

## WEC AFRICA WORKSHOP ON ENERGY EFFICIENCY

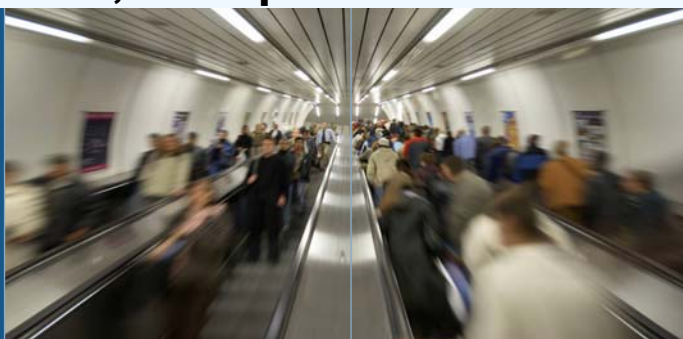
*“Energy Efficiency: What are the Priorities, the proper Policy Measures and the best Practices for Africa?”*

29 – 30 June 2009  
Addis Ababa, Ethiopia

**Energy Efficiency:  
to foster Africa’s  
Sustainable Development**

Promoting the sustainable supply and use of energy for the greatest benefit of all

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## Impacts of EE for Africa

- EE impacts positively on many global and local topical issues, such as: energy security, industrial development, climate change, local air pollution, consumer welfare, job creation, etc.
- Beside these, EE improvements offer multiple opportunities and benefits, including: preventing energy waste, reducing need for investment in energy infrastructure and facilities, reducing production costs, lowering fuel bills, reducing risks, improving business productivity, increasing competitiveness, saving substantial money, and paving the way for a most efficient economy
- For Africa, EE improvement constitutes a key strategy for the energy sector and offers a cost-effective tool to contribute in a substantially manner to the Continent development.

## Main challenges for Africa

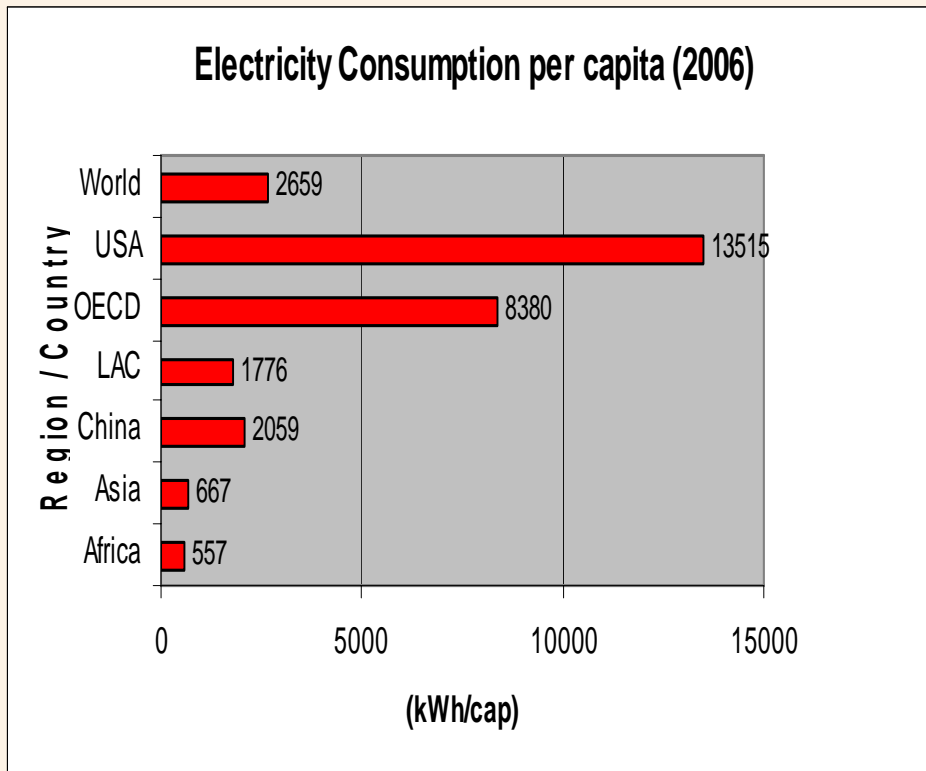
The main challenges to address to boost EE in Africa include:

- Adapted policy-measures and appropriate Institutions
- Strong Government engagement
- Affordability of EE projects (high up-front costs)
- Access to adequate financing schemes
- Leveraging market opportunities for EE investments
- Establishing incentives to sustain EE improvements
- Technology transfer / deployment / dissemination
- Participation of the private sector
- Raising awareness of the public.

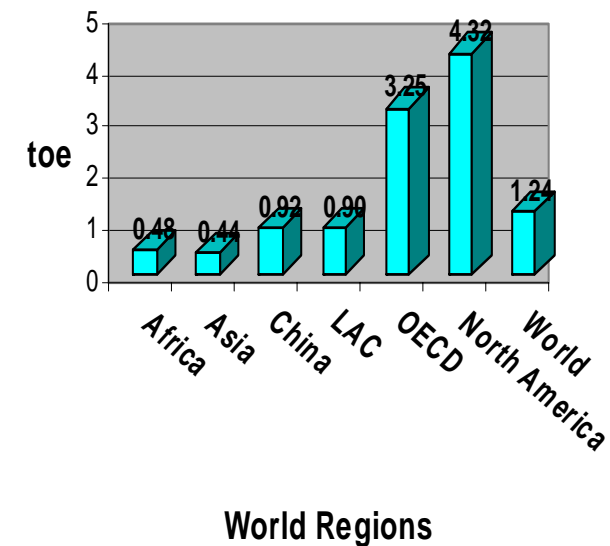
## Driving forces: what makes EE critical for Africa?

- Scarcity of adequate funding for the rational expansion of the energy system
  - Lack of adequate energy infrastructure and facilities to meet a growing energy demand
  - Frequent energy shortages (fuel, electricity) and the subsequent need for energy savings and conservation
  - High energy prices and their impact on economic and social development
  - Depletion of conventional hydrocarbon resources and biomass resources (forests)
  - Global warming and post-Kyoto issues that can be more stringent
- => For African countries who are experiencing severe load shedding due to acute power shortages, EE improvements can bring a timely and opportune relief by significant reduction in peak demand.*

