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ENERGY EFFICIENCY

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ENERGY SECURITY AND SUSTAINABLE DEVELOPMENT

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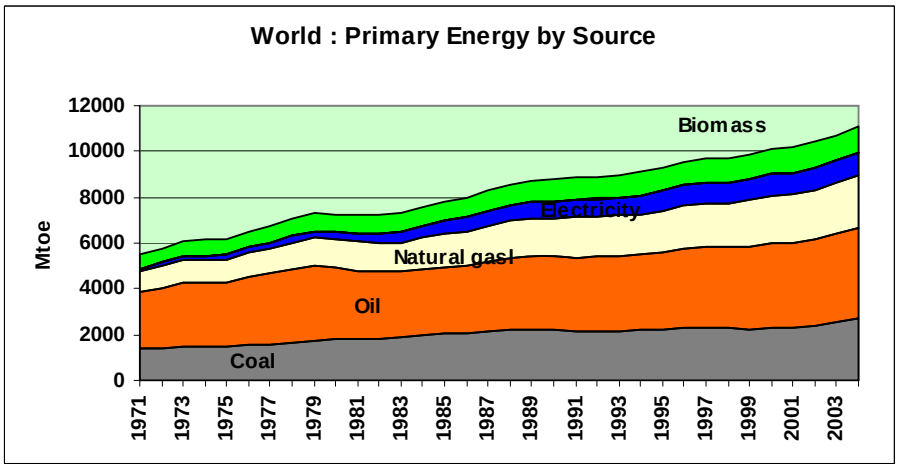
1. WORLD ENERGY SINCE 1971

1.1 TOTAL ENERGY

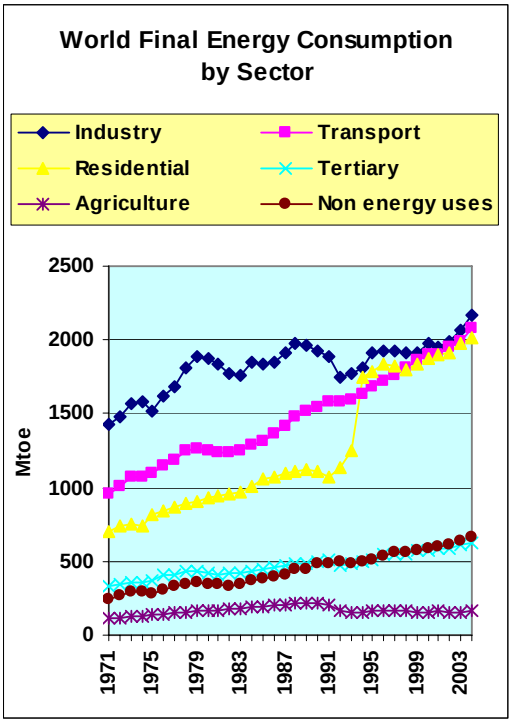
Data used in this document comes from the ENERDATA data base (Grenoble – France).
World population increased from 3 750 to 6 341 millions from 1071 to 2004, by a factor of 1.7.
World primary energy consumption grew by a factor of 2 from 1971 to 2004.
Oil remained the first energy source over the period, its share decreasing however from 44% in 1971 to 35% in 2004 to the benefit of coal and natural gas.

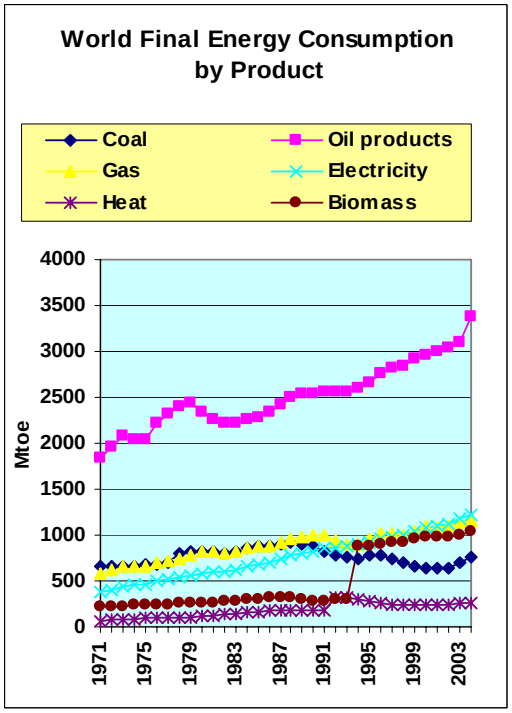
Figure 1



World final energy consumption doubled also over the period. First consuming sector in 1971, "Industry" is now second behind "Residential and Tertiary". "Transport" is very near and increasing faster. Oil products remain the first final energy product (in relation with Transport).

