"Making Energy Efficiency Work for Energy Suppliers"

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International Cooperation on Energy Efficiency: Working together for a Low-Carbon Economy
Geneva, UN Palais des Nations, May 28, 2008

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Introduction (I)

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Two dimensions will be considered in this contribution:

- The **Economic dimension** – primarily from an enterprise management perspective
- The **Environmental dimension** – specifically arising from the energy needs and consumptions

Introduction (II)

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The "big" question is:

May a balanced relationship between these two dimensions be found, where all human beings can flourish and develop their potential, in a planet where the effects of human activities don't exceed certain limits, in order to preserve the system's diversity & complexity which allows the "***ecological life***"?

The **Economic dimension**

(primarily from an enterprise management perspective)

Adding Value to Products & Services

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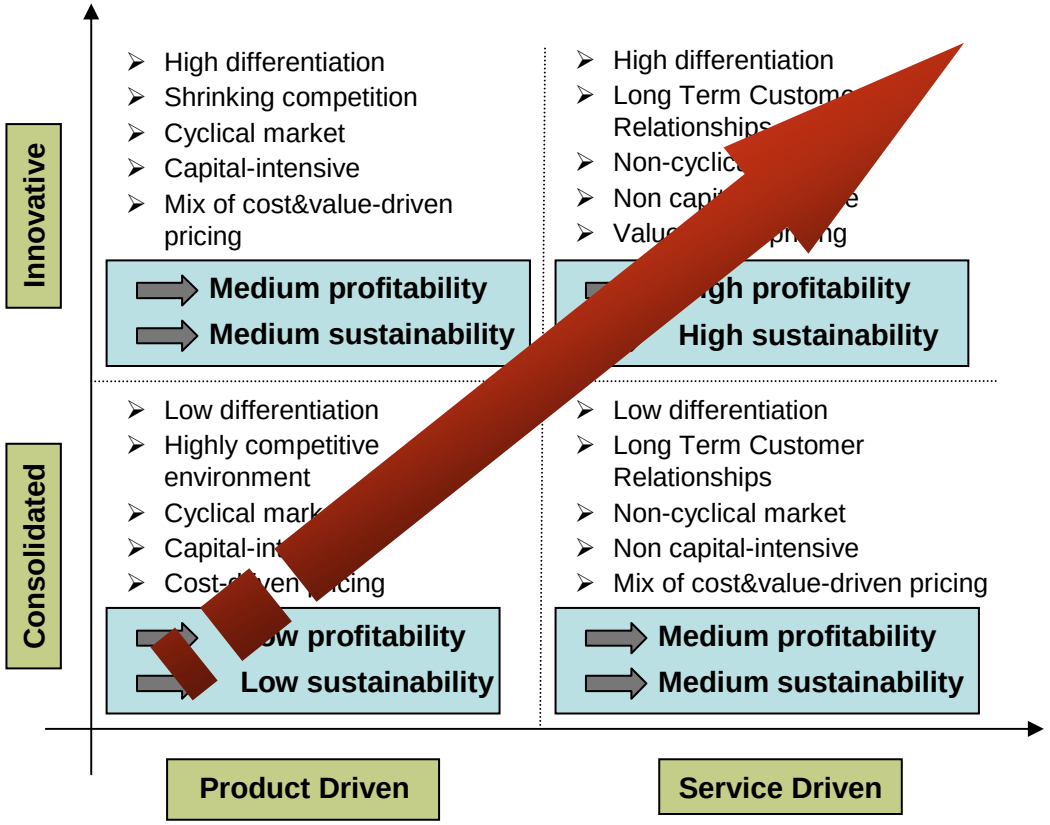
In the interest of whom?