## Africa, compared to other World Regions



**World Regions: Final Energy Consumption per Capita (2006)**

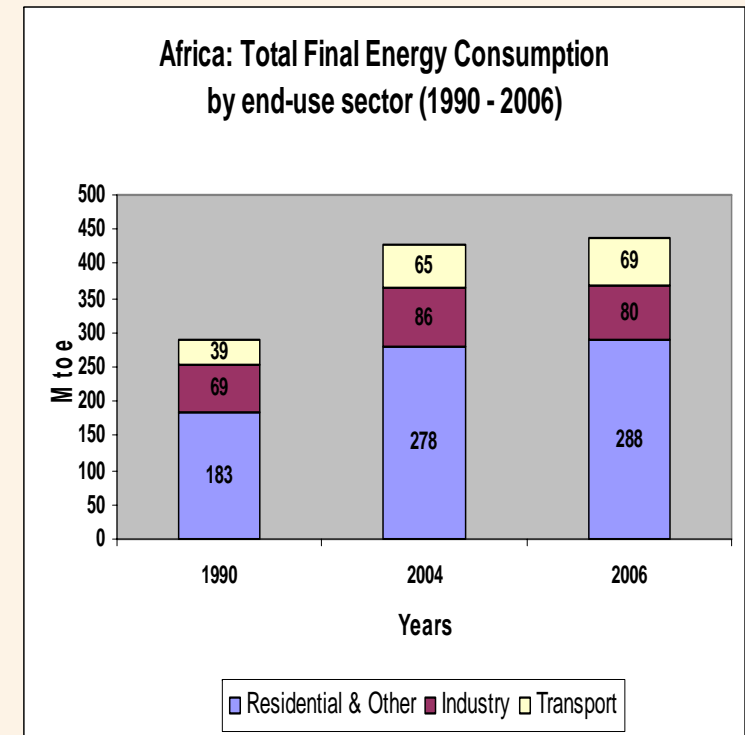


The electricity consumption per capita is far below the one of the US and the World average (ratios: US/Africa ~ 24 and World/Africa~5)

Source: Data from IEA – Key World Energy Statistics & Statistics 2008

## Energy demand and use in Africa

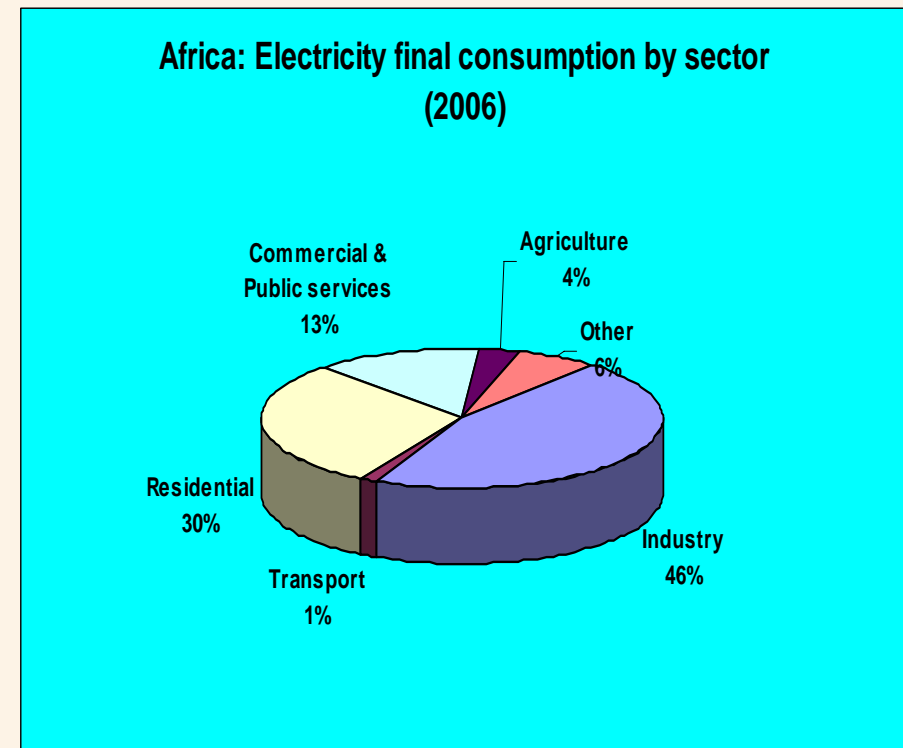
- Transportation:** is a critical end-use sector of energy – its share in the TFEC amounted at around 16% in 2006 (Graph)  
 Oil represents nearly 98% of the energy consumed by the sector; and of this, more than 80% is due to road transport  
 There are good prospects to realise substantial EE improvements in this sector, which is the most inefficient and the most rapid growing energy consumer, with an annual growth rate of 3.6% in the period 1990 – 2006 (versus 1.0% for Industry and 3.4% for Residential & Others)
- Industry:** the share of this sector in the FEC in 2006 is estimated at 18%. But, there are huge disparities between the African countries (Egypt: 33%, Tunisia: 25%, SA: 35%, Senegal:11%, Kenya: 6%)
- Residential-Services-Agriculture:** which is grouping a large range of economic activities, is also the most important energy consumer, with a share of around 2/3 of FEC) – (Graph)  
 This is likely the sector with the greatest potential of energy savings.



Source: Data IEA, WEO 2006 and Statistics 2008

## Africa: Electricity Final Consumption by sector

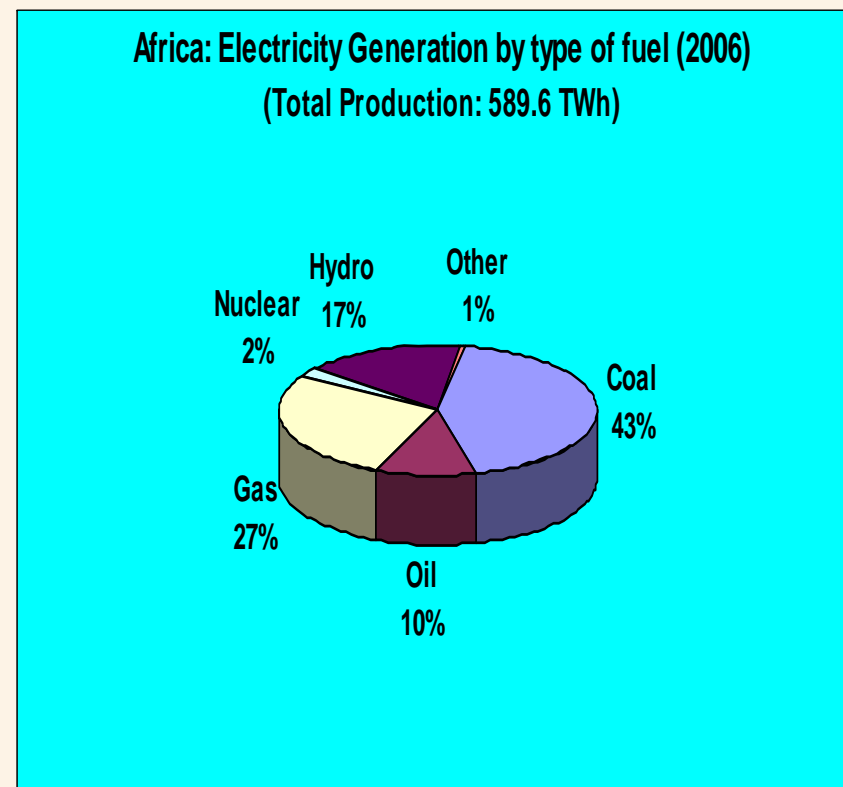
- In the electricity demand side, the biggest areas of consumption are: Industry (46%), Residential (30%) and Commercial & Public services (13%) – together they are responsible for about 90% of the African electricity consumption (see Graph)
- The most important part of energy savings in the electricity sector should be targeted in these areas.