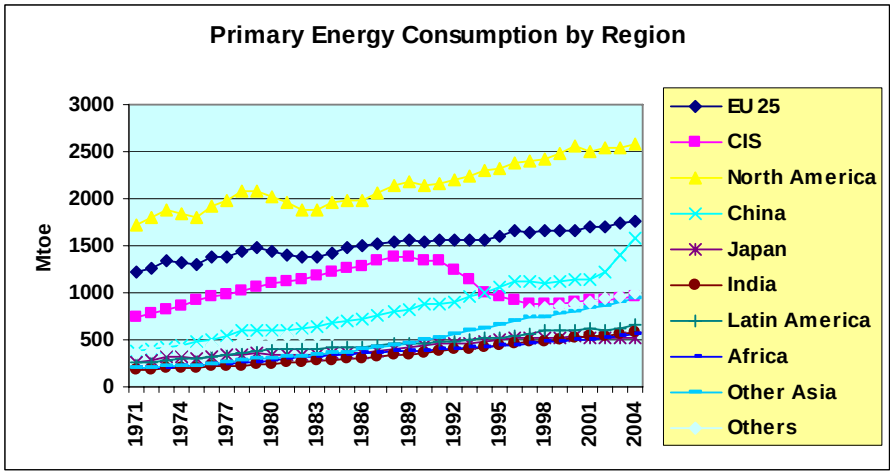
Figure 2





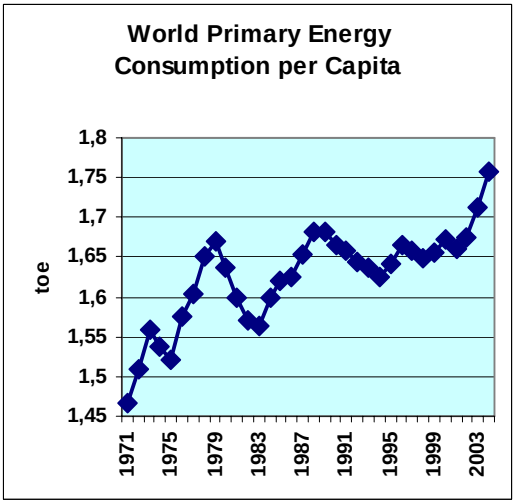
1.2 ENERGY BY REGION

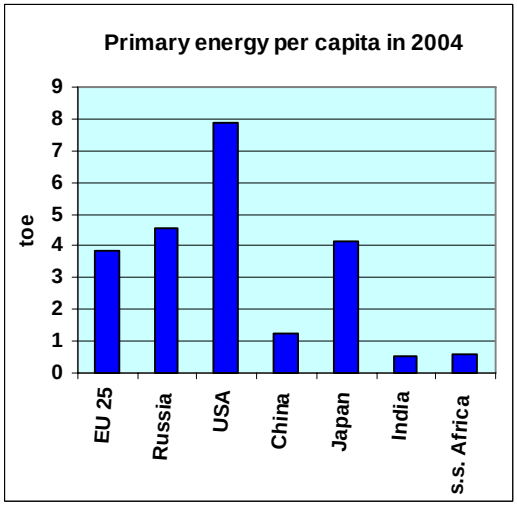
Figure 3



1.3 ENERGY PER CAPITA

Figure 4





Primary energy consumption per capita historical record illustrates the effect on energy of the two oil shocks of 1973-74 and 1979-80 (strong reduction of energy demand), the growth following the 1985-86 "counter-shock" and the economic crisis in the former USSR during the early 90s.
After a period of stabilisation from 1995 to 2002, World energy consumption is again rising due to the fast economic growth of China, the consumption per capita of which remains low compared to that of the industrialised countries.

World energy consumption is marked by deep discrepancies by regions and countries : with 18% of the world population (6340 millions), the OECD countries absorb 50% of total primary energy (11 150 Mtoe).
A more detailed distribution by selected countries and regions shows a factor of sixteen between the higher per capita consumption for United States and the lowest, for sub-saharan Africa (the consumption being even much lower for the poorest countries of this zone).

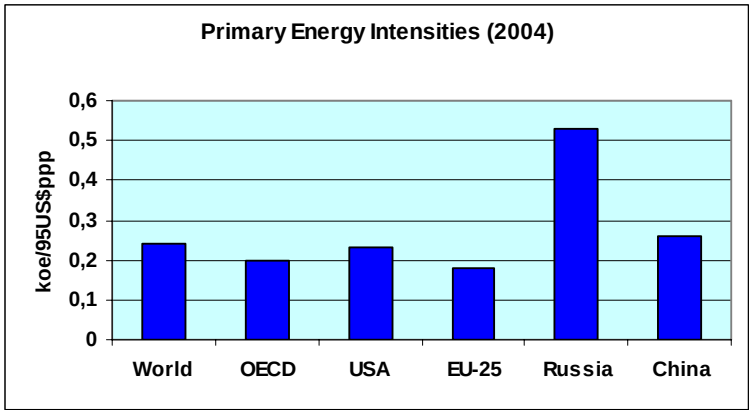
1.4 ENERGY INTENSITIES

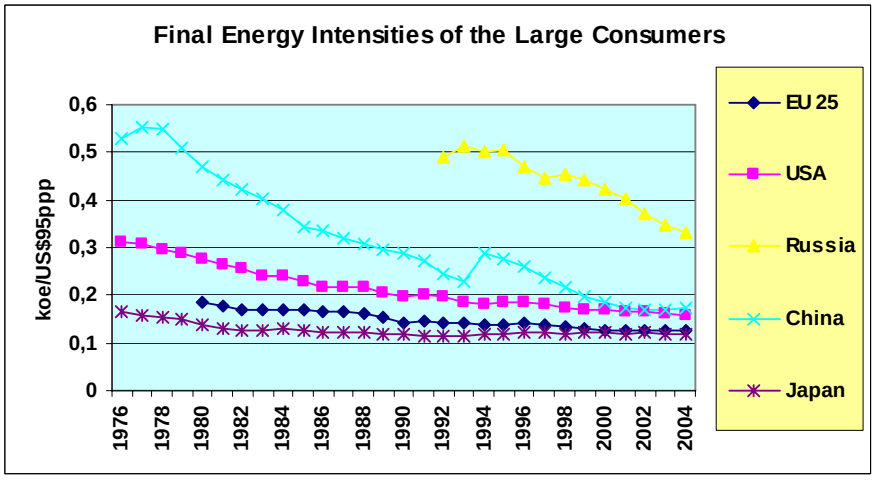
Apart from energy consumption per capita, another global indicator is widely used to assess the energy situation of a country and its evolution and to compare different countries or regions : the "energy intensity", ratio of the energy consumption (final or primary) over GDP expressed at purchase power parity (ppp). Energy intensity, expressed in toe per GDP unit, is the quantity of energy consumed during a given year per unit of GDP. This value depends on several factors : climate, size of the country, structure of the economic activities (economy dominated by industry, or tertiary activities, importance of the transport sector, etc.), the "way of life" (different between USA and Western Europe for example) and, above all, by the degree of efficiency of the energy consumption patterns and techniques (the "demand side") and of the energy production and transformation system ("supply side"). Energy intensity indicates if a country's (or a region's, or the World's) economic and social activities are globally more or less "energy intensive".

As a first approximation, energy intensities gives a rough idea of the efficiency of the demand side (final energy intensity : FEI = FEC/GDPppp) and of the total energy system (primary energy intensity : PEI = PEC/GDPppp). The value of this global indicator as a measure to compare the energy efficiency of different countries economic and social activities is of course better if these activities are not too different.

The following tables gives the values of primary energy intensity in 2004 for the largest energy consumers.