Yesterday's answer: Of the shareholders

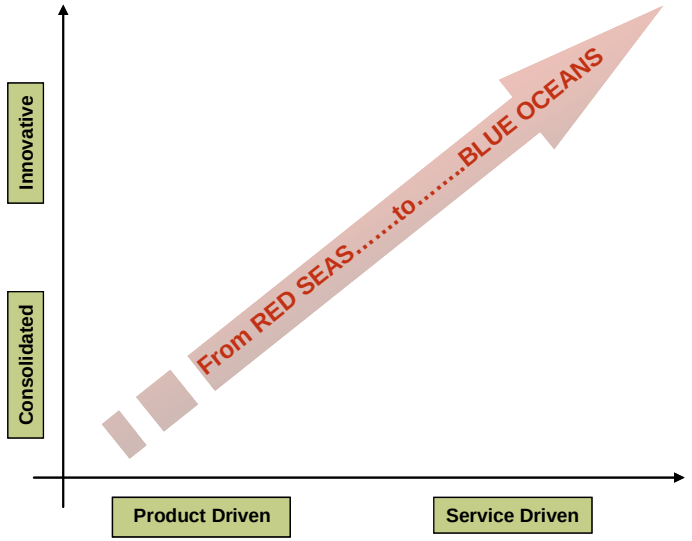
Today's answer: Of the stakeholders

(i.e.: customers, local communities, suppliers, shareholders, employees, unions, …)

Profitability vs. Sustainability



From Red Seas to Blue Oceans



Service-driven enterprises, heavily investing in R&D and with strong product and process development capabilities, are more likely to maximize stakeholders value, i.e.:

- Higher financial returns
- Long term sustainable growth
- More adaptive to new laws & regulations
- More aware and respectful of local & diverse environments

The Supply Side view…..

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Key Processes:

- Design for maintainability
- Total life cycle management
- Product life extension
- Supply Chain redesign
- Environmental, Health & Safety procedures

Key Products & Services (examples) :

- Low NOx gas turbine burners
- Low BTU gas combustors (e.g.: syngas from industrial processes)
- Blades and vanes refurbishment

Achieving sustainability goals …….while pursuing economic goals

The **Environmental dimension**

(specifically arising from the energy needs and consumptions)

CO2 "inertial" scenario is catastrophic

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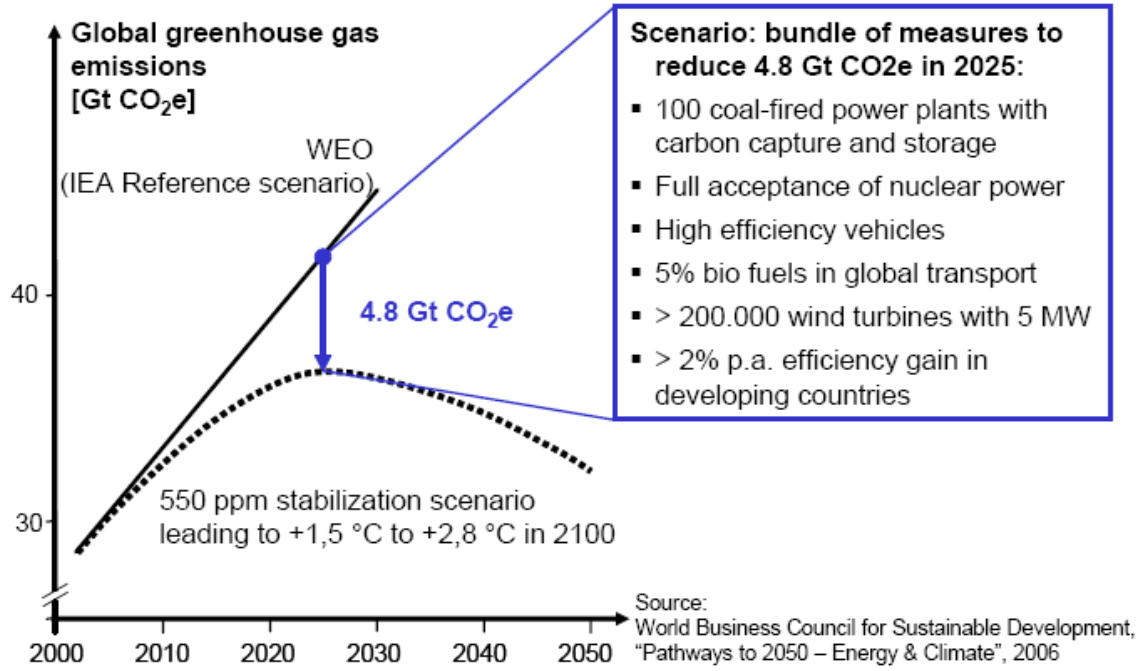