Source: « Africa Recovery, United Nations » – Africa Renawal

## Africa: Electricity Generation by type of fuel

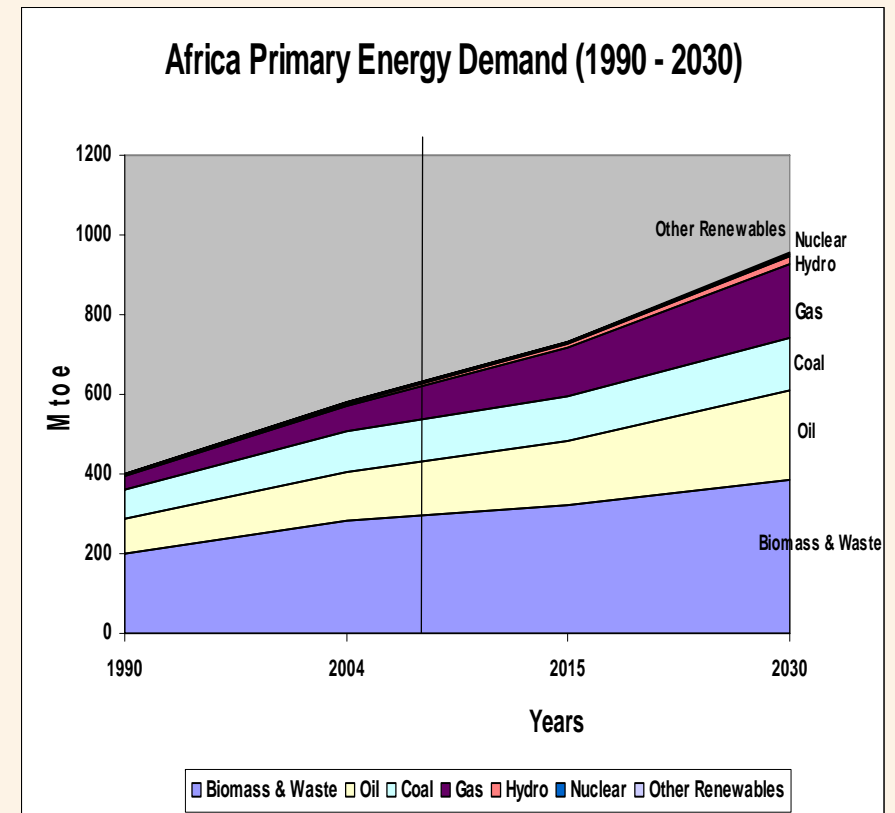
- In the electricity production side, huge energy savings can be realised by replacing the old inefficient thermal power plants by high-efficiency generation technologies, or simply by rehabilitation and retrofitting of some old power plants
- There is room for substantial planning & operational optimization, with regard to power generation, transmission & distribution, and end-uses; and this could result in huge energy savings
- In particular, EE improvements in the electricity sector can be achieved by a series of measures: optimal economic dispatching of the plants, load factor management, load shifting, network analysis, reduction of T&D losses, etc.
- Developing a balanced power generation mix, with greater use of RE and nuclear, would help to reduce fuel consumption as well as GHG emissions.



Source: « Africa Recovery, United Nations » – Africa Renewal

## Africa: Trend in Primary Energy Demand (by type of fuel) IEA – Reference Scenario (Business-as-usual)

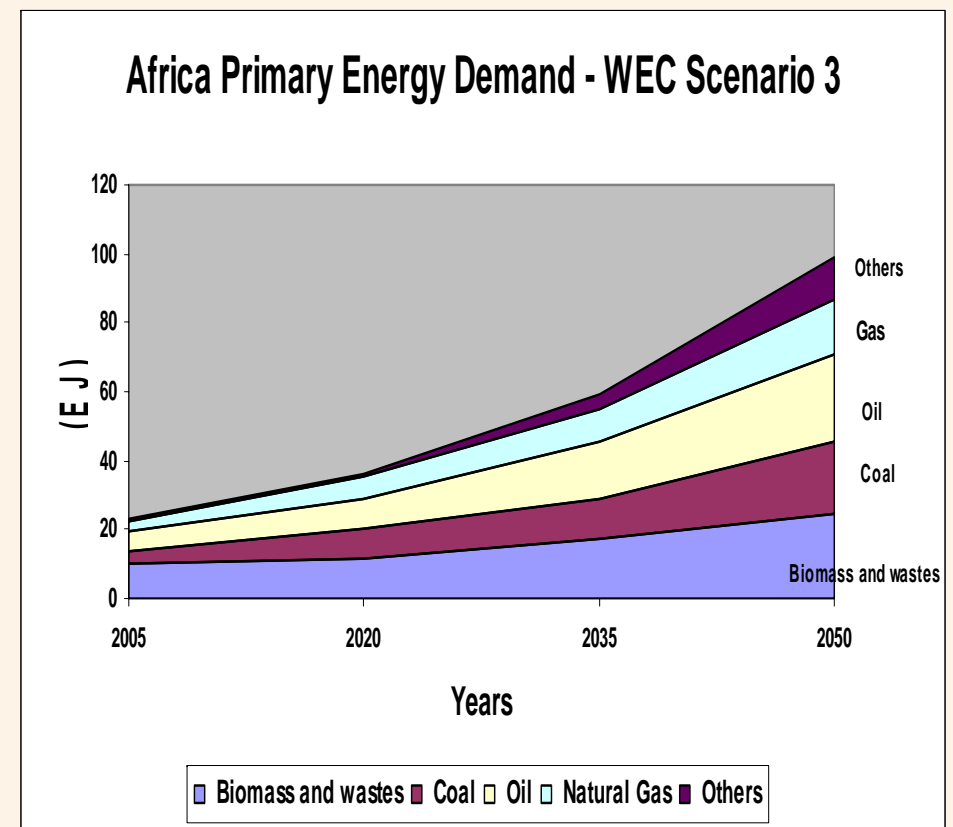
- Biomass & fossil fuels are overwhelmingly dominating the African primary energy supply, with a share of 98% in 2004 evolving towards 97% by 2030 (Graph)
- Meanwhile, the share of biomass, which accounted for 50% in 2004 will decrease up to 44% by 2030.