Figure 5

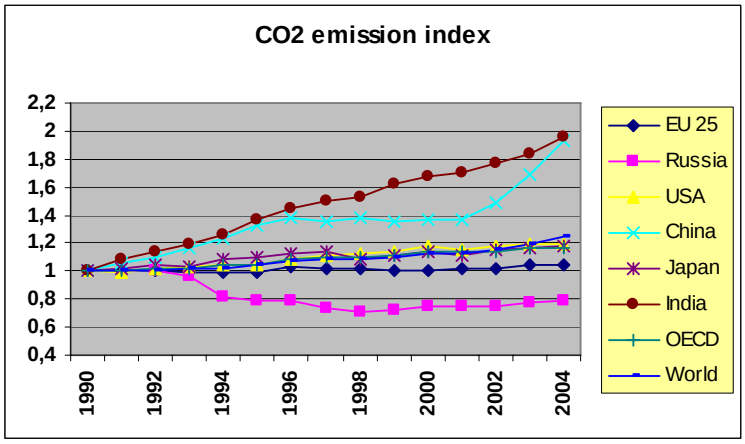


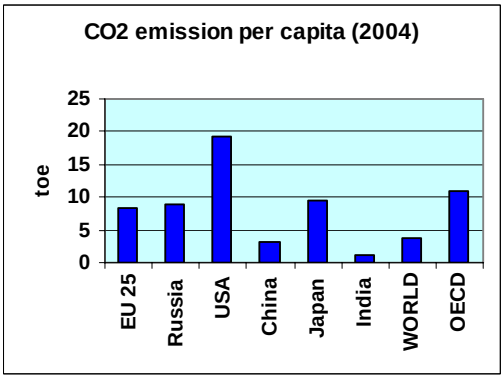


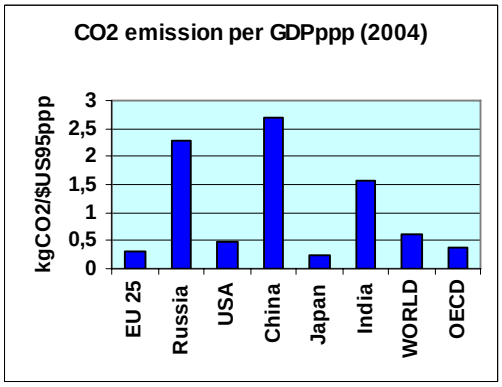
1.5 CO2 EMISSIONS

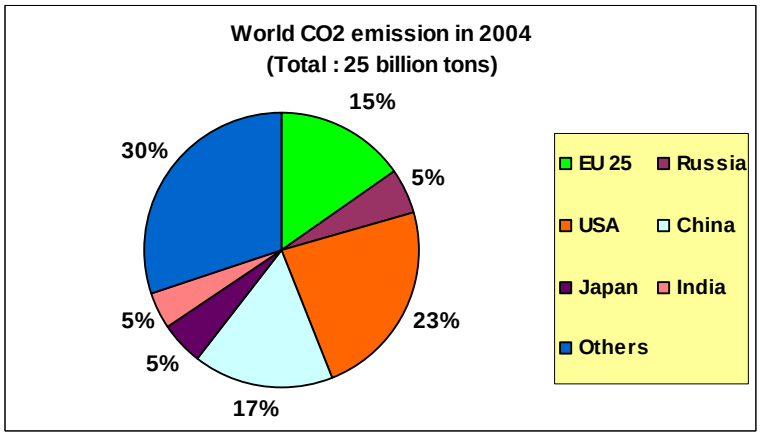
The next figure shows the evolution of these emissions since 1990 (1992 for Russia), the reference year for the Kyoto Protocol.
Total World emissions increased by 20% over the period 1990 – 2004. EU 25 emissions roughly stabilised with a slight increase in the early 2000s. United States and Japan increased by about 20%; Russia's decreased during the 90s due to the economic crisis but are on a slow growth trend since year 2000.

Figure 6







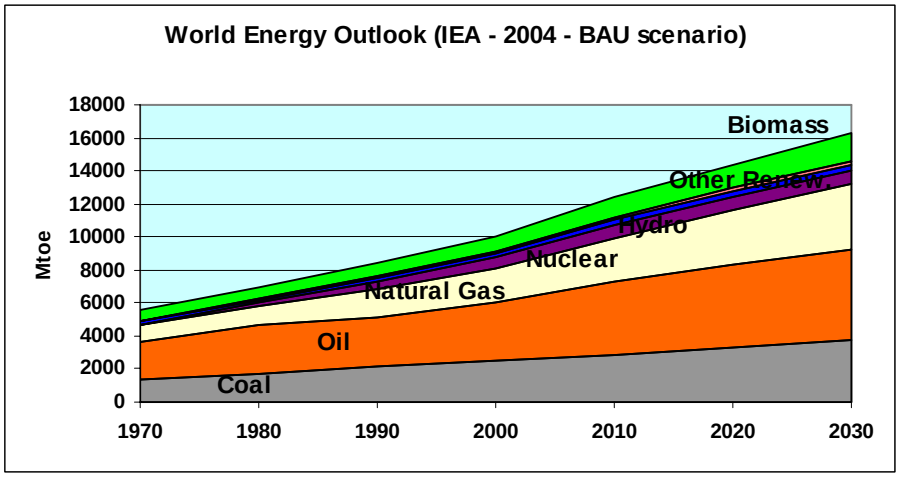


2. THE UNSUSTAINABLE FUTURE

2.1 "BUSINESS AS USUAL" : A WARNING SCENARIO

The International Energy Agency (IEA) produces regular publications on "World Energy Outlook", from on an analysis of demand and supply evolution for the next decades. The "Business as Usual" (BAU) scenario is based on the assumption that current energy policies continue.
In the 2005 BAU scenario, World primary energy demand would increase steadily from 9,200 Mtoe in year 2000 to 16,300 Mtoe in 2030[1]. Fossil fuels would remain dominant in 2030 (about 89%) with natural gas growing more quickly than oil and coal.
62% of the increase in world demand would come from developing countries, especially in Asia. Almost all the increase in production would occur outside the OECD. OECD countries would become more and more dependent on energy imports.
CO2 emissions would be multiplied by 1.5 in 2030 compared to 2000.
The anticipated total world energy investment over the thirty year period in this scenario is 16 trillion dollars, of which 60% for electricity (46% in power generation and 54% in transport and distribution).

Figure 7



On November 14th, 2006, at the World conference on climate change in Nairobi, the IEA Executive Director Claude Mandil declared : ***"With current policies, our energy future is insecure and environmentally unsustainable"[2].***
After his presentation of the BAU scenario (see 2.1), the IEA Executive Director declared :
"We need to bridge the gap between our present energy structure and policies, and focus on implementing policies and technologies that will empower a different energy future" (...) "Energy efficiency policies ought to be the foundation for this bridge"[3].

