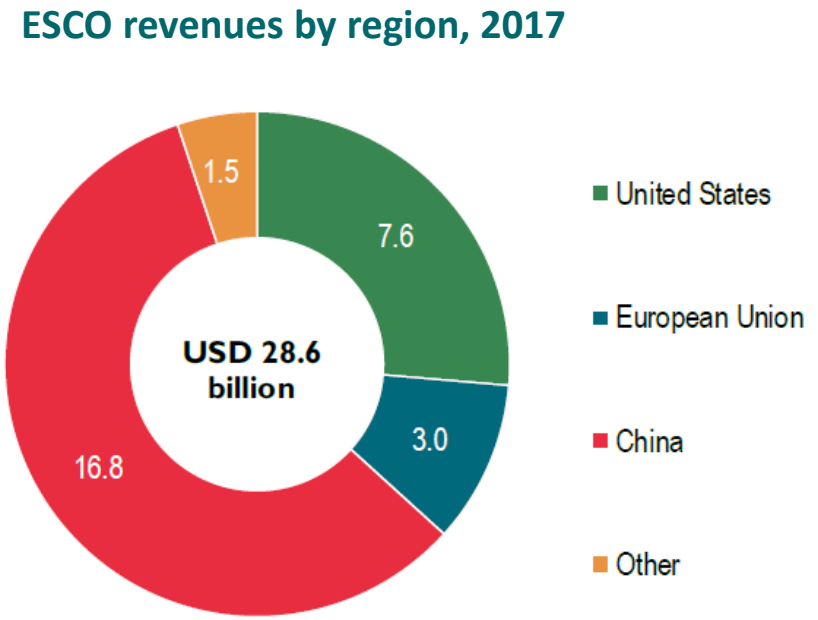
- Energy Efficiency **is** ESCo's core business
- EE Project can be financed by third parties (**TPF**) through the ESCo
- **EPC/O&M services** can be purchased by the ESCo and supplied to the consumer
- **Energy** can be provided to the consumer through the ESCo itself **or** by other energy suppliers (both options are valid)
- EPC (Energy Performance Contract) is different from EPC (Engineering Procurement Construction) ….
- Typical duration: 5 to 8 years



Some figures about ESCo revenues worldwide

Worldwide, ESCo market size exceeds 28 billion dollars (2017), largely dominated by China and US

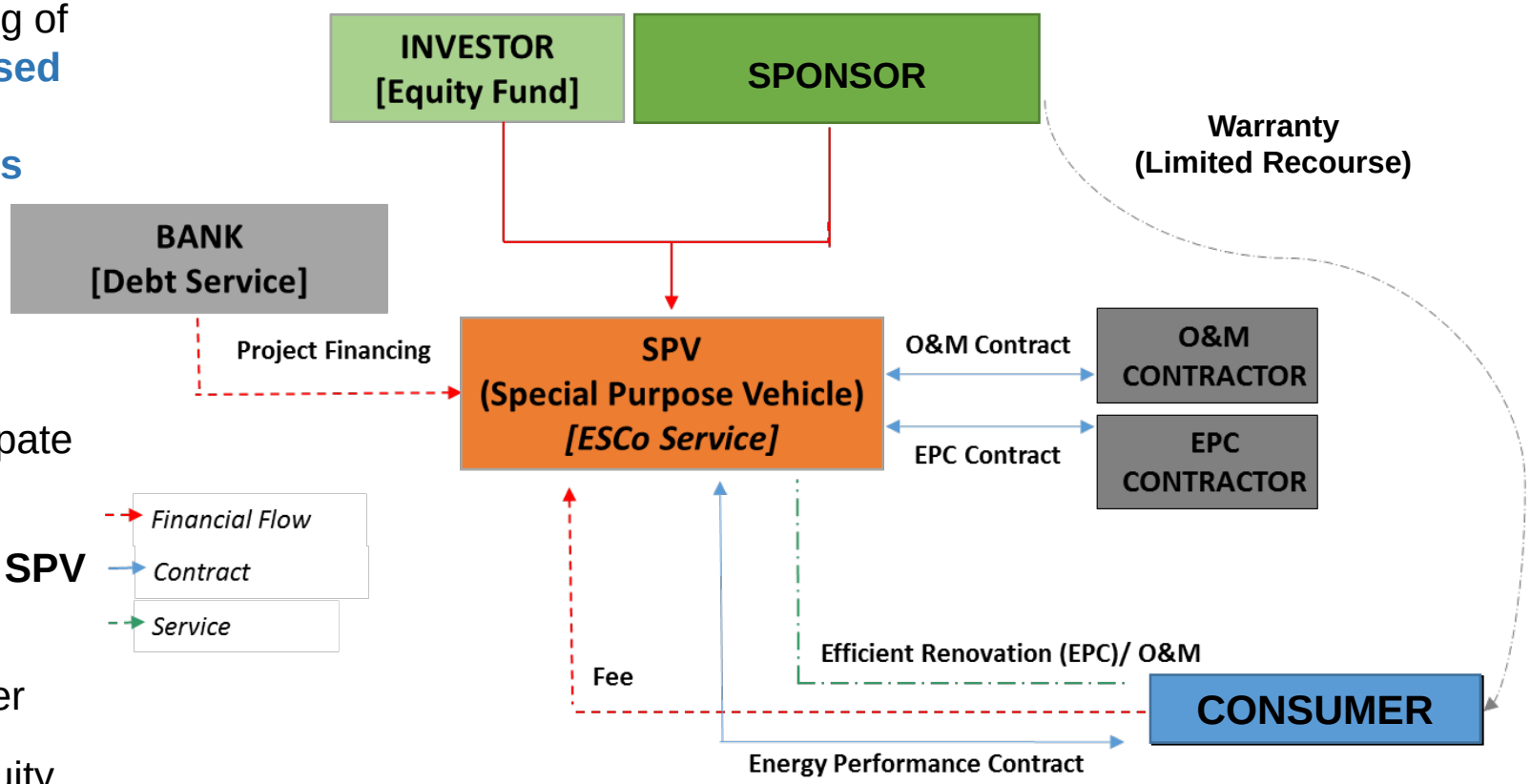




An idea to overcome financial barriers and unlock energy efficiency potential

Combining "limited recourse" project financing bank technique and ESCo model can help to involve the banking system more in energy efficiency projects