Source: Data from IEA, WEO 2006 & Statistics 2008

## Africa: Trend in Primary Energy Demand (by type of fuel) WEC Scenario 3: More Govern. & More Cooperation / Integration)

- In this Scenario, the share of biomass & fossil fuels which accounted for 98% in 2005 will decrease up to 87% by 2050
- Meanwhile, the share of biomass, will decrease from 43% in 2005 to 25% by 2050
- Biomass is the dominant fuel used in African rural areas - traditional biomass accounts for up to 90% of energy consumed by rural households, mostly for cooking
- Consequently, the focus should be placed now on sustainable biomass, because the energy transition would take long time for millions of rural households (to move away from biomass).

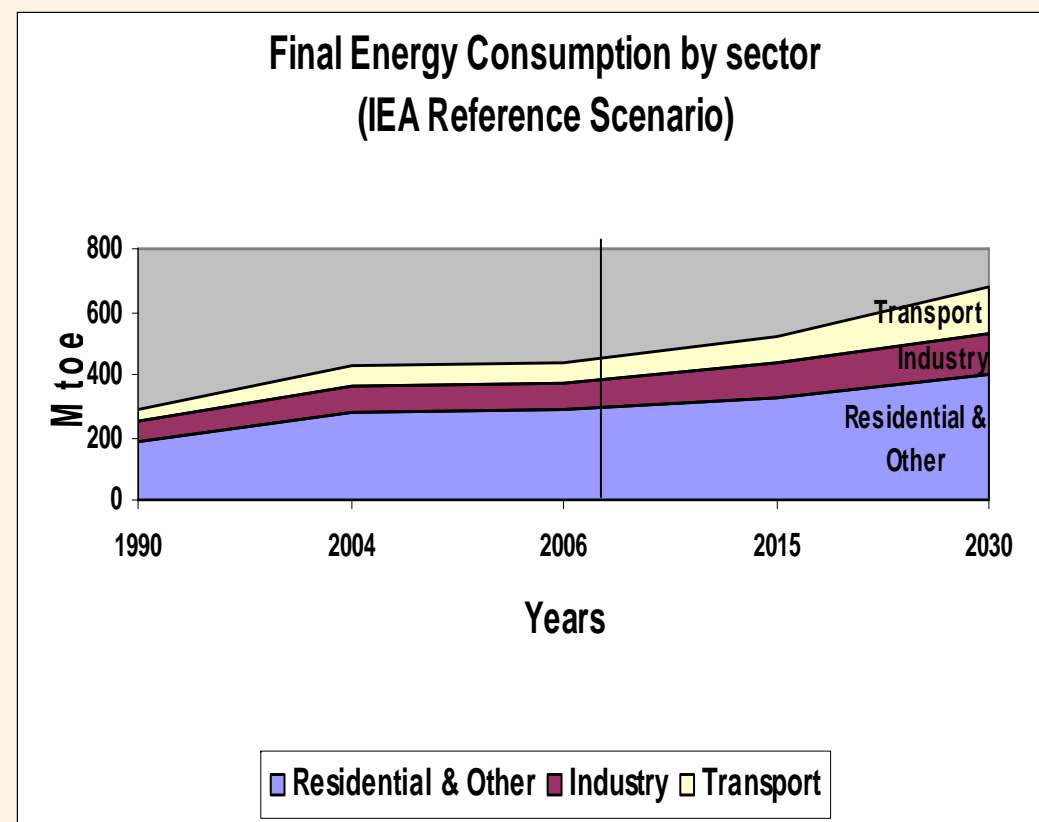


Source: Data from WEC Scenario Study, 2007

## Trend in Final Energy demand and use in Africa, by sector

According to IEA Reference Scenario (business-as-usual):

- The share of the transport sector in the TFEC is projected to grow up to 21% by 2030 (16% in 2006)
- The share of the Industry sector is projected to reach 19.4% by 2030 (18% in 2006)
- The share of the Residential-Services-Agriculture sector is projected at nearly 60% in 2030 (66% in 2006)

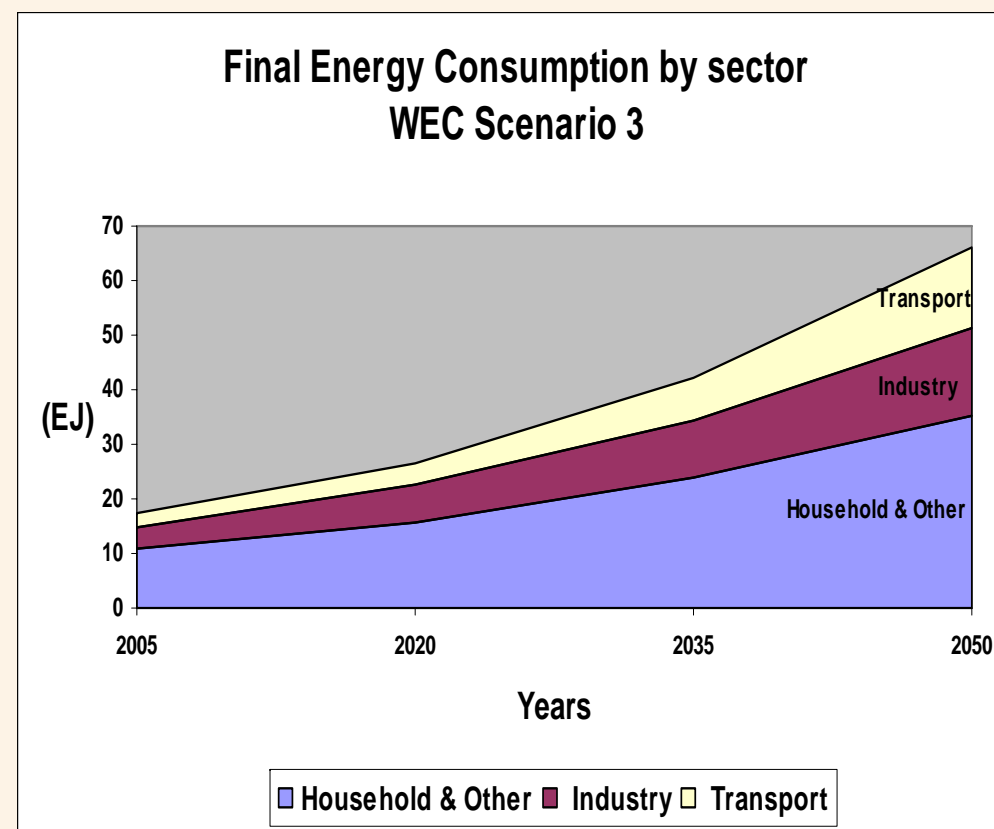


Source: Data from IEA, WEO 2006 & Statistics 2008

## Trend in Final Energy demand and use in Africa, by sector (cont.)

According to WEC Scenario 3 (more Gov. & more cooperation /integration):

- The share of the transport sector is projected to grow up to 22% by 2050 (16% in 2006)
- The share of the Industry sector is projected to reach 24.3% by 2050 (18% in 2006)
- The share of the Residential-Services-Agriculture sector is projected at 54% in 2050 (66% in 2006)