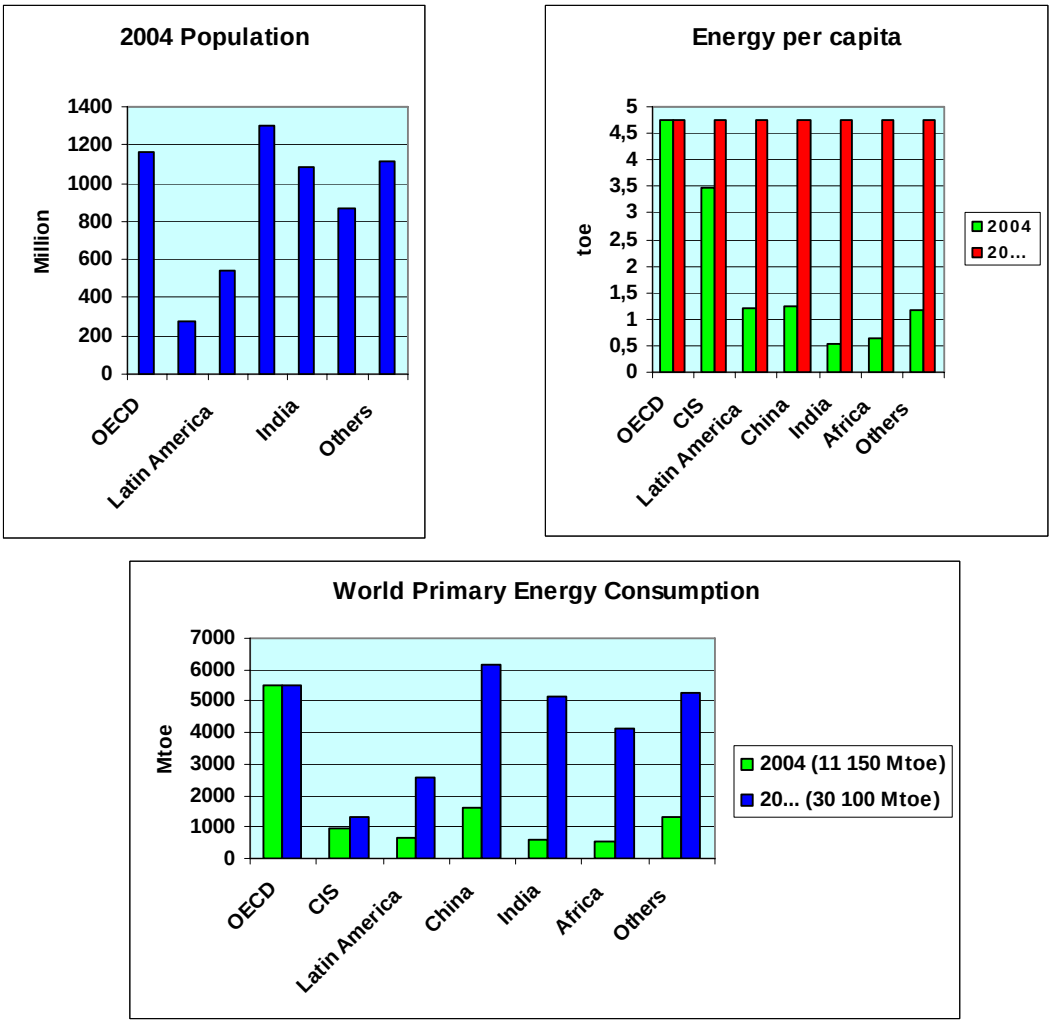
To pursue the present path for energy systems development leads to growing insecurity of supply and unacceptable increase in greenhouse gas emissions : in the IEA scenario, world energy-related CO_2 emissions increases by 1.8% per year to 38 billion tonnes in 2030, 70% above the 2000 level. Furthermore, the increase in energy prices due to the magnitude of energy investments and the announced limitation of oil and gas medium and long term low cost resources would increase the already existing disparities on access to energy between the rich and poor countries.

[1] In the 2006 IEA "World Energy Outlook" presented in november 2006, World total primary energy consumption is 17 000 Mtoe in the BAU scenario.
[2] IEA press release, 14 November 2006.
[3] IEA press release, 14 November 2006.

2.2 WHAT IF?

If the energy model of ever growing energy supply to sustain ever growing energy demand was limited to the OECD (or "rich") countries, it could probably go on during a number of decades. But if one recognises the legitimacy of economic and social development of such countries and regions as China, India and the rest of the world, the development of energy systems based on the present trends and business as usual policies is simply impossible.
The following figures show what would be the World primary energy consumption, if China, India and the other large regions of the planet reached, an unknown year of the XXIst century, the same level of primary energy consumption as the OECD group of countries today, assuming a constant population for each region and that energy consumption per capita of OECD would not increase.

Figure 8



Even with a constant population, the total primary energy consumption would reach 30 000 Mtoe, that is about three times the present consumption.
If, as expected, the World population reached 9 to 11 millions, the total consumption would be of the order of 50 000 Mtoe.
This is clearly not only ***unsustainable*** but ***impossible*** (in terms of resources, economic costs, environmental damages, etc.). The energy supply system would never be able to sustain such a demand : ***three to four "Planet Earth" resources would be necessary!***

3. A NEW ENERGY PARADIGM

3.1 CONVERGING FORCES FOR ENERGY EFFICIENCY

The energy security and environmental constraints converge to offer to mankind both a challenge and an opportunity: to invent a new model compatible with sustainable development, in order to "meet the needs of the present without compromising the ability of future generations to meet their own needs".
The compatibility of energy development with sustainable development lies with the capacity to develop in all countries energy systems based on high energy end-use efficiency, improved efficiency of the supply technologies, in particular in the use of fossil fuels, and the development of renewable energy sources.
Energy efficiency comes first, because it presents the largest potential, it is applicable to all sectors of activities in all countries and because it is a pre-requisite to slow down the depletion rate of fossil fuel resources and to ensure a rational and significant increase of the share of renewable energy sources in the total energy requirements.

3.2 THE REAL DEMAND : ENERGY SERVICES

Access to affordable energy is fundamental to human activities, development and economic growth. But it is access to "energy services", not energy supply *per se*, that matters. An energy service is the combination of the way we can or do provide this service (for example the mode of transportation, or the type of housing), the quality of the equipment or appliance used (insulated house, low consuming car, efficient bulb or boiler, etc.) and the quantity of energy necessary for running this equipment.
The new energy paradigm based on the "energy service approach" is symbolised by the formula :

$$\mathbf{S = U*A*E}$$

A service "S" is provided through the combination (symbolised by the sign * without any mathematical pretension) of the "type of use" U (way of life, climate, behaviour), the equipment or appliance "A" and a quantity of final energy product "E".
The quantity of energy needed varies considerably according to the type of use and the equipment used : if they are "energy efficient", the quantity of energy needed for the same service can be brought well below its current level.