- Project finance is the long-term financing of infrastructure and industrial projects **based upon the projected cash flows of the project rather than the balance sheets of its sponsors.**
- Combining the ESCO model and the bank project finance technique can be an effective way to increase the interest of the banking system to participate in energy efficiency projects
- The ESCO services are provided by an **SPV**
- The **Sponsor** could be an ESCo or a corporation controlled by the consumer
- An **investor** can be involved, i.e. an equity fund



An interesting case study: the supermarket sector in Italy

Project Finance has been applied to important energy efficiency projects in the supermarket sector in Italy

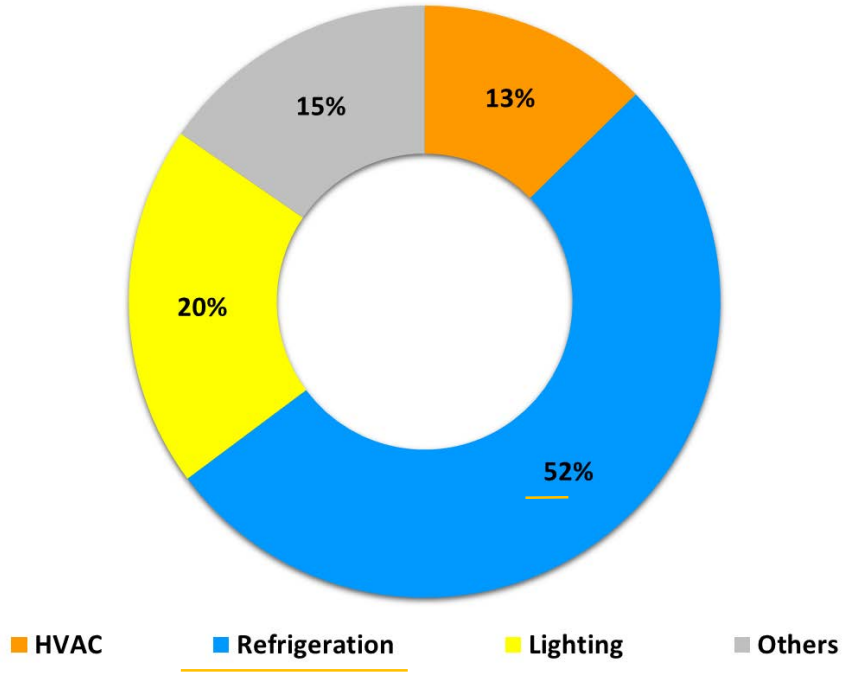
Worldwide, supermarkets consume more than 3.5%
of Total Final Energy Consumptions in Commercial Sector

Total World Electricity Consumption in Supermarkets is **equal** to the Total Italian Electricity Consumption (around **300 TWh/year**)

Supermarket sector is energy intensive due to food refrigeration and the energy consumption structure by service is **peculiar:**

3 services cover more than 80%-90% of the total energy consumption

Typical Supermarket Energy Consumption Structure by Energy Service (Italy)



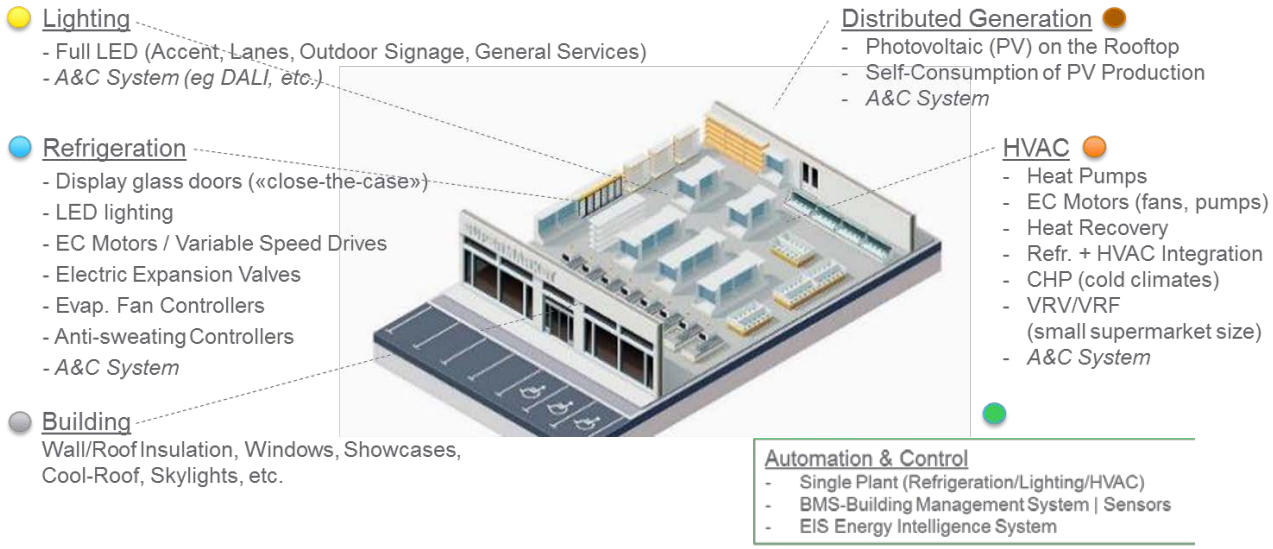
Technology Gap and Potential Energy Saving