Cross sector mitigation scenario for 2025

"Power Rocketing" Countries Economic Growth

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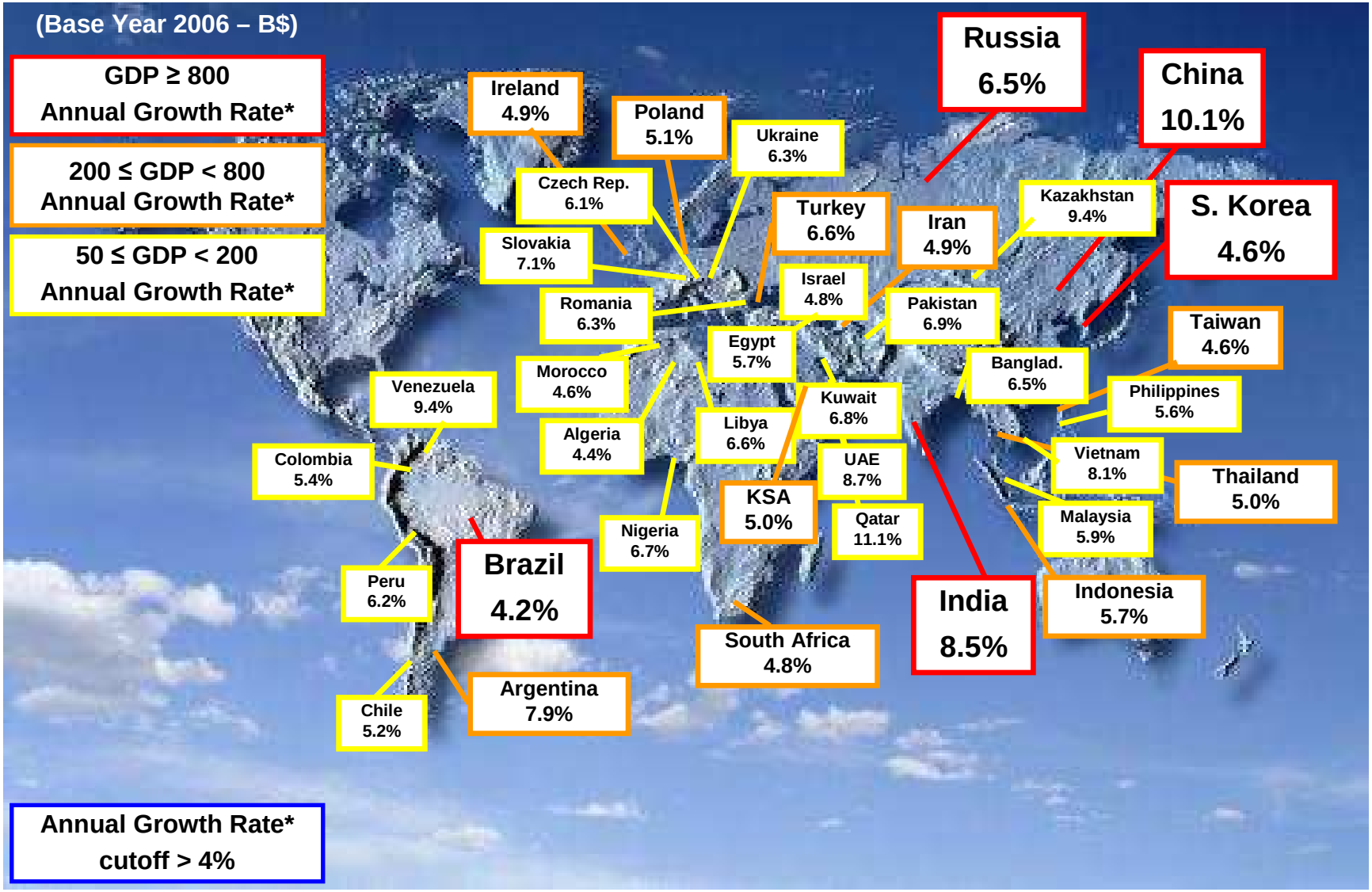
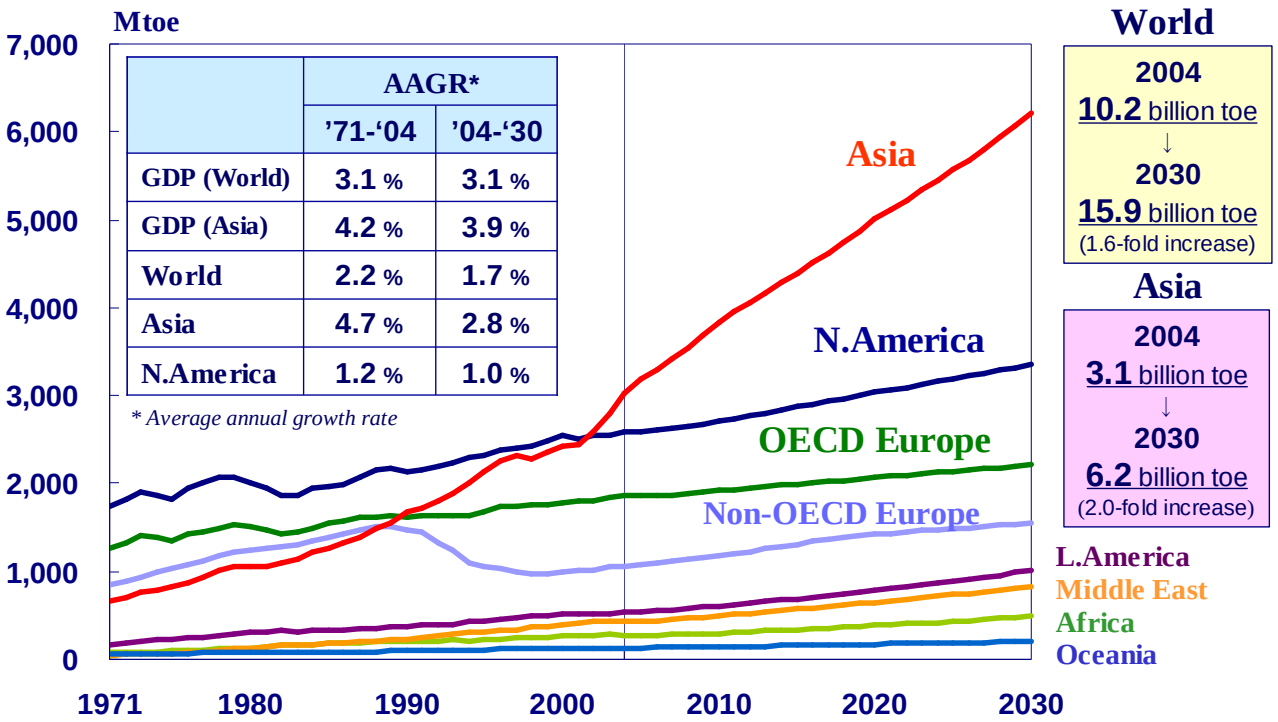


Annual GDP growth expressed as an average of 2004-2008 data (source: IMF)

Energy Consumption reflects GDP's



World primary energy consumption to 2030 by region

Source: EIA Energy Outlook 2006

The dimension of the challenge is unprecedented

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Technological innovation, industry competitiveness and sustainable development should walk hand in hand in the next decades to come. As long as everyone realizes that ***time*** is the scarcest resource we have on the planet, rather than oil or natural gas.