An energy end-use efficiency policy consists in elaborating and implementing a series of measures and programmes in order to improve both the way we can provide the required service and the quality of the equipment used : that is to invest in "energy services".
An important element of energy services is that price competition between energy services providers leads to a reduction of the amount of energy consumed in rendering the service, as the cost of the energy consumed by these services can be a significant part of the total cost of the service. Optimising the total cost of the service is achieved by minimising its life-cycle cost. This cost minimisation allows market forces to assume an important role in improving energy efficiency when energy services are provided.

3.3 A WIN-WIN STRATEGY

Energy efficiency is a factor of economic development, for experience has shown that, in many circumstances, it is cheaper to save a given quantity of energy – or to avoid using it – than it is to produce it. This means that huge financial resources can be transferred from energy supply development to more valuable activities which better fulfil the needs of population (health, education, etc.). Beyond this global effect, the direct effects of energy efficiency on productive activity are significant : improvement in industrial productivity, development of new activities and creation of jobs in all economic sectors and all geographical areas.

The environmental benefits are even clearer: the energy which creates the least pollution is that which is neither used nor produced. Each time the energy consumption for a given need is reduced, the emission of pollutants is also, automatically and proportionally, reduced.

3.4 A COMMON PATH

An energy efficiency strategy is not a slight adjustment to an energy supply policy but a new concept of economic policy which takes into account the costs of environmental degradation, growing energy insecurity and the medium and long term trend to increasing costs of energy.
The industrialised countries can and must reduce their total energy consumption. Most of the developing countries must increase their energy consumption for their economic development, but they can reach this objective with a much lower growth than the industrialised countries in the past by applying energy efficiency strategies.
Conscious of the formidable challenge of both energy security and global environment, most countries present energy efficiency as the priority of their energy policy. Indeed, in some of them, energy efficiency measures and programmes have reached impressive results. The energy saving policies implemented in the OECD countries between the oil price increases of 1974 and 1979 and the steep decrease of 1986 strongly contributed to the stabilisation of their energy consumption over the period, while their GDP increased by 30%[4]. Unfortunately, the efforts were not pursued and the "rebirth" of energy efficiency polices, at relatively low levels, came with the international awareness of the climate change menace.

[4] California offers a remarkable success story for energy efficiency: per capita electricity consumption was stabilised at about 7,500 kWh per year from 1976 to 2002 through energy efficiency measures and actions.

4. HUGE ENERGY EFFICIENCY POTENTIALS

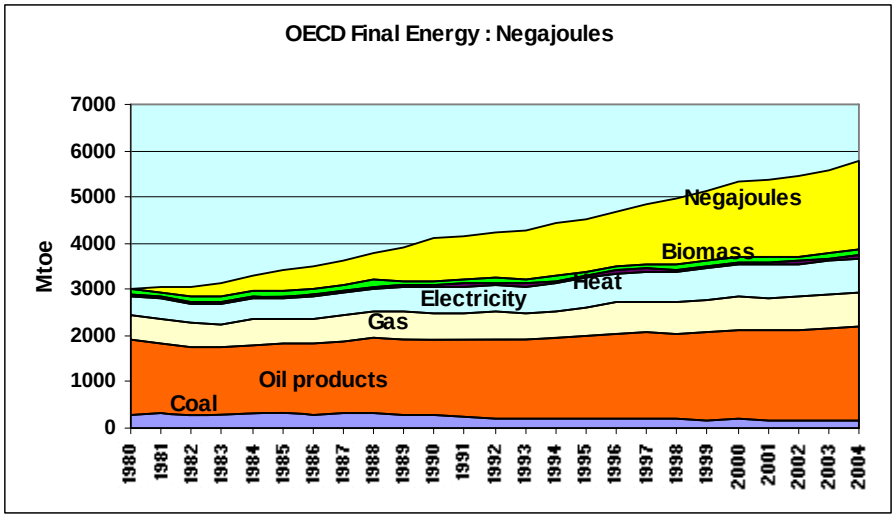
4.1 A THIRTY YEAR EXPERIENCE : THE HIDDEN RESOURCE, NEGAJOULES

Following the oil price increases of 1973-74 and 1979-80 (the "oil shocks"), the OECD industrialised countries implemented energy efficiency policies and programmes through :

- Institutional and capacity building (agencies, local teams…).
- Research and Development on more efficient techniques.
- Regulations and standards on equipment and appliances.
- Information and training.
- Financial incentives.

In addition to the effect of structural changes in the economic development, these policies obtained remarkable results, as shown by the following figure.

Figure 9



If the energy intensity of the OECD as a whole had remained constant over the 1980-2004 period, the energy consumption in 2004 would have been much higher : the difference is the contribution of the "Negajoules", saved yer after year, due to the decrease in energy intensity. The contribution of Negajoules in 2004 (1917 Mtoe) is about the same of that of the oil products (2025 Mtoe) and above the total of all other energy products contributions (coal, gas, electricity, heat and biomass).
The total of Negajoules or energy savings over the period 1980-2004 is 23 000 Mtoe.

4.2 POTENTIAL IN EU-25

The European Union is, with Japan, the most energy efficient region. Nevertheless, the potential for energy efficiency improvement is still very high.
The Green Paper on Energy Efficiency presents a 20% energy saving potential on total energy consumption of the EU (25) to be reachable from now to year 2020, as is shown in the following table.
These 20% primary energy savings in 2020 by energy efficiency measures and investment are now the objective of the "EU Action Plan for Energy Efficiency" presented by the European Commission in October 2006.
That means that the EU primary energy consumption in 2020 would be equal to 1500 Mtoe, instead of 1890 Mtoe in the "business as usual" scenario, and compared to 1750 Mtoe in 2004.

Potentials of energy savings at year 2020 in the Green Paper on Energy Efficiency (June 2005)
For the EU (25)

Potential savings in Mtoe	**2020** **Rigorous implementation of adopted measures**	**2020+** **Implementation of additional measures**
Buildings heating/cooling, electric appliances	56 (41) (15)	105 (70) (35)
Industry	16	30
Transport	45	90
Co-generation	40	60
Other energy transformation, etc.	33	75
TOTAL energy savings	190	360

4.3 IN TRANSITION COUNTRIES AND RUSSIA

4.3.1 A rough evaluation

The energy efficiency potentials are larger in countries in transition which than in the EU-15 countries. A study[5] on energy efficiency in European countries in transition presented an assessment of the energy efficiency potentials in the Central and South Eastern European countries, including the new EU Member States, based on future energy intensity values in these countries.
The countries concerned by this study were grouped as follows :
- Countries to be EU members in 2004 : Hungary, the three Baltic States, Poland, Tchech Republic, Slovakia and Slovenia;
- South Eastern European countries : Albania, Bosnia Herzegovina, Bulgaria, Croatia, Macedonia (FYROM), Romania, Yugoslavia (Serbia and Montenegro);
- CIS European countries : Armenia, Azerbaijan, Belarus, Georgia, Moldova, Russia, Ukraine.