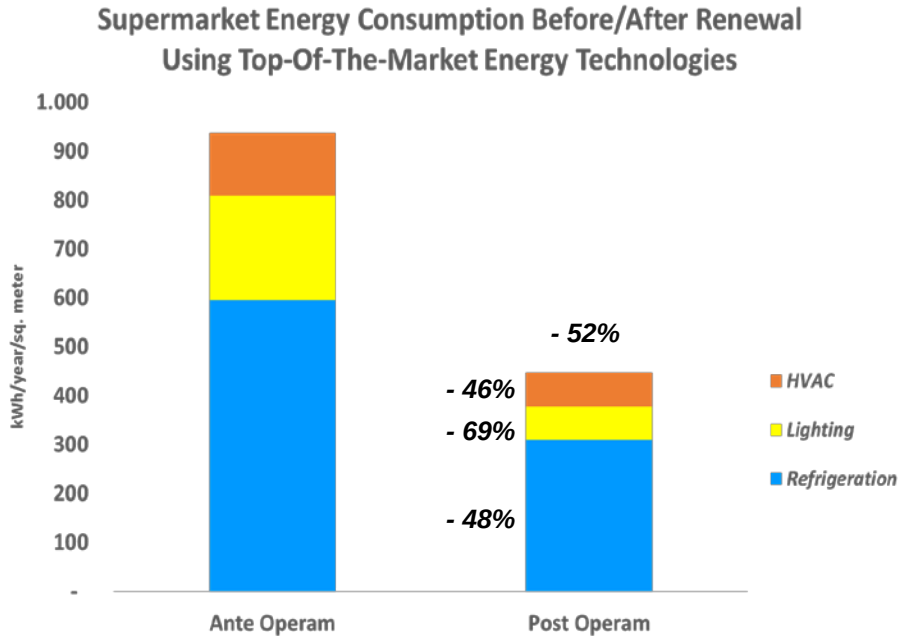
Top-Of-The-Market Energy Technology Allows > 50% Energy Saving

Supermarket average renovation time: every **10-15 years**
(sales network upgrade: 5%-10%/year)

Lighting, Refrigeration, HVAC, A&C: significant **gap** between *top-of-the-market* technologies and installed ones

Huge energy saving potential: about **50%**, convenient and achievable





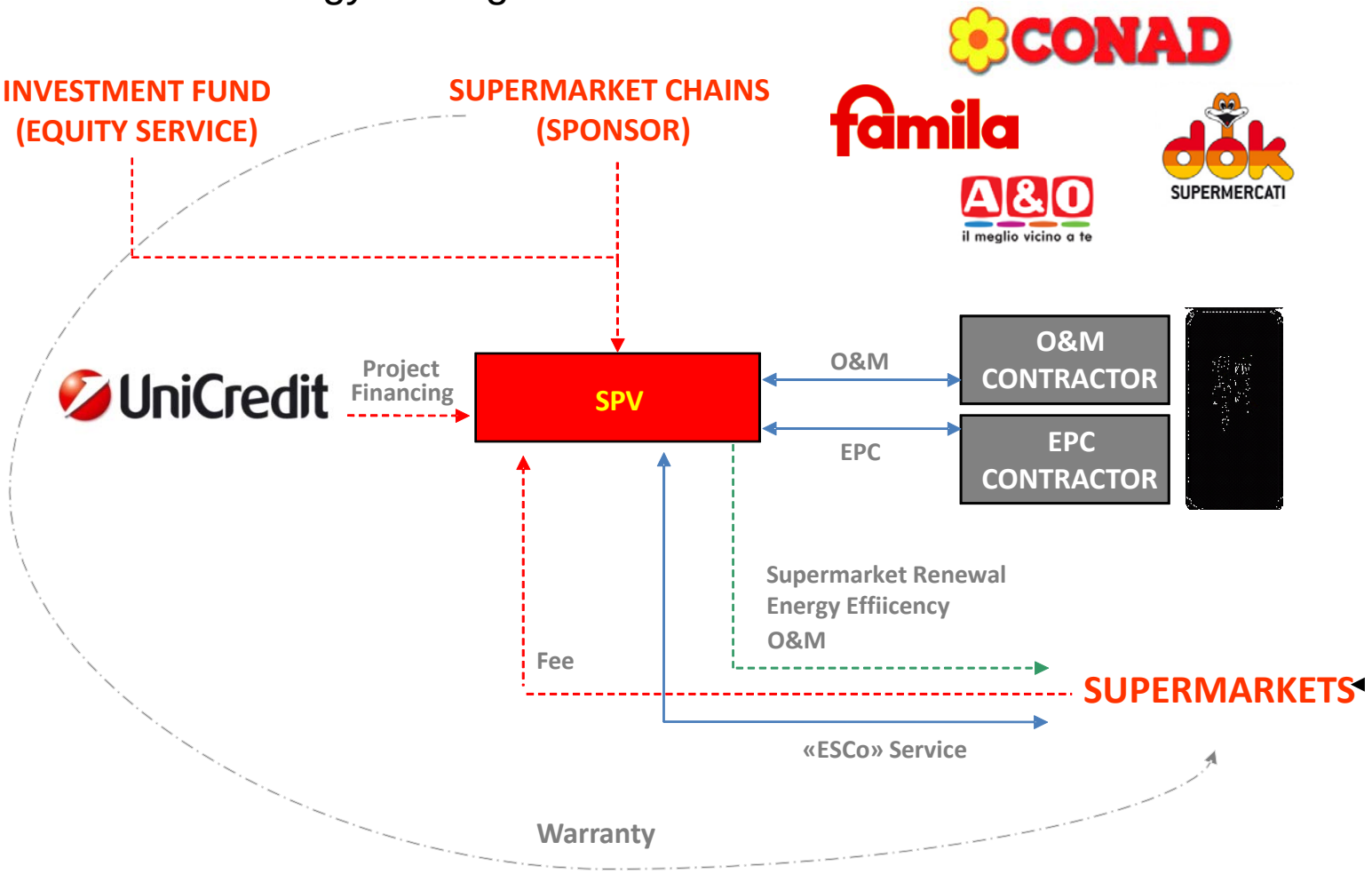
Supermarket based in Rome (Italy)
Fully renewed in 2014 (> 5 years monitoring)