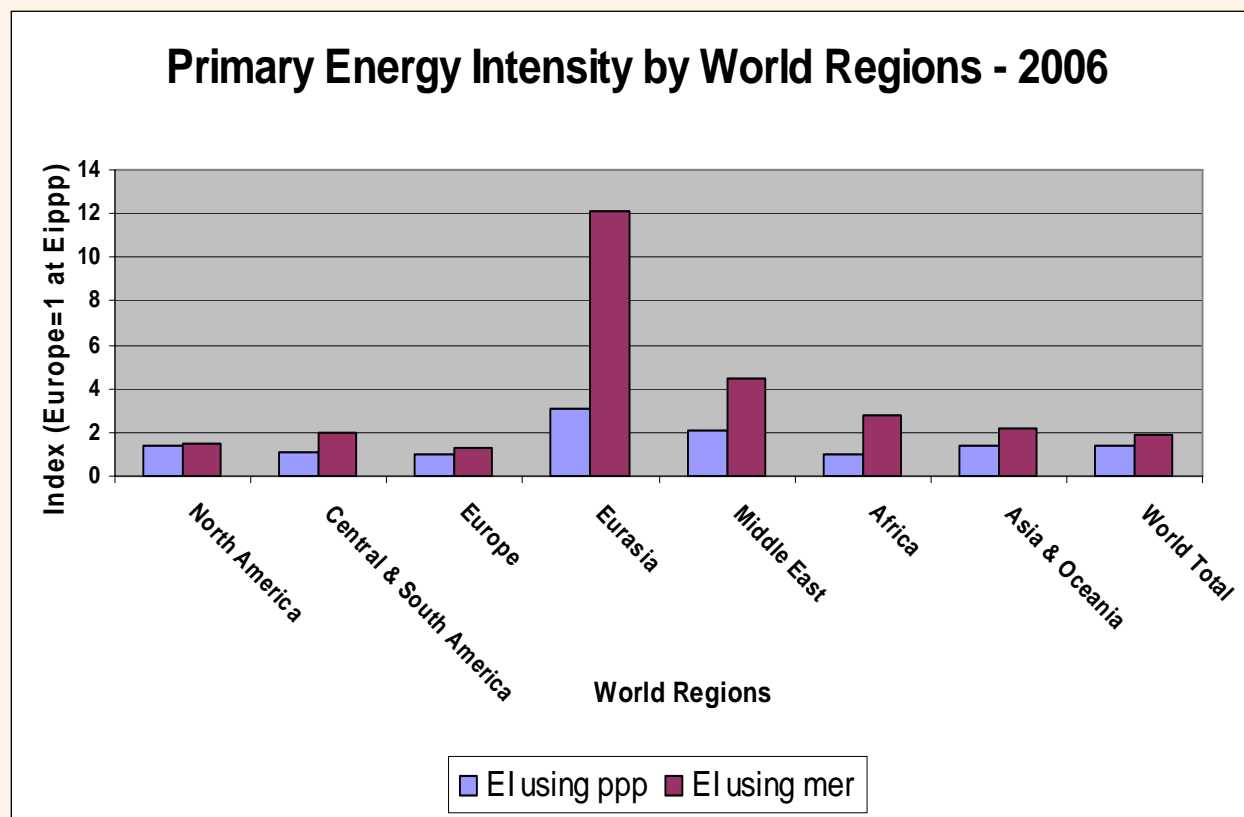


Source: Data from WEC Scenarios Study – 2007

## Energy Intensity - Generalities

- Energy Intensity (EI) is the amount of energy used to produce a unit of economic activity (e.g. GDP, VA)
- Variations of Energy Intensity result both from changes in Energy Efficiency and changes in economic structures
- Economic structure is different from country to country, depending on several factors: level of industrialisation, production of basic materials like steel, availability of energy resources, energy prices, energy consumption structure, climate conditions, etc.
- Energy Intensity can be higher in countries with a larger part of electricity consumption in the energy demand structure. Due to efficiency limits, 60% to 70% of primary energy is lost during the generation process, instead to be used to produce national wealth (i.e. GDP)
- To complement Energy Intensity analysis, an association of relevant sectoral indicators is needed for EE improvement evaluation.

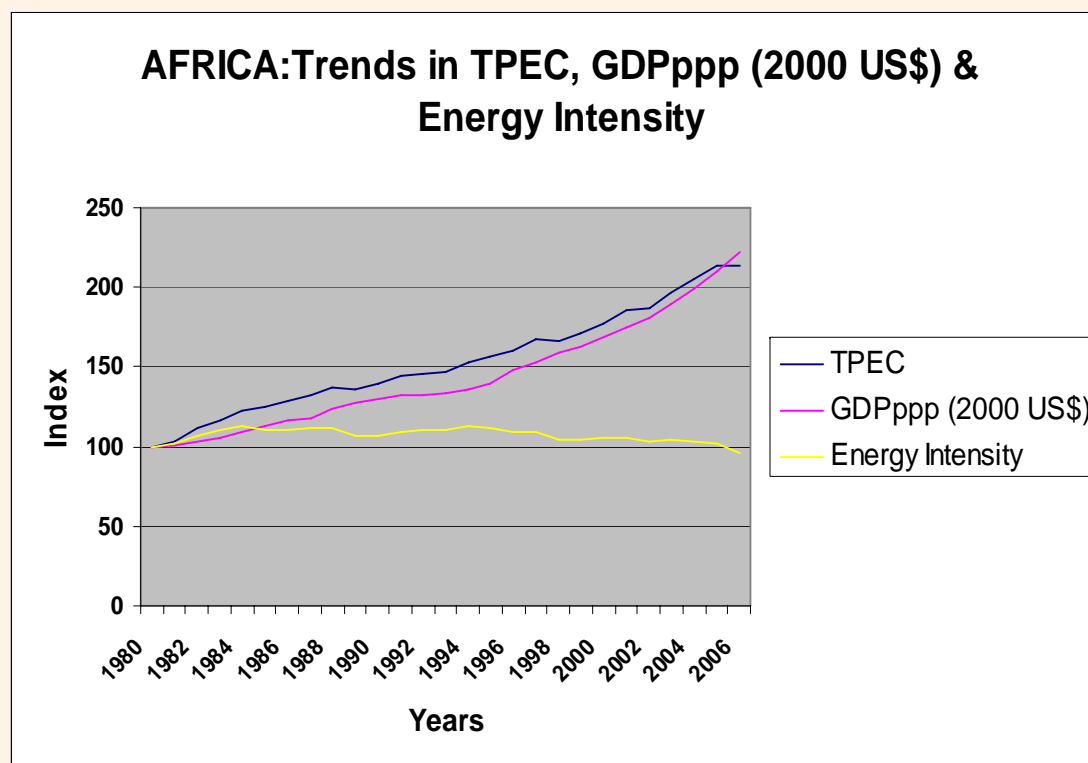
## Energy Intensity: Africa, compared to other World Regions (GDPmer & GDPppp (2000) US\$)