When it comes to the environmental concerns, decoupling emissions from economic growth is a long term goal, which even the more optimistic scenarios cannot predict to happen before 2050.

The dimension of the challenge is unprecedented

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By that time, the world demand for energy will be double than today, but even more importantly the mix of power generation technologies and their impact on the environment will have to be dramatically changed in order to preserve a living earth.

What measures & policies are needed on the supply side?

A case study: Italy

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Improving Energy Efficiency

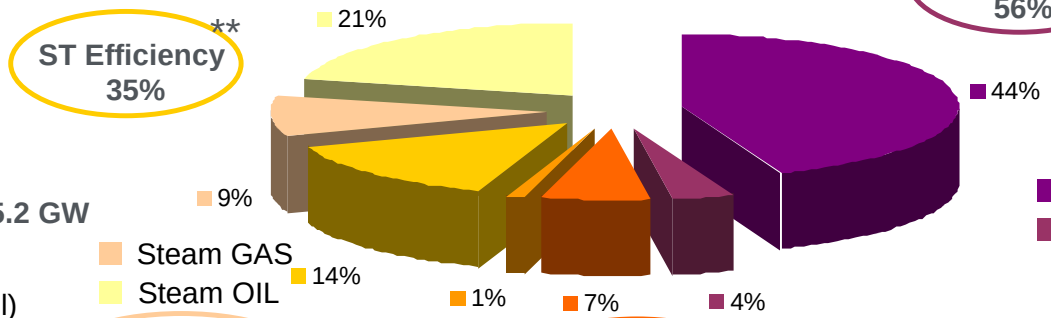
With Best Available Technologies, to significantly reduce CO2 emissions

The 2006 Scenario

(Power Plants operational as of end 2006)

Technological Mix

56.3 GW – 250 TWh



25.2 GW

- Steam COAL (from solid fuel)
- Steam GAS
- Steam OIL

ST Efficiency 35% **

Operating Hours 7640

Operating Hours 1500

26.8 GW

- Combined Cycles GAS
- Combined Cycles OIL

CC Efficiency 56%

Opearting Hours 5893

OC Efficiency 35%

4.2 GW

- Open Cycles GAS
- Open Cycles OIL

Operating Hours 1000

Total Efficiency
(on generation)
48%

CO_2 Emissions
139 MTon

Transitioning to 2011……

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Steam Turbines

- Coal Fueled
- 6 generation units
- Large Utilities

→

- Thermal cycle upgrade to **USC**
- Major efficiency improvement (e.g., low pressure section modification)

Δ Efficiency: ~8%

Δ Efficiency: ~1%

Steam Turbines

- Oil&Gas Fueled
- 5 generation units
- Large Utilities

→

- Repowering of the plants into Combined Cycles

Δ Efficiency: up to 20%

The "as determined" 2011 Scenario

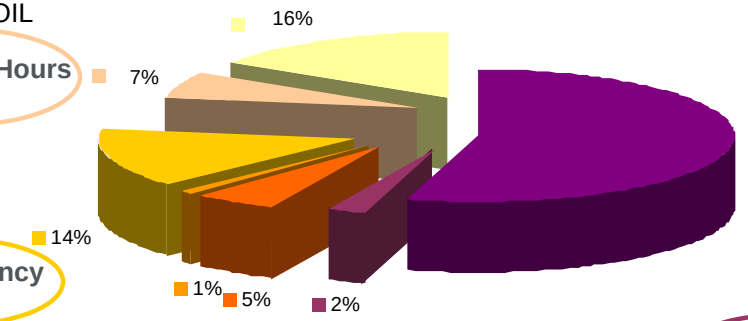
(Power Plants operational as of end 2011)