Savings: 60-120 €/y/m^2
1% of sales, but 20% to 100% of EBIT
Energy saving can double supermarkets EBIT
(*Energy Star: in the US, 1$ saved = 59$ increase in sales*)

Project Finance applied to EE projects in 35 Italian supermakets

Top-Of-The-Market Energy Technology Allows > 50% Energy Saving

- **35 supermarkets** (various brands)
- **3 SPVs** (3 different investors)
- **61 M€** total investment (49 M€ debt)
- Debt/Equity: **80%/20%**,
  DSCR < 1.4, WACC < 3%
- PF contract duration: **10 years**
- (Measured) Energy Savings: **-50%**
- End-of-life supermarkets, to be renovated (no stranded costs)
- Supermarket are highly satisfied: they are «smart by design» and measures sale increasing due to the «green» renewal



Conclusion and key messages

1. Energy efficiency is the **1st fuel** and the **1st lever to decarbonize** the energy system, worldwide
2. Energy efficiency has **multiple benefits**: Energy Security, Economy, Society, Environment, Development
3. Energy efficiency increases “naturally” (few percent per year) but policies/actions are needed to **accelerate**
4. Energy efficiency is normally out of the *core-business* and finds cultural, financial and operational **barriers**
5. To externalize energy efficiency services and risks to an Energy Service Company (**ESCo**) is a way to help energy consumers to overcome some barriers, avoiding direct investments and debts, keeping energy efficiency projects *off-balance*, gaining guaranteed savings, modernizing plants, structure and processes
6. Banking **Project Finance** can be combined to ESCo model in order **to involve the banking system more** and than to overcome financial barriers and unlock energy efficiency potential
7. A successful application of this idea, in Italy, in the supermarket sector (*perfectly replicable everywhere and in any sector, with obvious adaptations*) has **demonstrated its feasibility** and the benefits of having banks and investment funds directly involved in energy efficiency projects (in this case, without involving any ESCo)
8. Evidence shows that analysis, policies and measures must take in account the impossibility of separating energy efficiency from the core processes. Life cycle must be considered as well as the total cost of ownership in any energy efficiency project. It is important to maintain an holistic approach to energy efficiency and to direct all efforts towards the implementation of the concept of “***Efficient by design***”, **including energy efficiency in a modernization/digitization strategy**