Source: Data from US- EIA, 2008

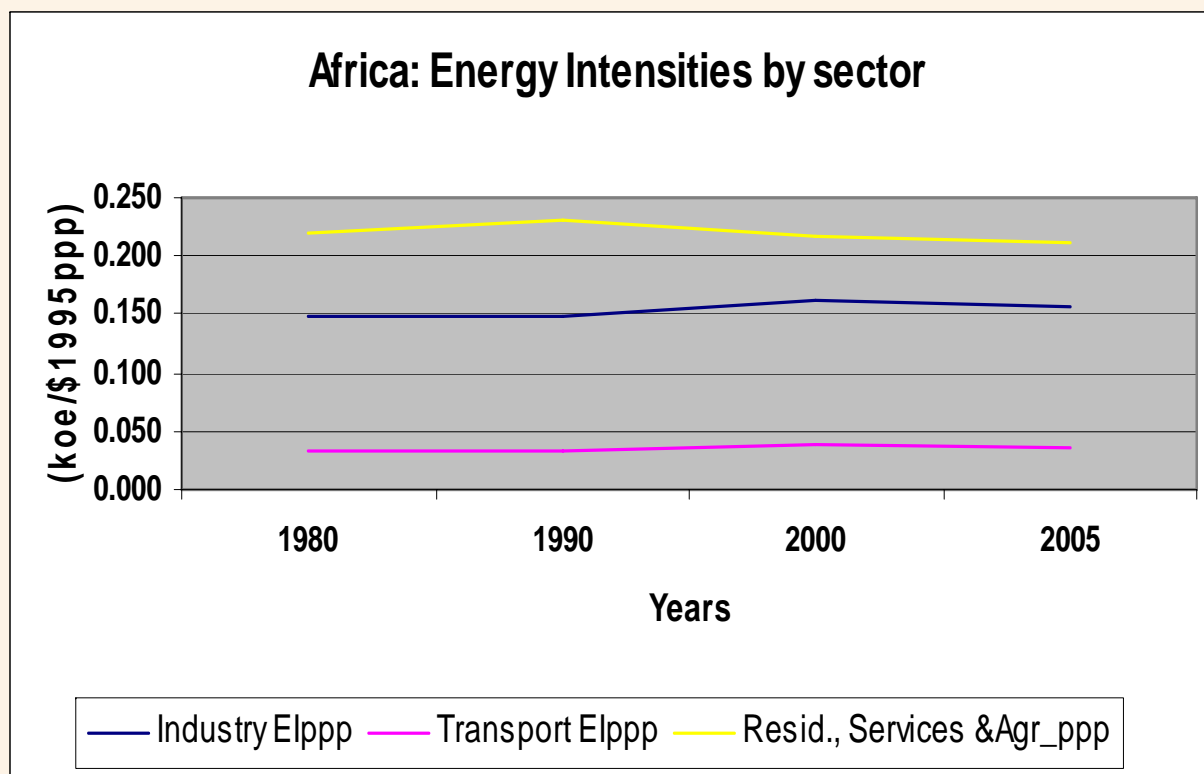
## Africa: Trends in TPEC, GDPppp (2000 US\$) & Energy Intensity (1980 – 2006)

- High economic growth - GDPppp: +113% since 1980
- High growth of Total Primary Energy Consumption: +122% since 1980
- Modest reduction of Primary Energy Intensity: -3.8% since 1980 (Graph)



Source: Data from US- EIA, 2008

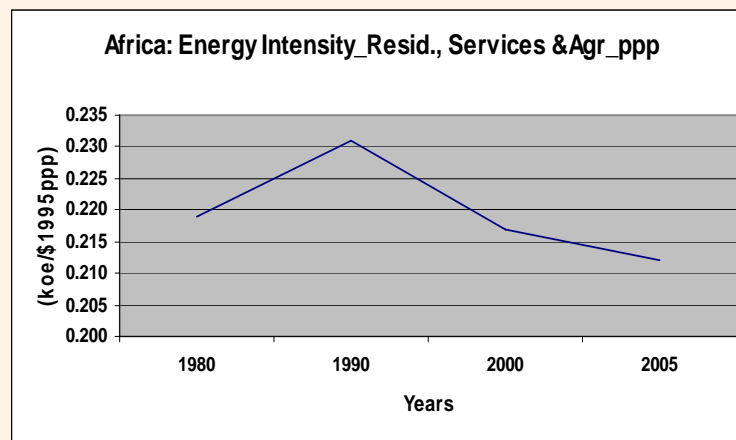
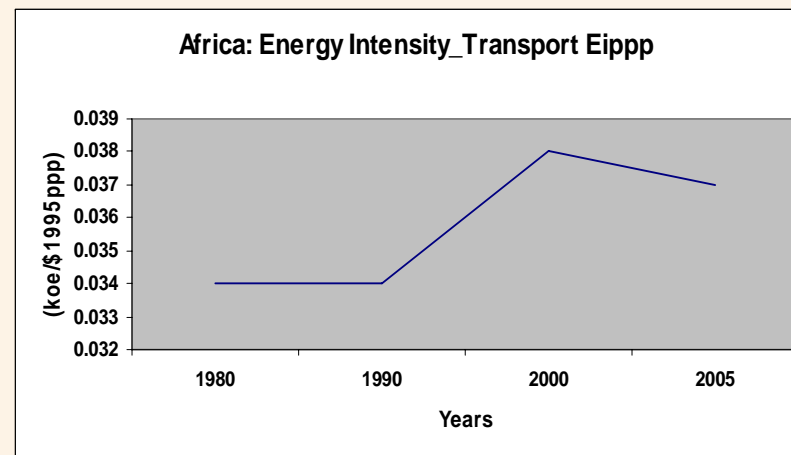
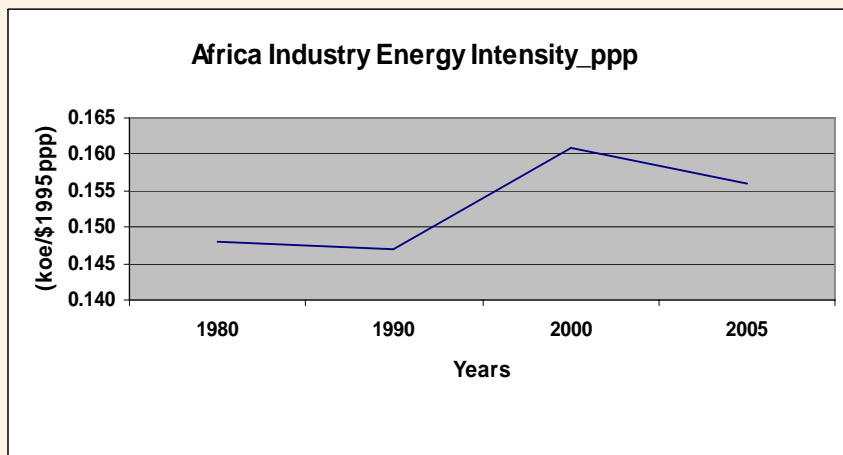
## Africa: Evolution of Energy Intensities by sector (1980 – 2005)