Technological Mix

70.6 GW – 273.6 TWh

26 GW

- Steam COAL — Operating Hours 5500
- Steam GAS
- Steam OIL — Operating Hours 1000



40.1 GW

Combined Cycles GAS
Combined Cycles OIL

Operating Hours 5000

ST Efficiency 36%

CC Efficiency 58%

OC Efficiency 35%

4.5 GW

Open Cycles GAS
Open Cycles OIL

Operating Hours 300

Total Efficiency
(on generation)
52%

CO_2 Emissions
136 MTon

Fuel Mix Change between 2006 and 2011

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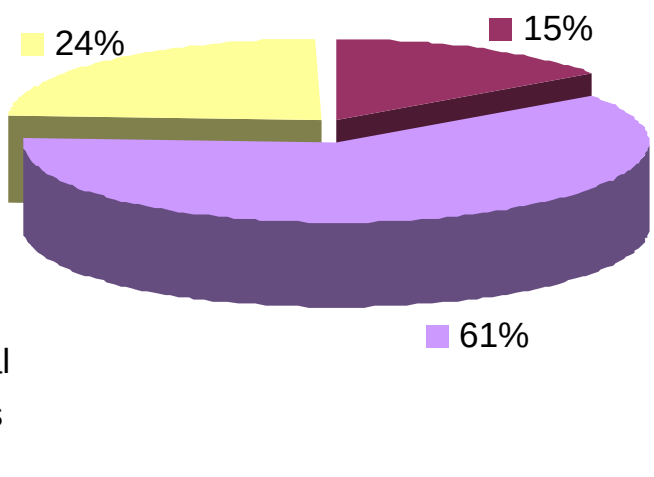
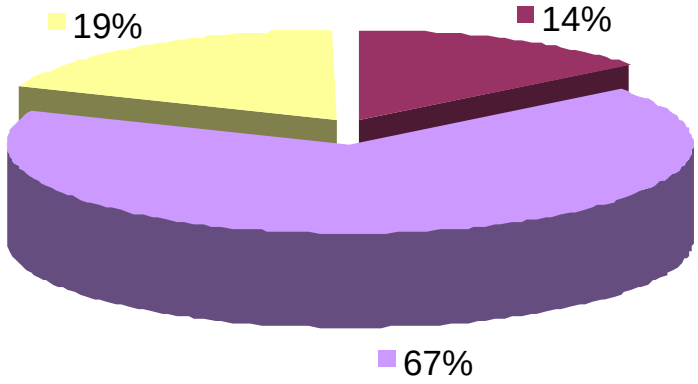
2006

56.3 GW



2011

70.6 GW



Coal
Gas
Oil

Fuel Mix Change

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Performance of the analysed fleet

	2006	2011
– Fleet Subset:	**56.3 GW**	**70.6 GW**
– Energy generated:	**250 TWh**	**273.6 TWh**
– Average efficiency: (on generation)	**48%**	**52%**
– CO_2 Emissions:	**139 MTon**	**136 MTon**
– MTonCO_2/TWh ratio:	**0.56**	**0.50**

Much more needed…….

While the 2011 scenario depends completely on decisions already taken, and little can be done to improve its environmental footprint, today is the time to make the strategic decisions that can lower the impact of the Italian thermal fleet on the country's overall GHG emissions and help reach the target

from 136 MTon CO2 to 100 MTon CO2 by 2020

Major interventions have to be deployed, and they will only in the case that appropriate new

REFURBISHMENTS - UPGRADES – SERVICES

policies & regulations

are swiftly put in action!

Broader application of BAT…..

