Energy efficiency

Energy efficiency and energy intensity around the world

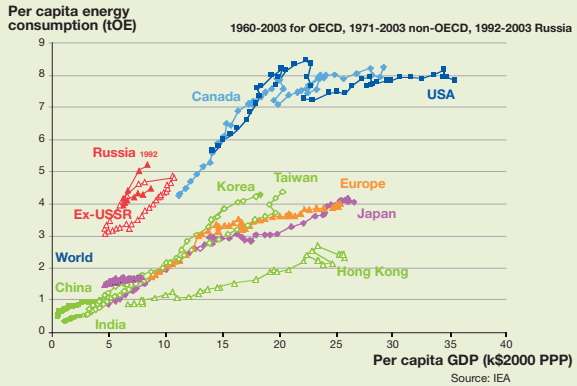
Of all the measures that will contribute to meeting the challenge of sustainable development and limiting climate change, one obvious solution is to use energy more efficiently.

That means consuming less energy to produce goods and services, thanks to new behaviors and working methods, coupled with the use of new technologies that offer better energy performance.

The energy consumption of countries is generally compared by establishing the ratio of per capita energy consumption to per capita gross domestic product (GDP); or, expressed otherwise, the total quantity of primary energy consumption from all sources, reported per capita and according to the level of economic activity. To avoid distorting the comparison, GDP figures are adjusted for Purchase Power Parity (PPP). Simply stated, the lower the energy intensity, the greater the energy efficiency.

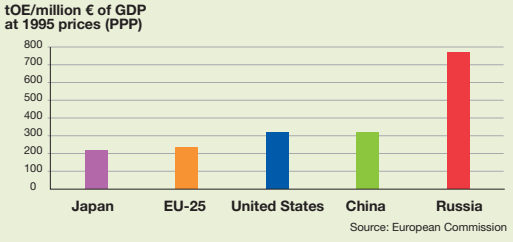
The following figure compares the situation of developing countries with several development models that exhibit different relative intensity levels. It shows significant disparities between the various regions of the world. Per capita energy consumption ranges from 8 tOE[1]/inhabitant in North America to less than 0.5 tOE/inhabitant in India.

Energy consumption and growth potential in developing countries



However, if the wealth produced per country in 2003 is considered without regard to the number of inhabitants, then the highest energy consumption per unit of GDP was reported for Russia, followed by the United States and China.

Energy intensity in 2003



[1] tOE: metric ton of oil equivalent

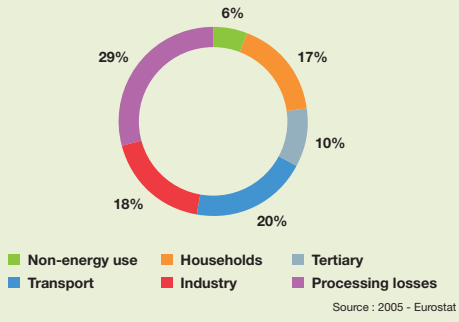
Focus on Europe

In Europe, aggregate primary energy consumption rose by about 40% between 1970 and 2000, representing an average annual increase of about 1%.

In 2005, energy consumption in the European Union-25 stood at 1,725 MtOE. Without efforts to contain the rise, consumption could reach 1,900 MtOE by 2020. Yet according to the European Commission, energy products account for 78% of the EU's aggregate greenhouse gas emissions, with more than one-third of that amount coming from the transport sector.

Furthermore, due to the composition of the energy mix (fossil fuels account for more than 80% of consumption), the EU is becoming increasingly dependent on imported energy (70% projected by 2030 against 50% today), which takes a heavy toll on national economies.

Structure of primary energy consumption by sector (EU-25)



For all of these reasons, energy efficiency has emerged as a global priority and is viewed as one of the most effective instruments for combating climate change.

Accordingly, the European Union has set an ambitious goal of cutting its energy consumption by 20% by 2020.

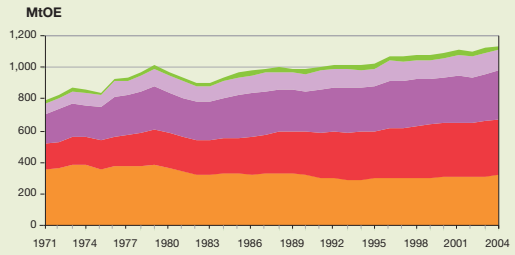
Although all sectors are affected, the power generating, transport and tertiary-residential (especially existing housing) sectors are the prime targets for the various energy efficiency programs deployed within the European Union.

TOTAL

Energy efficiency in industry

Industry has made greater headway than any other sector with respect to energy: its share in final energy consumption[2] declined from 45% in 1971 to 28% in 2004. Over the same period, the share of the transport sector rose from 20% to 31% and that of the residential/tertiary sector increased from 33% to 38%.