From 2000, there is a general trend of slow EI reduction for all sectors

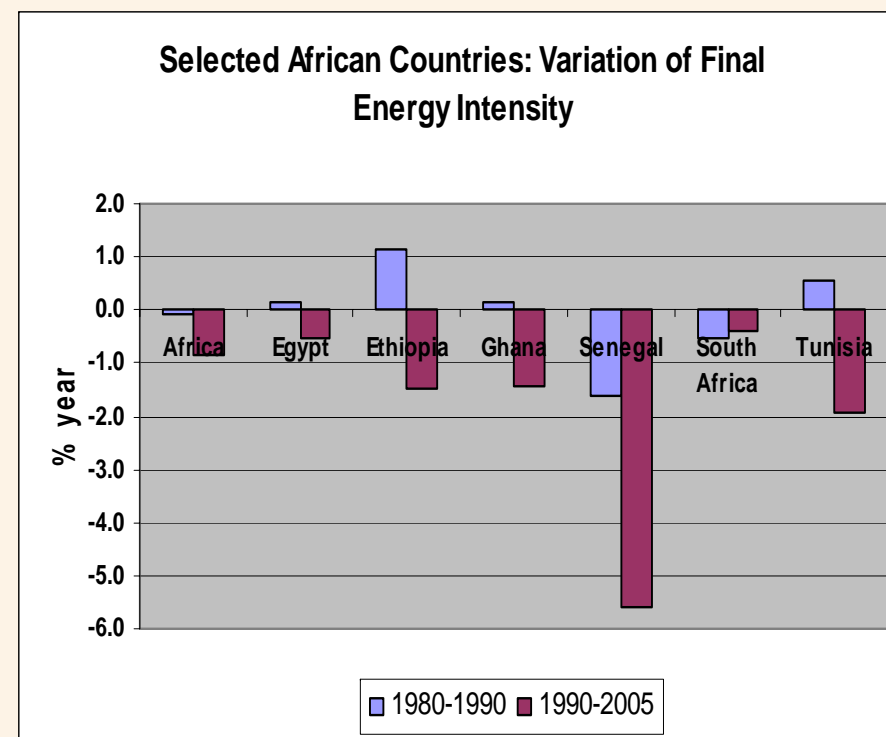
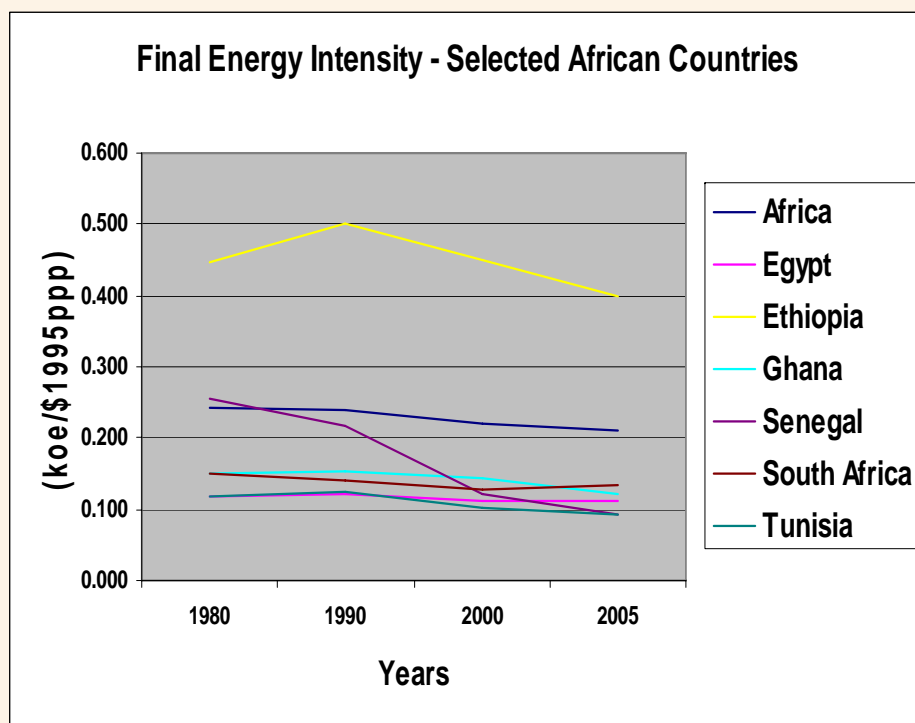
Source: ENERDATA-WEC Indicators, 2007

# Africa: Trend in Energy Intensity: Industry, Transport, Residence & Others (1980 – 2005)



Source: ENERDATA-WEC Indicators, 2007

## Evolution of Final Energy Intensity (1980 – 2005): selected countries



Source: ENERDATA-WEC Indicators, 2007

## Main facts and findings for Africa

- Some progress has been achieved over the past decade in EE improvements, but much needs to be done, particularly, in the following directions: EE policy and regulatory measures, technology deployment and dissemination, data collection and analysis, EE potential assessment and realisation, etc.
- Specific policy measures are in place in some countries, and some of them have proven to be effective, but there is still a long way to go for most countries and for the Continent as a whole
- So far, labelling and efficiency standards are not very common, and rarely mandatory – and for most countries they do not exist at all in any sector
- Used second-hand household electric appliances and old used cars account for a large part of the market – The incentives to change this situation is absent or not yet sufficient
- There are not suitable incentives to sustain purchase of EE products & equipment, or to boost EE investments substantially, or to set up voluntary agreements or mandatory regulatory measures to expand EE projects.

## Main facts and findings for Africa (cont.)

- There are not sufficient resources allocation or related political support to foster EE projects
- Policy measures with specific goals and targets are not clearly defined and Institutions are still generally very weak
- EE market development is still embryonic – Although high EE products already exist in / or are entering the market, they are not deployed and disseminated as they should be
- There is a huge cost-effective EE potential and great opportunities to save a bulk of energy and cost in many areas - but achieving this potential will need effective policy measures, substantial investments, technology deployment & dissemination and market development
- Substantial immediate results can be achieved, thanks to strong Government engagement
- Strong private sector involvement and more international & regional cooperation / integration are also needed to boost EE in Africa.