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Steam Turbines — **1.3 GW**

- Coal Fueled
- > 150 MW
- 4 generation units
- Large Utilities

→

- Thermal cycle upgrade to **USC**
- Major efficiency improvement (e.g., low pressure section modification)

Δ Efficiency: ~8%

Δ Efficiency: ~1%

Steam Turbines — **7.4 GW**

- Oil&Gas Fueled
- > 150 MW
- 20 generation units
- Large Utilities

→

- Repowering of the plants into Combined Cycles

Δ Efficiency: up to 20%

All such technologies are 100% available today!

The "improved" 2011 scenario

(Scenario at 2017-2020, all proposed interventions operational)

Technological Mix

72.8 GW – 296 TWh

10 GW

- Steam COAL
- Steam OIL

ST Efficiency 40%

Operating Hours 4800

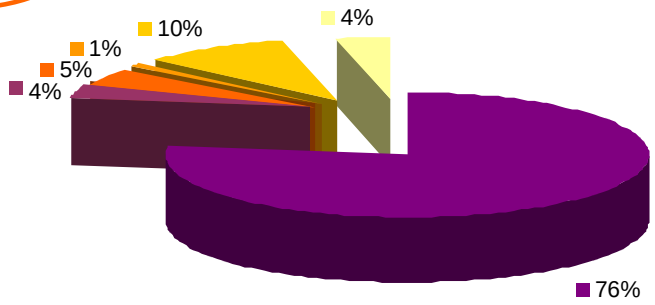
Operating Hours 874

4 GW

- Open Cycles GAS
- Open Cycles OIL

OC Efficiency 35%

Operating Hours 262



58.8 GW

- Combined Cycles GAS
- Combined Cycles OIL

Operating Hours 4371

CC Efficiency 58%

Total Efficiency (on generation) 56%

CO_2 Emissions 123 MTon

Improved Performance of the analysed fleet

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Performance of the analysed fleet

	2006	2011	2017-2020
– Fleet Subset:	**56.3 GW**	**70.6 GW**	**72.8 GW**
– Energy generated:	**250 TWh**	**273.6 TWh**	**296 TWh**
– Average efficiency: (on generation)	**48%**	**52%**	**56%**
– CO_2 Emissions:	**139 MTon**	**136 MTon**	**123 MTon**
– MTonCO_2/TWh ratio:	**0.56**	**0.50**	**0.42**

Great Improvement….not enough though!

Multiple generation technologies (I)

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- **BAT Thermal Generation**
  - Increased Efficiency
  - Flexible Operations
  - Multiple Fuels
  - Syngas
  - Biomass
  - Capture Ready
  - Waste-to-Energy

- **Hydrogenerators & Geothermal**

Multiple generation technologies (II)

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Future Thermal Generation

- CO_2 Capture
- Gasification

Fuel Cells & Micro Turbines

Advanced Nuclear

Distributed Generation

A wide spectrum of energy sources…….

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- None of them can be excluded from the game….solution comes from a combination
- More funding has to be deployed for energy R&D
- In the short and medium term (2020 vision), funding has to be addressed to clean energy technologies….e.g. those who help reaching the Kyoto and the new EU targets (i.e.: the "20-20-20" target)
- In the medium to long term (2050 vision), a new generation of technologies (implying major breakthrough's) need to be commercially viable, in order to head to a complete decarbonization (e.g. hydrogen economy, fuel cells, zero-emission fossil fuel plants with 100% carbon sequestration, 4th generation nuclear from fission, nuclear fusion,…)