References

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5. J. Findley, *Growing Energy Efficiency Investments - Global Analysis of Energy Service Companies*, Utrecht University, August 20, 2019 - Master Thesis Energy System Analysis
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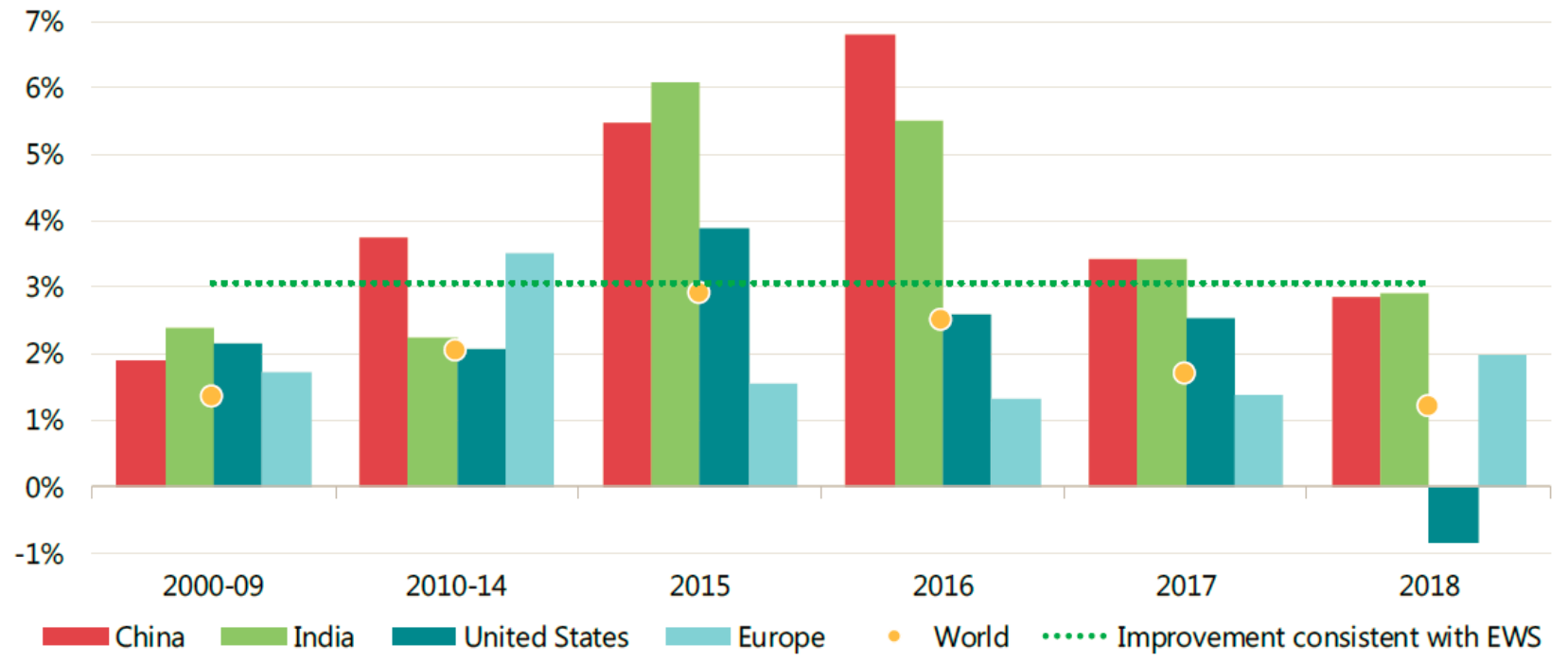
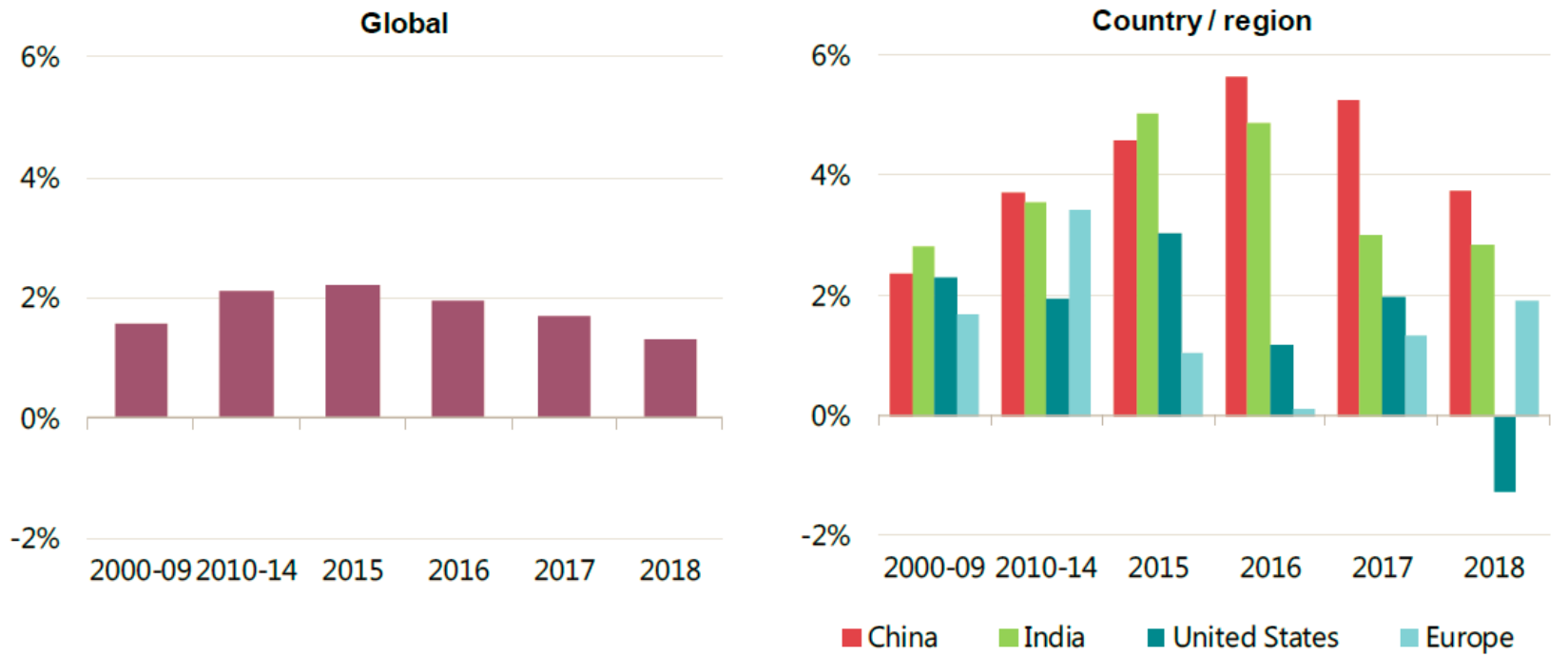
BACK-UP

Primary Energy Intensity Improvement



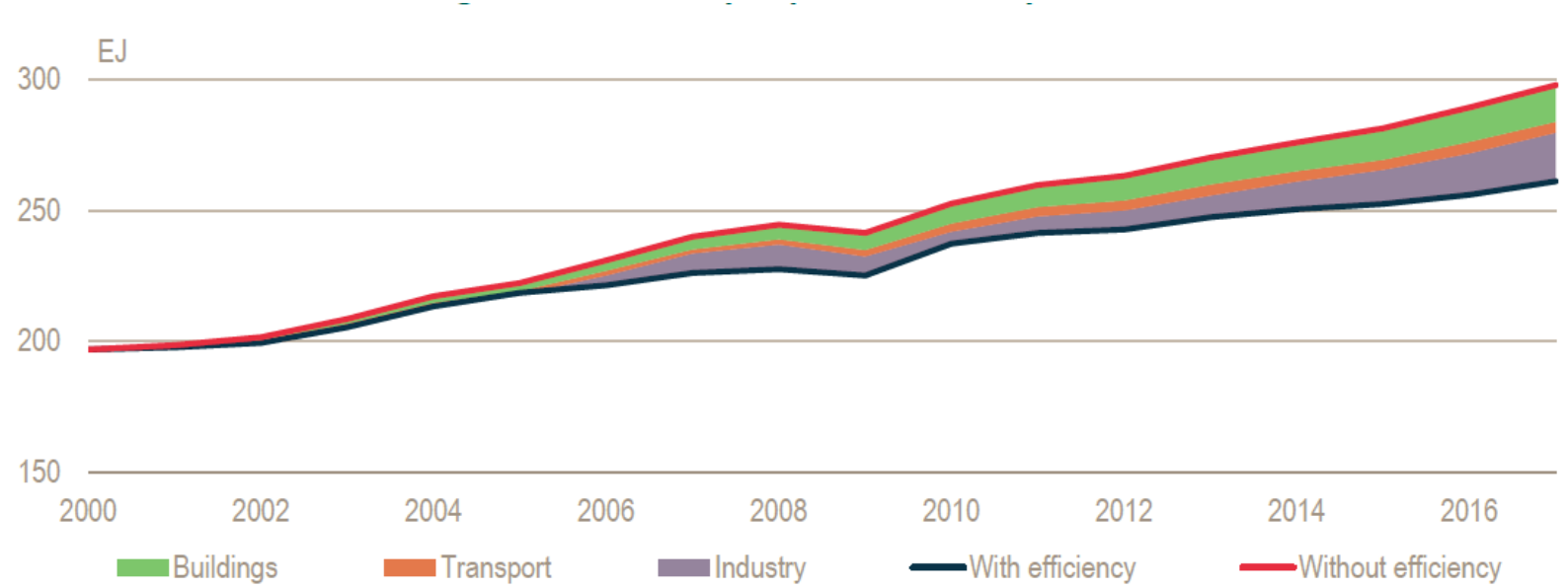
Source: IEA (forthcoming), *World Energy Outlook* 2019; IEA (2019a), *World Energy Balances 2019* (database).