Three scenarios (A, B, C) have been envisaged, each with a 3% annual average economic growth over the 2000-2020 period. In scenario A, energy intensity remains at its present value over the 2000-2020 period. In scenario B, energy intensity reaches in 2020 the value for the European Union (15 countries) in 2000. In scenario C, energy intensity reaches in 2020 the value for the European Union in 2020 (based on the present EU energy outlook).

While in scenario A, the energy consumption would increase by 80% between 2000 and 2020, it would increase by 16% in scenario B and decrease by 16% in scenario C.
That means that the energy efficiency potential at 2020 would be of the order of 35% in the case of scenario B and 45% in the case of scenario C. In the case of scenario B, for which the energy intensity convergence is less drastic, the 35% potential represents about 170 Mtoe saved in year 2020.

4.3.2 Special focus on IEA energy outlook (WEO 2006)

The IEA "World Energy Outlook 2006" published in November 2006 present a "Business as usual" scenario BAU) which the IEA considers as "unsustainable" and an "Alternative" scenario (ALT) which should alleviate the constraints (on economic development, energy security and climate change) of the BAU scenario.

[5] Reference: "*L'efficacité énergétique dans les pays d'Europe centrale et orientale*", a report for the French Ministry of Foreign Affairs, B. Laponche, M. Cru (ICE), R. Fayed (ICE), December 2002.

We present and discuss in this chapter the energy perspectives presented for the "Transition Economies"[6] and Russia.

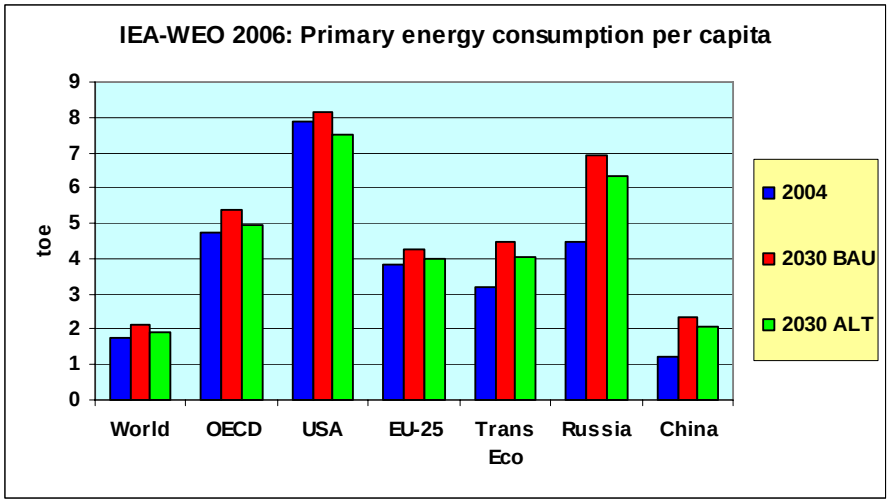
IEA energy perspectives

In Transition Economies and Russia : IEA Primary energy perspectives[7]

		2004	2015				2030			
			BAU	ALT	BAU-ALT	%*	BAU	ALT	BAU-ALT	%*
PEC Mtoe	**Trans. Eco.**	1077	1259	1210	49	**3.9%**	1420	1285	135	**9.5%**
	Russia	640	751	715	36	**4.8%**	854	780	74	**8.7%**
PEC/cap toe	**Trans. Eco.**	3.18	3.79	3.64	0.15	**3.9%**	4.48	4.05	0.43	**9.5%**
	Russia	4.44	5.52	5.26	0.26	**4.7%**	6.88	6.29	0.59	**8.7%**
PEI : koe/US$	**Trans. Eco.**	0.49	0.36	0.34	0.02	**5.6%**	0.26	0.24	0.02	**7.7%**
	Russia	0.53	0.40	0.38	0.02	**5.0%**	0.29	0.27	0.02	**6.9%**

PEC : Primary energy consumption; PEC/cap : PEC per capita; PEI : primary energy intensity.
**% : (BAU-ALT)/BAU*

The difference between energy consumption in 2030 in the BAU and ALT scenarios is very small, for Transition Economies as a whole as well as for Russia : less than 10%. Both energy consumption par capita and energy intensities have almost the same values in both scenarios.
This small discrepancy between scenarios BAU and ALT is also found for most regions of the world in the IEA 2006 perspectives but it is particularly misleading for Transition Economies and Russia.
Figure 10 presenting primary energy per capita values for the great consumers.
Figure 10



[6] Transition Economies : Albania, Armenia, Azerbaijan, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Estonia, Serbia and Montenegro, the Former Yugoslav Republic of Macedonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Romania, Russia, Slovenia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.
[7] WEO 2006.

This figure shows :
a) The small discrepancy between BAU and ALT values for all countries.
b) The stability of energy consumption per capita for World, OECD, USA and EU from 2004 to 2030.
c) The high increase of energy consumption of Transition Economies and Russia between 2004 and 2030, with already high values in 2004.

This result is very surprising since all studies, from Russian and foreign experts, as well as the practical knowledge and experience of reality of energy consumption in countries in transition is that of important waste of energy in all sectors, compared with, for instance, the western European standards.