Final energy consumption in EU-25



In fact, the first oil shock gave the industrial sector a natural incentive to reduce its energy consumption in order to optimize its economic performance (especially heavy industry, by improving the energy management of its production infrastructure). Efforts have focused on the promotion of energy efficient equipment as well as on process optimization and improvement in fuel characteristics.

These initiatives are being pursued with the additional incentive of new environmental constraints, aimed particularly at preserving air quality.

The power-generating, chemicals, pulp and paper and horticulture segments in some countries (e.g., the Netherlands and the United Kingdom), have established sector-wide agreements on voluntary commitments to curtail energy consumption.

Finally, a number of recent European directives have focused on the energy efficiency of products and the development of combined heat and power installations.

For example:

- Directive on energy efficiency labeling of household appliances sold in EU Member States (1995),
- Directive restructuring the Community framework for the taxation of energy products and electricity (2003),
- Directive on the promotion of cogeneration in the internal energy market (2004),
- Framework directive on the eco-design of energy-using products (2005).

In addition, to facilitate and stimulate further energy-related improvements in industrial processes, the Commission is preparing a multi-disciplinary reference document consolidating best practices. Our experts are contributing to this effort within the European framework for sharing information about the best available technologies.

A number of key objectives have been defined for the power generating sector:

- replace low-efficiency power plants,
- use the best available combined-cycle technology for new units,
- develop distributed power generation,
- promote the use of combined heat and power technology and consider link-ups with district heating systems,
- take steps to boost the efficiency above 50% at coal-fueled power plants.

Combined heat and power at the Normandy Refinery

© Marco Dufour / Total

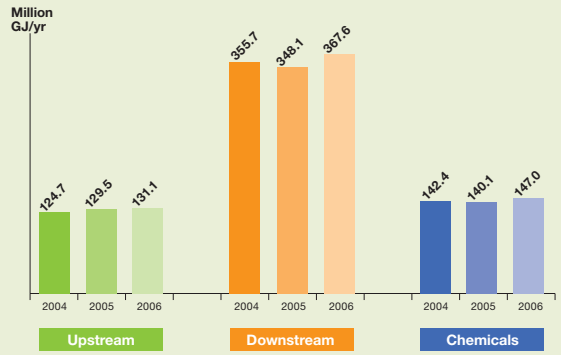
[2] Final energy refers to primary energy minus the losses incurred in transport and conversion.

Total's **commitment**

Inventory of Group energy consumption

In addition to being a producer of energy through its upstream activities and a supplier of both primary and final energies through its downstream activities, Total is a major energy consumer[3]. Energy efficiency is therefore a crucial issue for the Group.

Total's primary energy* consumption per Branch (in millions of GJ/yr)



* Primary energy includes generation of exported electricity but excludes flaring, venting and gas from hydrogen and ammonia production.

Thoughts on the future of energy

As early as 2000, the Group set up an Energy Committee staffed by technical experts and representatives of the Strategic Planning departments of each Branch. The Committee's purpose is to pursue a joint analysis of all energy-related issues and propose action plans.

Chaired by the Executive Vice President, Sustainable Development and Environment, this centralized organization manages three working groups dedicated to:

- Energy efficiency and environment
- Energy market trends
- Long-term energy outlook.

Energy consumption of oil and gas activities

- **Flaring**:
  6% of worldwide natural gas consumption
- **LNG industry**:
  Self-consumption of 11 to 17% of produced natural gas
- **Refining industry**:
  Self-consumption of 6 to 8% of processed crude oil

Initiatives related to our operations

The Group has always stressed the optimization of energy efficiency in its installations. To reinforce the progress already achieved at each facility and better meet the additional efforts requested of the industrial sector, Total is pursuing the following initiatives:

Common orientations for energy management

A strategy has been defined, an organization put in place and tools for energy audits and modeling have been harmonized, with the necessary resources and expertise. The orientations are transposed to each activity to aid in the selection of the best projects.

Development of a methodological guide on the theme of energy management in our businesses

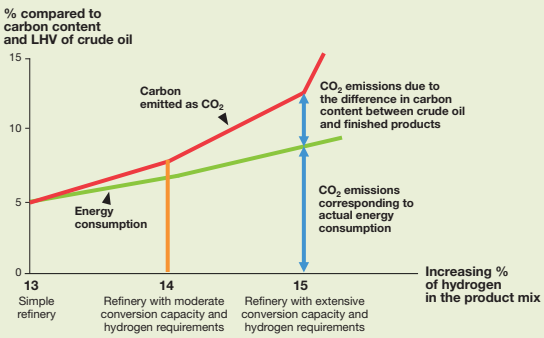
A guide intended for the managers of the Group's branches and installations is now being prepared. Its main aims are to establish a common language and create a shared momentum for improving energy efficiency by identifying the best practices relevant to our activities and by offering managers the necessary tools, methods and organizational resources.

Ambitious investment programs

Upgrading projects have been identified for the Refining division; they represent investments on the order of €200 M by 2012. These large-scale projects, which aim to improve the quantity and quality of petroleum products derived from crude oil, consume energy and hydrogen.