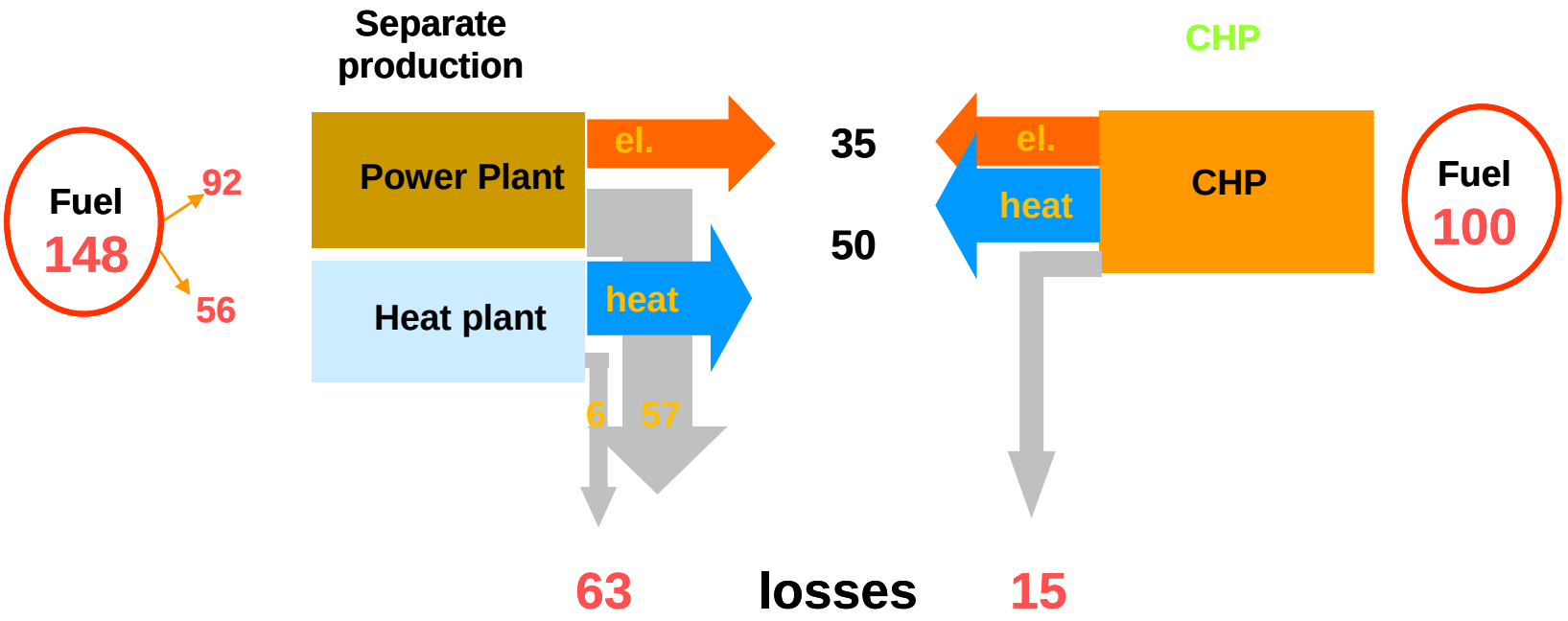
Energy Policies have to help boosting….

- Renewable sources (e.g. wind, photovoltaic, biofuels from wastes)
- Cogeneration
- Distributed energy
- Energy Efficiency
- Clean fossil fuel technologies

While infrastructures need to support the cleaner and more efficient generation through:

- Smart grids (without which renewables and distributed cannot be fully exploited)
- Fuels transportation infrastructures (e.g.: pipelines, LNG, etc..)
- Waste treatment and disposal facilities
- Energy Efficiency
- Energy Storage Technologies

Cogeneration (I)



Source: Vattenfall, 2007

In Conclusion…..

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- We are facing an unprecedented challenge, on a global scale
- Oversimplifications & slogans do not lead anywhere
- Energy-producing and energy-consuming countries have to embarque in a constant dialogue on energy options
- Best Available Technologies will have to make the biggest contribution to the CO2 reduction in the 2020 scenario
- Technology & Innovation will make the difference, especially in a clear political, economical and legal framework
- In such scenario, typical business' metrics & goals do not conflict with environmental goals and targets, actually they get along hand in hand

Words of Wisdom……..

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The significant problems we have cannot be solved at the same level of thinking with which we created them.