Furthermore, the Russian annual consumption of oil and natural gas would increase over 2004-2030 in both scenarios, as shown in the following table :

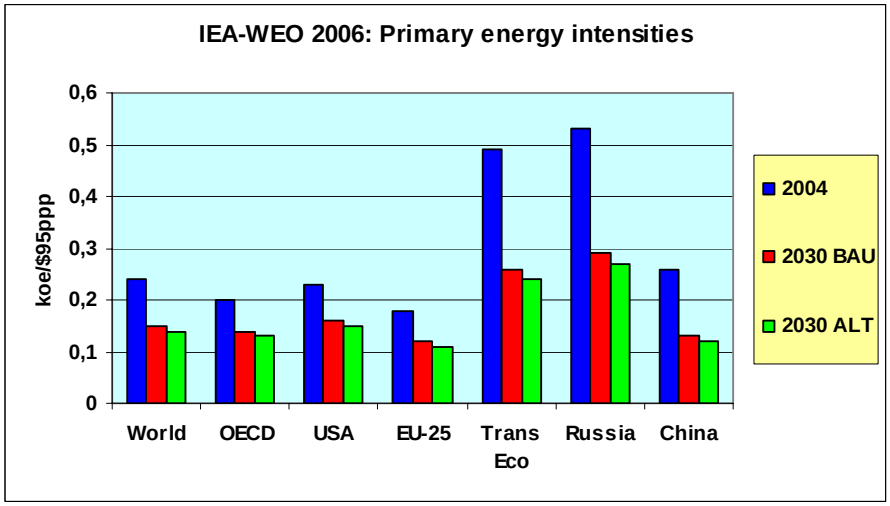
Oil and natural gas consumption in Russia in IEA perspectives

Mtoe	**2004**	**2015**		**2030**	
Scenario		**BAU**	**ALT**	**BAU**	**ALT**
Oil	130	152	140	170	149
Natural Gas	345	413	391	478	417

Even taking into account the vast resources of Russia, there is certainly a risk for a decrease in export capacities if the domestic consumption is still increasing in the future.

Energy intensities in 2030
The explanation of such a result appears when one compares the values of energy intensities, as shown in figure 11.

Figure 11



For all countries, energy intensities decrease from 2004 to 2030.
This is true for Transition Economies and Russia; but for those countries, the values of energy intensities, both in BAU and ALT scenarios, remain very high compared to those of the other countries.
If such high values can be expected in a "business as usual" scenario, an alternative scenario based on the development of energy efficiency policies should have a much lower energy intensity value in 2030.

4.4.3 A more realistic evaluation

A more realistic approach consist in assuming the convergence, over the 2004-2030 period, of the energy intensity of Transition Economies and of Russia, in direction of the energy intensities of the OECD and the United States.
This convergence is already existing in the IEA perspectives and for the BAU scenario. We assume that it is accelerated in our "Energy Efficient" scenario which replaces the ALT scenario.
Our assumption is that, for both the Transition Economies and Russia, the values of energy intensity in the "Energy Efficient" scenario would be in 2030:

- for the Transition Economies, equal to that of the OECD in BAU 2015 : 0.17;
- for Russia, equal to that of the United States in BAU-2015 : 0.19.

Which gives the following for the energy intensity values over the 2004-2030 period :

Transition Economies and Russia energy intensities : the "Energy Efficiency" scenario

Primary energy intensity	**2004**	**2030**	
koe/95US$ppp		**Business as usual (BAU-IEA)**	**Energy Efficiency (EE)**
Transition Economies	0.49	0.26	**0.17**
Russia	0.53	0.29	**0.19**

Based on these valued of the energy intensities, the total primary energy and energy per capita consumption are the following.

		2004	**2030**			
			BAU-IEA	**EE**	**BAU-EE**	**%***
PEC Mtoe	**Trans Eco**	1077	1420	910	510	**36%**
	Russia	640	854	549	305	**36%**
PEC/cap toe	**Trans Eco**	3.18	4.48	2.87	1.61	**36%**
	Russia	4.44	6.88	4.43	2.45	**36%**

PEC : Primary energy consumption; PEC/cap : PEC per capita.
**% : (BAU-EE)/BAU*

In this case, the energy efficiency potential for Transition Economies and for Russia would be of the order of 36%.

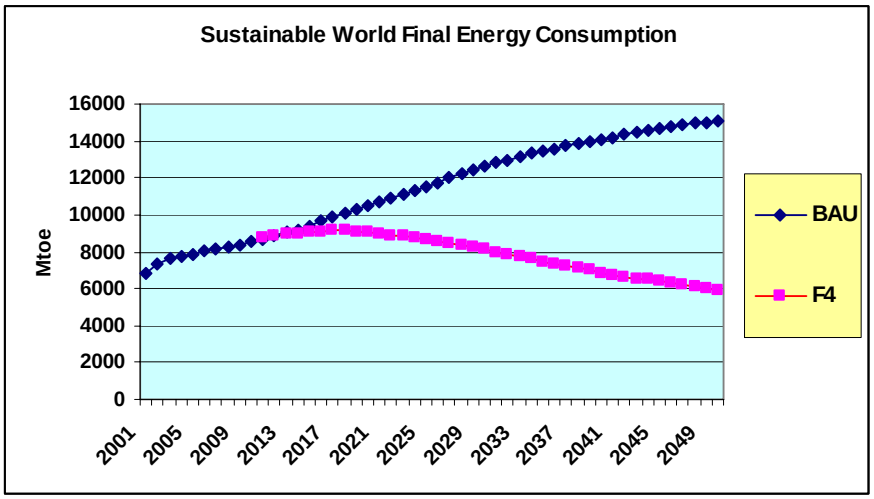
The potential of about 300 Mtoe energy savings in 2030 for Russia is consistent with the evaluations presented in the Russian Federation Energy Strategy of 2002 (the total potential for energy efficiency at year 2020 was estimated between 250 and 300 Mtoe).

5. SUSTAINABLE ENERGY DEMAND FUTURES

5.1 WORLD "SCENARIOS"

Several World Energy scenarios have been developed, in particular under the "World Energy Assessment" (WEA) study led for UNDP by Professor J. Goldemberg[8].
A recent study[9] by ENERDATA and IEPE-LEPPI, two well known research institute on energy and environment forecast, presents two World energy scenarios at 2050 : the first scenario is a business as usual scenario (BAU) and the second (F4) is built in order to ensure a division by a factor of 4 of the CO2 emissions (in 2050 compared to 1990) due to the energy production, transformation and use.
The above figure presents the results obtained on the final energy consumption. The stabilisation around 2020 of the final energy consumption, followed by its decrease from 2020 to 2050 is obtained by the implementation, in all sectors, of a vigorous energy efficiency policy in all countries.
Several expert teams or institutes have developed such scenarios at World or regional level, including Europe. There is a need for all member countries of the UNECE to develop "high efficiency and renewable energy" scenarios to show to the decision makers, at all levels, the potentials and impacts (for security, environment and economic and social development) of a "**Sustainable Energy Future**".