Final energy intensity improvement



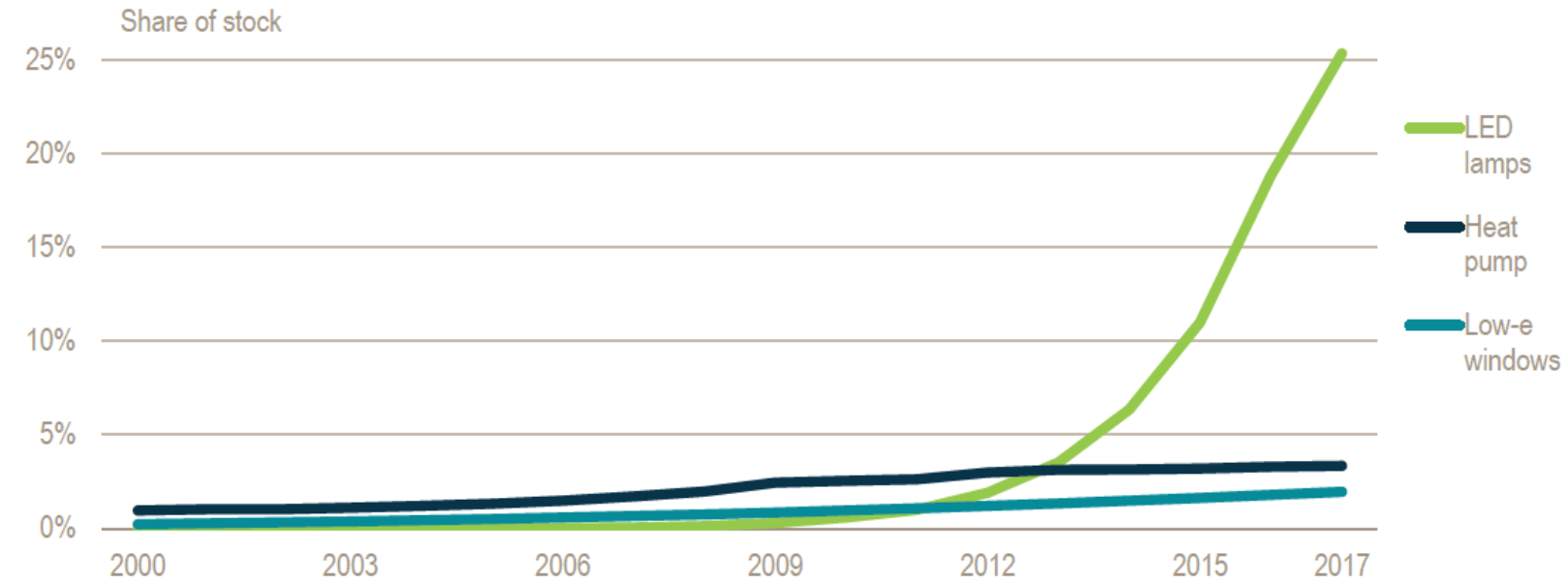
Source: IEA (forthcoming), *World Energy Outlook 2019*; IEA (2019a), *World Energy Balances 2019* (database).