## Good experiences & best practices in African countries

- **Lighting:** promotion & diffusion of CFLs to replace incandescent lamps (Egypt, Ghana, South Africa, Tunisia, Senegal, Nigeria,..) – dissemination of LED lamps (with used or new batteries) in rural areas to replace candles, kerosene and fuel-wood lighting (now very common in most West African countries) - promoting the establishment of CFLs local manufacturers (Egypt)
- **Electrical appliances & equipment:** establishment of labelling programmes and/or efficiency standards (for lamps, refrigerators, room air conditioners, water heaters) (Egypt, Tunisia, Ghana) – promotion of high efficiency cooking stoves and/or fuel substitution for traditional biomass use (Senegal, Egypt, Algeria,..) – promotion of solar systems (home & community PV, dryers, water pumping, water heaters) – (Tunisia, Kenya, Morocco, Senegal, SA, ...)
- **Buildings envelope:** establishment of building codes for new buildings (Egypt, South Africa, Tunisia) – energy audit for big buildings (Tunisia, Senegal) – appointment of EE managers for large buildings (Egypt).

## Good experiences & best practices in African countries (cont.)

- Large Industries & SMEs : performing energy audits and/or savings programmes (Egypt, Tunisia) - supplying industries with EE technologies, including motors, lighting, cooling & heating (Egypt, SA) - promoting co-generation in industry (Tunisia and SA) – promoting EE in big sized and SMEs (Tunisia)
- Transport: promoting use of alternative fuels to reduce oil consumption (Egypt) - improving quality of transport infrastructure, modernising public transport and improving the traffic management system (Senegal and SA) - prohibiting import of old & inefficient second-hand vehicles (Senegal) - establishing fiscal measures for cars and motor fuels (SA and Tunisia) - establishing cars manufacturing facilities and providing financial schemes to taxi & public bus drivers to buy new cars (Egypt, Senegal)
- Electricity Utilities: improving efficiency of thermal power plants (Egypt, Senegal) - developing new high-efficiency generation technologies (NGCC, Diesel power plants, CCTs, CHP, Integrated CSP/CCGT) - (Algeria, Egypt, Morocco, Senegal, SA) – benchmarking power plants performance and monitor the performance (Egypt, SA) - promoting DSM (Egypt, Tunisia, SA) - establishing long-run marginal cost tariffs (Algeria, Egypt, Nigeria, Tunisia).

## Good experiences & best practices in African countries (cont.)

- Cross - Sectorial: setting up a proper regulatory framework with EE laws and quantitative targets for EE improvement (Tunisia) - establishing national EE funds to facilitate financing and guarantee of EE projects (Tunisia) - promoting and supporting ESCOs (Egypt) - establishing economic & fiscal incentives to stimulate EE investments (Egypt, Tunisia, SA) - establishing National EE&C Agencies (Ghana, Nigeria, Tunisia, Egypt) - establishing local energy information / advisory centres (Egypt, Nigeria) – establishing energy performance test standards & measurement laboratories (Egypt) - enhancing the capacity of national experts to develop and implement EE projects (Egypt, Tunisia) - raising public awareness and sensitizing policy decision makers (Tunisia, Nigeria, Algeria, Ghana, Senegal, SA, etc.)

## Requirements for Africa to enhance and spread up EE projects & programmes

- Although there are specific EE applications and good experiences & practices in Africa, they are generally spread out amongst few countries, and rarely a comprehensive “*package of measures*” applies to one single country in a coherent and rational manner
- The implementation of a comprehensive “*package of measures*”, adapted to national circumstances of each country, would have greater impacts and produce better results
- In addition, inside a country, efforts on EE improvements should be spread in all sectors of the economy (and not only limited to specific applications), and also, should target a great amount of energy consumption and/or a large number of consumers
- Country evaluation of implemented policy measures and their monitoring, as well as cross-country comparison of measures (benchmarking) should be highly encouraged and undertaken by the relevant institutions
- Strengthening policy measures, realising required investments and deploying new high-efficiency technologies are essential for further EE improvements in a wide scale.

## Successful policy measures to foster EE projects in Africa

- Establishing a favourable and stable regulatory & institutional framework adapted to EE – and setting official quantitative targets for EE improvements
- Assessing the huge potential of EE in the whole energy chain - and harnessing as much as possible the economically achievable EE potential
- Making more systematic and more general, labelling and efficiency standards for lighting, electric appliances and new big buildings, as well as mandatory energy audits in industries and medium & large companies - and accordingly, introducing relevant regulatory measures
- Initiating voluntary/negotiated agreements with large consumers in the industrial, transport and residential/commercial sectors, as well as with equipment manufacturers – in particular, for electricity utilities, EE obligations should be enforced
- Reinforcing and extending financial & economic incentives to support EE projects (subsidies, taxes, dedicated public funds, banking financing, public-private partnership, CDM, ESCOs, etc.)
- Establishing national EE&C Agencies, as well as regional and local EE Agencies
- Establishing energy database (comprehensive data collection on all sectors)
- Promoting public awareness & information dissemination and education (including dissemination of EE best practices & tools) - and creating local energy information centres
- Promoting technology transfer, deployment and dissemination.

## Technology development, leapfrogging and deployment

- A number of new advanced or improved EE technologies have been developed in the recent years in industrialized countries and are rapidly penetrating the market. Africa also should benefit from this technology breakthrough to accelerate the uptake of more efficient technologies for its energy needs. These include:
- Higher efficient CFLs and household appliances, shifting the A-label to greater efficiencies
  - LED lamps with higher efficiencies than CFLs
  - Building design, insulation & management systems
  - Solar water heaters
  - Higher energy-efficient vehicles and hybrid & electric cars
  - Advanced automation systems in the industry to optimize EE (cement, petrochemical,..)
  - In the power sector, a wide range of high energy-efficient generation technologies, also capable of reducing GHG emissions, are available: GTCC (60%), IGCC coal-fired power plant (50%), new Supercritical & Ultra-Supercritical PC (50%), CHP(85 – 90%), etc. – there is also some scope for micro CHP based on small power units or fuel cells for DG
  - Especially for Africa where biomass use is / and will be prominent for long time, particularly for cooking in rural areas, focus should be placed on R&D and diffusion of improved biomass cook-stoves utilizing simple & promising new technology, but also on high-efficient cookers (LPG, kerosene,..), and solar cookers, to increase significantly their use.
- => The possibilities for energy savings through these technologies are immense, and their deployment and penetration could be stimulated by cost reduction and available financing.*

## Conclusions & Recommendations

- Proper policy measures will offer a route for meeting Africa's growing energy demand in a more responsible and sustainable way
- States should enact adapted EE policies and implement related regulatory measures to enhance energy efficiency by setting targeted objectives within a reasonable timeframe - Concrete actions plans with defined priorities would pave the way to ensure that targets are met and objectives achieved
- Strong and determined engagement & efforts are needed at a very high political level throughout the Continent to support these policies & actions
- In addition, governments, businesses and citizens in all African countries should collaborate, and co-ordinate their efforts for the achievement of the policy objectives
- Other policy objectives that need to be promoted to support energy efficiency include: 1/ development of renewable and alternative energy sources, and 2/ reinforcement of regional cooperation and development of cross-border electricity interconnection and gas pipelines, in an integrated energy market.



**Thank you for  
your attention**

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