Figure 12



5.2 FROM POTENTIAL TO MARKET

The huge potential for energy efficiency still needs to be transformed into market opportunities. The main obstacles preventing full integration of end-use efficiency actions into the market relate to a series of obstacles, of which :
- the lack of a harmonised and credible framework of instruments, mechanisms, definitions and information regarding energy efficiency services and measures;
- the fragmentation of the efficiency market, lack of visibility of saving potentials, limited access to capital, and the lack of knowledge of the cost-effectiveness, returns and risks of investment in energy end-use efficiency;
- the disparity of discount rates leading to the possibility for energy supply companies with low internal rates of return requirements to build power plants and other infrastructure, while the rate of return for end-use consumers for investment in energy efficiency is invariably higher;

[8] See also *"Energy for a Sustainable World"*, José Goldemberg, Thomas B. Johansson, Amulya K.N. Reddy, Robert Williams – 1988 – Wiley-Eastern Editions, New-Delhi, India.
[9] *"Etude pour une prospective énergétique concernant la France"*, French Ministry for Economy, Finance and Industry, February 2005.

- the division, in many countries, of public sector budgets into separate budgets for investment (for instance in energy-using technologies) on one hand, and budgets for operation and maintenance on the other, which does not incite managers to invest in energy-efficient technologies;
- the generally small size of energy efficiency projects (compared to supply ones) does not attract the attention of large financial institutions, including development banks.

A large part of the available energy savings potential that exists today can be effectively realised using a market for energy services and other energy end-use efficiency measures under a number of conditions : information provided on energy services; contractual, financial and legal instruments put in place; credibility and guarantees of performance and savings established.
For EU 25, the European Commission estimates that this would create a market for energy efficiency worth between 5 and 10 billion Euros per year. In addition, the energy efficiency market creates considerable added value and is often characterised by highly labour-intensive investment. These lead to many positive local and regional effects, such as substantially increased employment when large retrofitting projects in the buildings sector are carried out[10].
Recent studies by international financial institutions show that the technical potential in Eastern Europe alone for profitable investment in energy efficiency and renewable energy projects with payback periods of less than five years represents an investment amount between US$ 5 and US$10 billion.

[10] Reference : SAVE Employment Study, European Commission, 2001.

6. CONCLUSION : MAIN MESSAGES AND LESSONS LEARNT

From this overall – even though brief – review of energy in the World and its possible sustainable future and from the international experience gained through more than two decades of energy efficiency policies, in particular in most European countries, and notably through the experience of the Energy Efficiency 21 Project of the United Nations Economic Commission for Europe, the author should like to convey the following messages.

6.1 A COMMON STRATEGY

The first message is a Policy message, addressed to policy decision makers at all levels, and particularly the financial, economic and planning authorities. Its main elements are the following:

a) To pursue along the path of present trends and "business as usual" energy policies and related economic policies **is not sustainable**.

b) The **convergence of the three major constraints** – energy security, global warming, and economic burden – leads to the absolute necessity for a new energy-economic policy in order to sustain economic and social development.

c) At all levels – national, regional, World – the alleviation of the negative consequences of present energy trends requires to adopt vigorous **energy efficiency policies and measures** in all sectors. This **win-win strategy** is applicable in all countries, whatever their level of economic development and their energy resources. It reinforces economic growth, reduces environmental local and global damages, and creates new activities and jobs.
A **sustainable energy path** is necessary and possible: the future is open.

6.2 EUROPEAN EXPERIENCE AND POLICIES

The second message relates to energy demand situations and policies in the European countries.

a) **The European countries experience different situations regarding energy efficiency**. The Western European countries benefit from a thirty-year experience, while new EU Member States and South Eastern European countries are characterised, as a general rule, by higher energy intensities which reflect lower energy efficiency. The European countries in transition, as well as the CIS countries, present as a general rule high energy intensities and, therefore, very high energy efficiency potentials.
In all countries, the present trends of energy consumption are such that energy security is a growing concern, greenhouse gases emission reduction targets set in Kyoto will not be reached and the economy is undermined by the increase in oil prices, with heavy consequences on low income households.

b) In all European countries, **the cost-effective potential for energy efficiency is huge**, and the technical ways for "exploiting" it are well known.

c) At EU level, the 2000 Green paper on Energy Security and the 2005 Green Paper on Energy Efficiency **place energy demand at the first rank of priorities** (with a 20% energy efficiency potential at 2020).
InTransition Economies, including Russia, the energy efficiency potential can be estimated at about 35% at 2030 (on the basis of a "business as usual" unsustainable reference scenario).
These potentials pave the way for a strong Energy Efficiency Policy.
The greatest attention must be focused on three sectors:

- Heating in Buildings (district heating, rehabilitation of existing buildings).
- Electricity Demand in Households and Tertiary sectors.

- Transport Policy (mass urban transport, modal shift to rail).

d) **Innovative practices** for energy efficiency programme and project financing have been developed in a number of countries during the recent years. These "best practices" should be rapidly extended to all countries.
In particular, the development of Energy Efficiency Service activities, undertaken by local authorities, energy utilities, specialised companies, should be encouraged, supported and widely disseminated.

6.3 THE HUMAN FACTOR

The third message points out the importance of capacity building and the role of local authorities.

a) Energy Efficiency extends over all economic and social activities, far beyond the energy sector itself. All enterprises (industry and tertiary sector), regions, cities, public administrations, households, associations, and NGOs are concerned. Energy Efficiency must be a component of infrastructure development and social and economic policies.
The key words of energy efficiency spreading are **"decentralisation", "initiative", "networking".**

b) To overcome or remove the obstacles to energy efficiency, priority should be given to **capacity building at all levels** through:
- National and regional **energy efficiency agencies**.
- **Local teams** at city/ district/ conurbation level.
- **Networking** for training, exchange of experience, dissemination of best practice.

c) **Local authorities have a major role** to play, both as "energy consumer", "energy producer and distributor", "city regulator and developer", "motivator".
Energy-related issues are no longer exclusively in the hands of energy companies: **the citizen-consumer becomes a major actor.**

Capacity building is a major responsibility for governments and international organisations.

6.4 APPROPRIATE TOOLS AND FINANCIAL MECHANISMS

Analysis of the best policies and programmes shows that there is not one instrument or one measure which has to be privileged as capable to solve all problems. The success lies with the consistency of a whole system of tools and instruments, each adapted to a particular situation, sector, partner or technology. Regulation remain a very powerful measure but it must be supported by a high level of information, training, partnership and financial incentives. Among those, subsidies for demonstration operations are necessary but the bottleneck of large scale investment difficulties should be overcome through more sophisticated financial mechanisms, from "Energy Efficiency Funds" to "Public-Private Investment Funds".
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