Using more energy-efficient technologies allows a reduction in the quantity of energy consumed per tonne of crude oil refined. The hydrocracker unit commissioned at the Normandy Refinery in 2006 is one example.

Refinery CO_2 emissions



Source: B. Sigaud

The Petrochemicals segment, particularly the steam-cracking process, is another heavy energy consumer. An action plan for this sector has set the ambitious target of improving energy efficiency by nearly 2% per year over the period 2006-2012, through investments in excess of €125 M.

The Exploration & Production segment is also a target of energy efficiency improvements through the application of more stringent design standards for new projects.

[3] With primary energy consumption of 645.7 Million Giga-Joules (MGJ) in 2006.

Reliability improvement

This effort centers mainly on optimizing the operational monitoring and control systems of units to anticipate any problems, breakdowns or malfunctions. It also aims to improve the automatic control systems of installations, especially boilers and furnaces. Better reliability has a significant impact on overall energy efficiency.

Energy-saving projects

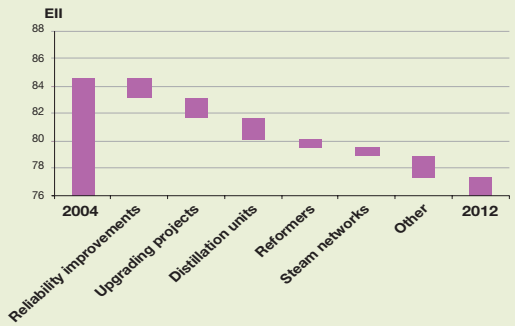
For the Refining division, studies have focused primarily on atmospheric distillation and catalytic reforming units, which are the main energy consumers. Noteworthy improvements are being achieved by a better heat integration and the use of new, more efficient types of heat exchangers.

Finally, investments in new cogeneration installations, which permit the simultaneous production of heat and electricity, have led to a substantial improvement in energy efficiency. For example, the cogeneration unit at the Normandy Refinery came on stream in late 2004, producing 450 t/h of steam and 250 MW of power. It is the largest such unit in France and achieves an overall efficiency of 84%.

The Group's other branches, particularly the Chemicals segment, are exploring every opportunity for modernization and synergy either within the Group or with outside partners, in order to achieve further energy savings. A case in point is the Daesan Petrochemical complex in South Korea, in partnership with Samsung.

Through these initiatives, Total is planning to lower the Solomon Energy Intensity Index (EII)[4] of its refineries by about 8 points between 2004 and 2012 (an average improvement of about one point per year), while at the same time lowering the specific energy consumption of the steam crackers of its Petrochemicals segment by 13% (or about 2% per year) over the same period.

Projected impact of various initiatives on EII by 2012



Total's initiatives with respect to its customers

Environmentally-friendly products

Total also intends to provide customers with a range of "energy-saving" products to help them manage consumption at an individual level. In April 2005, the launch of Total Excellium Diesel and Total Excellium 98 expanded the range of motor fuels to give customers a choice at the pump between two unleaded gasolines (95 and 98 octane) and two diesel fuels with different performance characteristics.

These motor fuels reduce vehicle fuel consumption and yield an additional 15 to 50 km for every fill-up, depending on the type of vehicle and the driving conditions. They also cut CO_2 emissions by as much as 5%, and curb emissions of other regulated pollutants as well (CO, smoke, etc.). Two full-scale tests were carried out – one by Fabricom Fleet, a subsidiary of Suez, and the other by the Bouygues and Saur groups – on a fleet of 500 company vehicles in 2005 and 2006. Results of the tests confirm that Excellium Diesel allows fuel savings of 3.7%, with an equivalent rate of reduction in CO_2 emissions.

In 2006, having its French retail network distribute one million copies of an information sheet developed in collaboration with the French energy management and environment agency Ademe provided one example of how the Group contributes to efforts to educate the public on ways to reduce motor fuel consumption.

In the residential sector, Total markets innovative solutions for single-family home heating. The "Eco-Déclic" offer by Totalgaz in France targets customers who seek help in installing systems (such as boilers, solar panels and control devices) to help them reduce their energy bill and lower their energy consumption by as much as 40%.

White certificates

Under the French "white certificates" (or energy-saving certificates) program, suppliers of energy (electricity, gas, heating oil, LPG, heat, refrigeration) must meet government-mandated targets for energy savings achieved through the suppliers' residential and tertiary customers. The stated goal of this program is to achieve energy savings equivalent to 54 TWh cumac[5] between 2006 and 2008.

Energy suppliers who do not meet their obligations must pay a penalty of €0.02/kWh.

A marginal share of the Group's sales (heating oil and LPG) falls within the scope of this obligation, and the Group has committed to the process. Total is one of the energy professionals taking part in the development of standardized operation sheets for sectors including transport and building construction.

[4] The EII is an indicator developed by Solomon Associates which compares actual energy consumption to the theoretical consumption of a benchmark refinery having the same units with the same process characteristics.

[5] kWh cumac means cumulative, discounted kWh.

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