Avoided energy use from energy efficiency from 2000 to 2017: 50 EJ



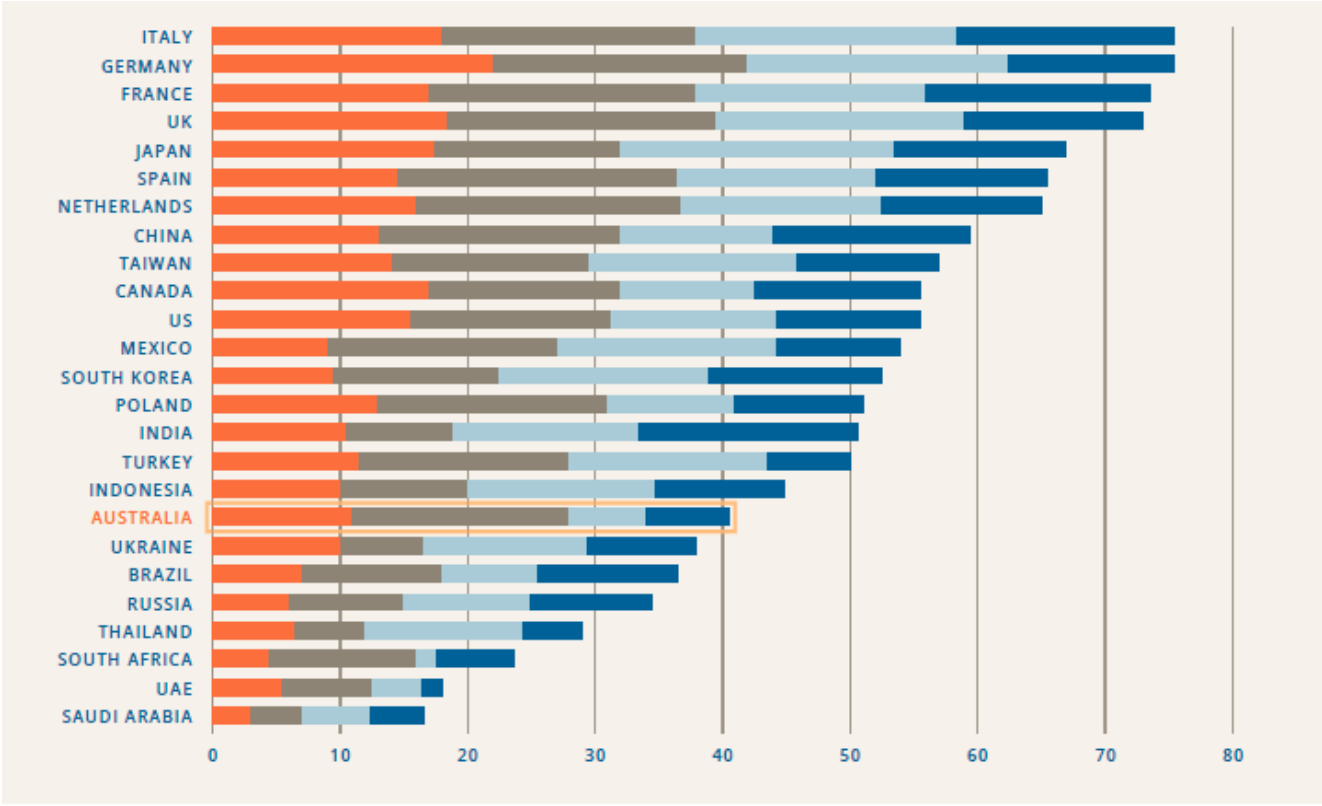
Notes: Left axis starts at 150 EJ. Countries covered are IEA countries plus China, India, Brazil, Indonesia, Russian Federation, South Africa and Argentina. "Energy use" excludes non-energy use (i.e. feedstocks), energy supply and US freight transport (see Chapter 2).

Share of stock in buildings for key energy efficient technologies



Sources: Adapted from IEA *Energy Technology Perspectives* Buildings model (www.iea.org/etp/etpmodel/buildings/) and Selkowitz (2014).

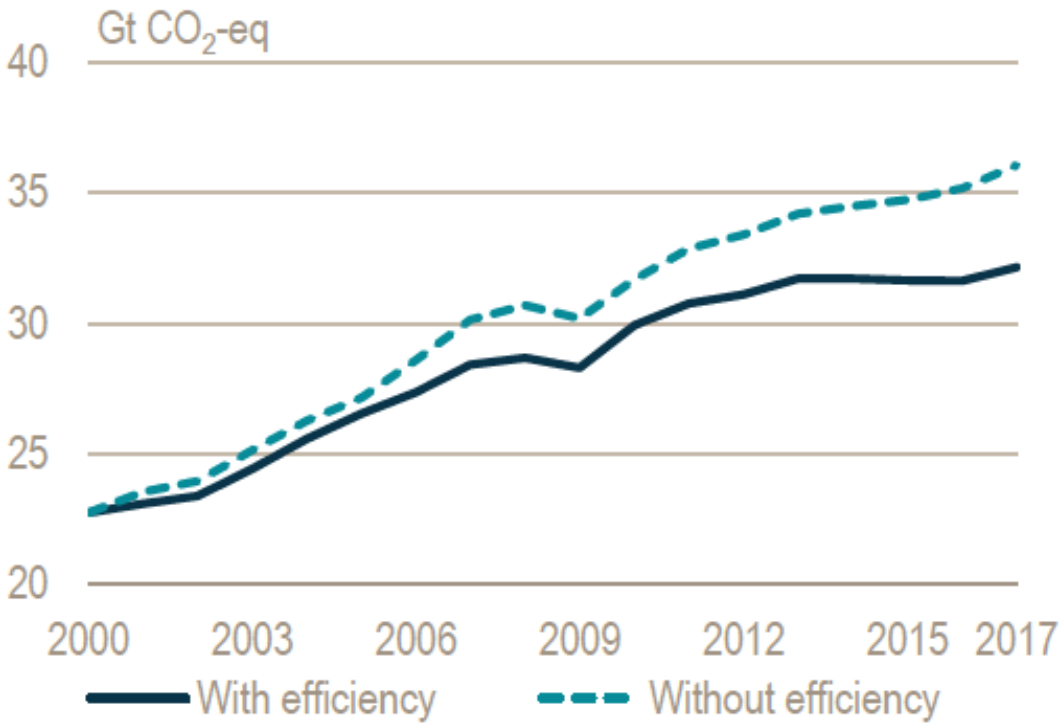
Energy efficiency policy and practice ratings for the world's largest energy users

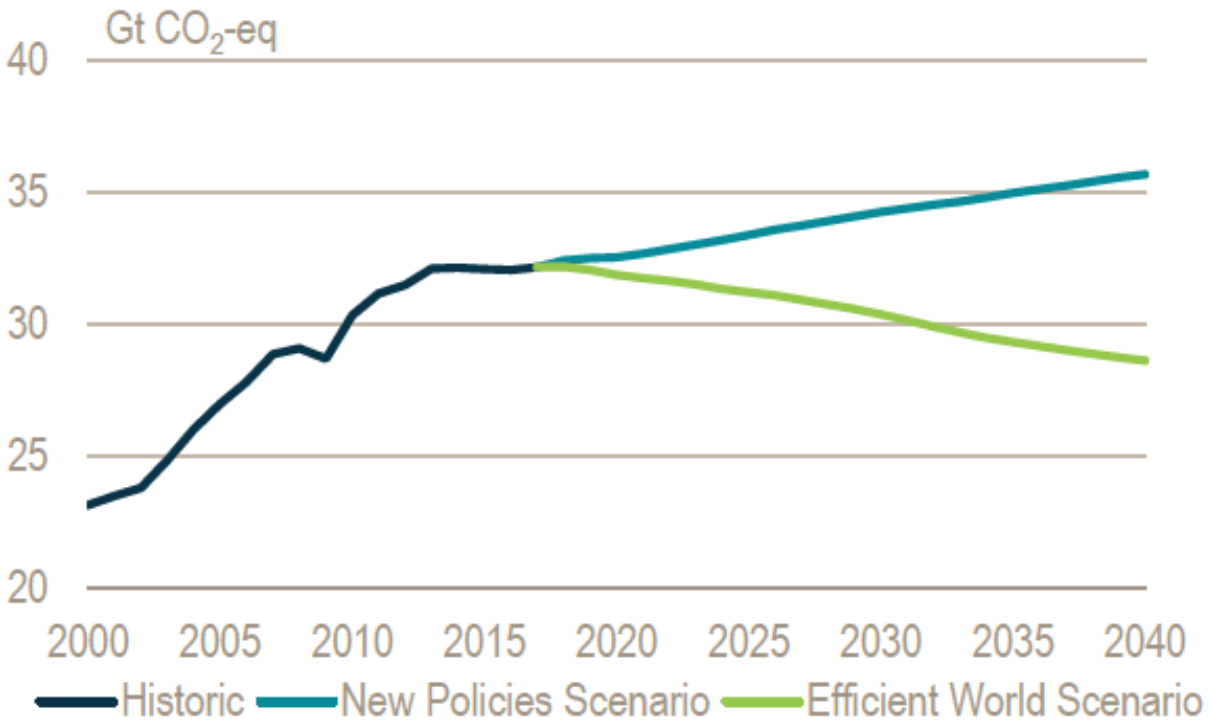


Source: Castro-Alvarez, F., Vaidyanathan, S., Bastian, H. and King, J. 2018, *The 2018 International Energy Efficiency Scorecard*, American Council for an Energy Efficient Economy, Washington DC.

Energy efficiency is the main lever to decarbonise the energy system

Avoided CO2-eq emissions from energy efficiency from 2000 to 2016 (cumulated) amounted to 5 Gt in 2016





Note: Left axis starts at 20 Gt CO_2-eq.

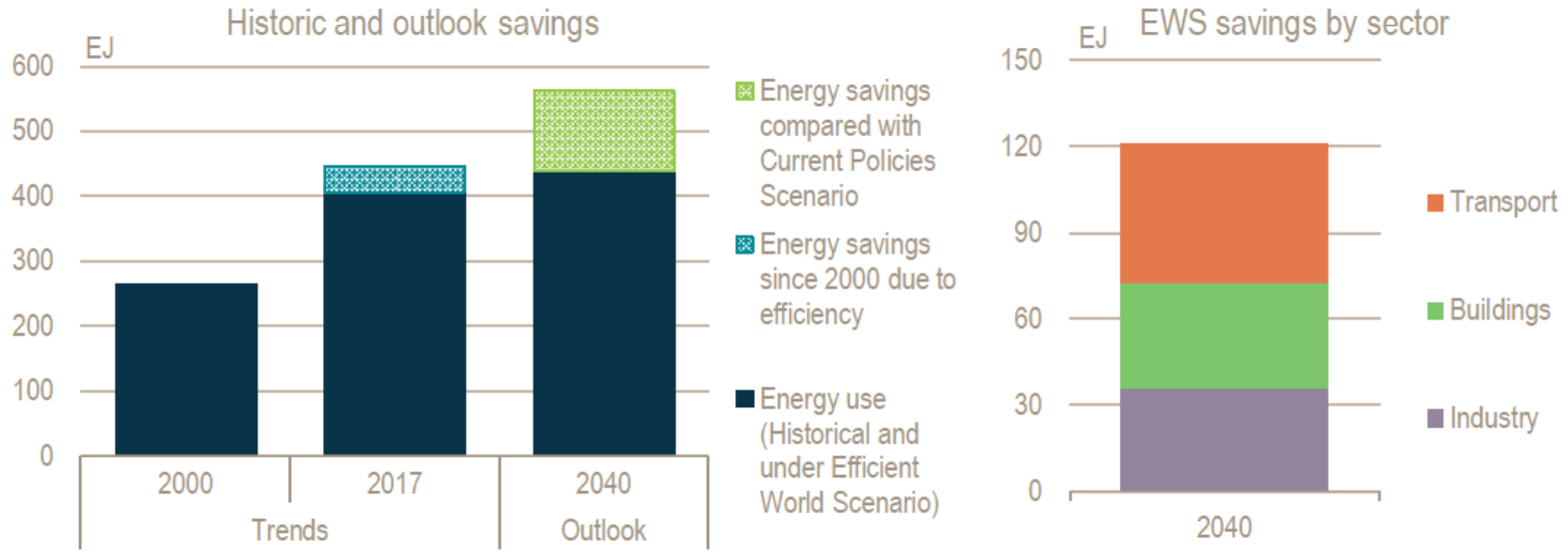
Energy efficiency is the main lever to decarbonize the energy system

In a «2º C» scenario, 40% of the total CO2-eq emissions savings must come from Energy Efficiency

Energy efficiency has to contribute -120 EJ in 2040 to limit climate change

Transport, buildings and industry must reduce their sectora energy consumption by more than 30/40 EJ each one

Global energy use and savings by scenario



Note: One-third of the energy savings in 2040 are the result of current and planned policy settings (New Policies Scenario) and two-thirds from measures contained in the Efficient World Scenario. "Energy use" includes non-energy use (i.e. feedstocks), excludes energy supply.

EWS = Efficient World Scenario (included in Sustainable Development Scenario, 2°C)