

CLIMATE CHANGE, ENERGY EFFICIENCY AND ECONOMIC GROWTH

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Scaling up Energy Efficiency: Bridging the Gap
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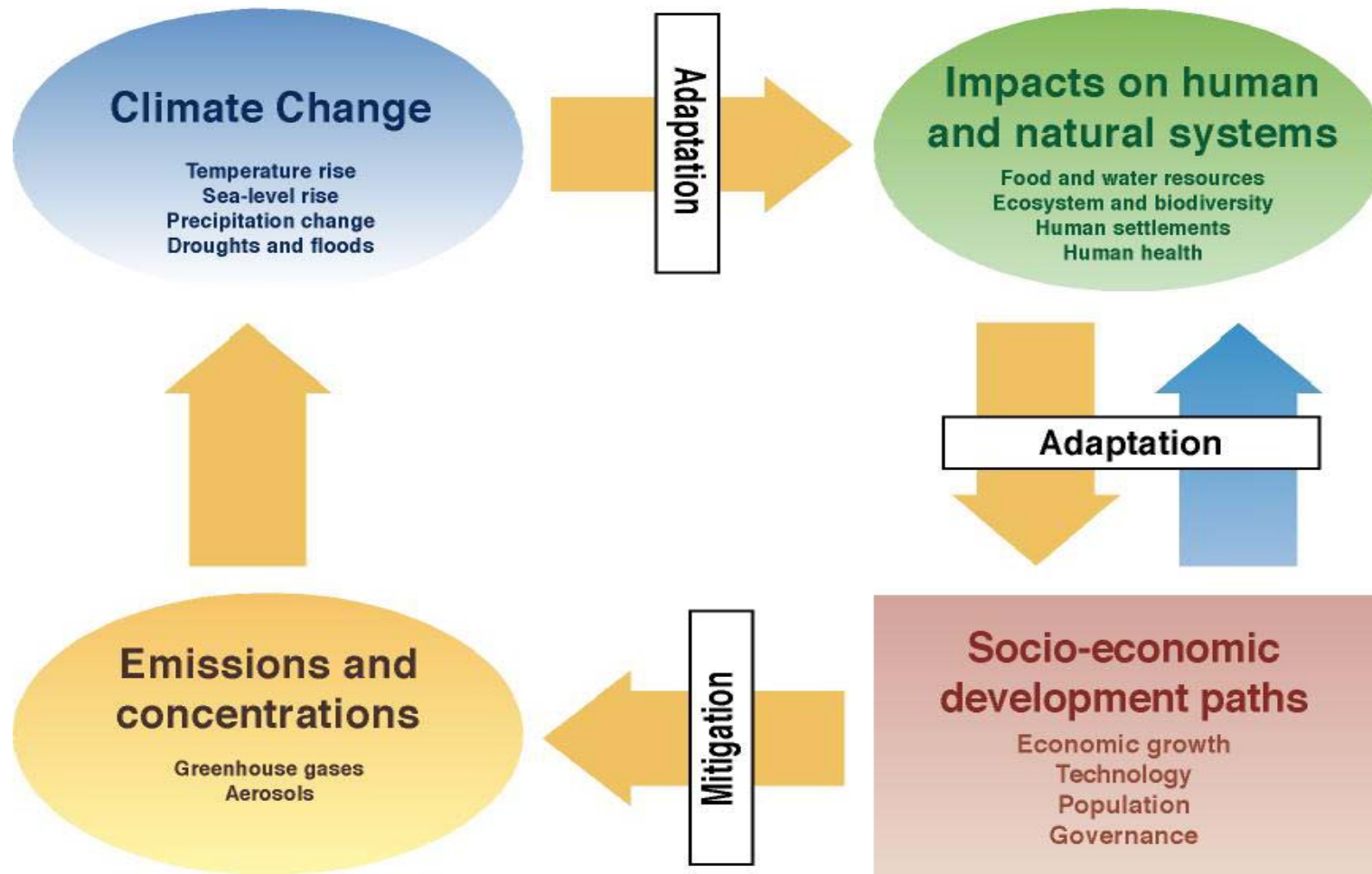
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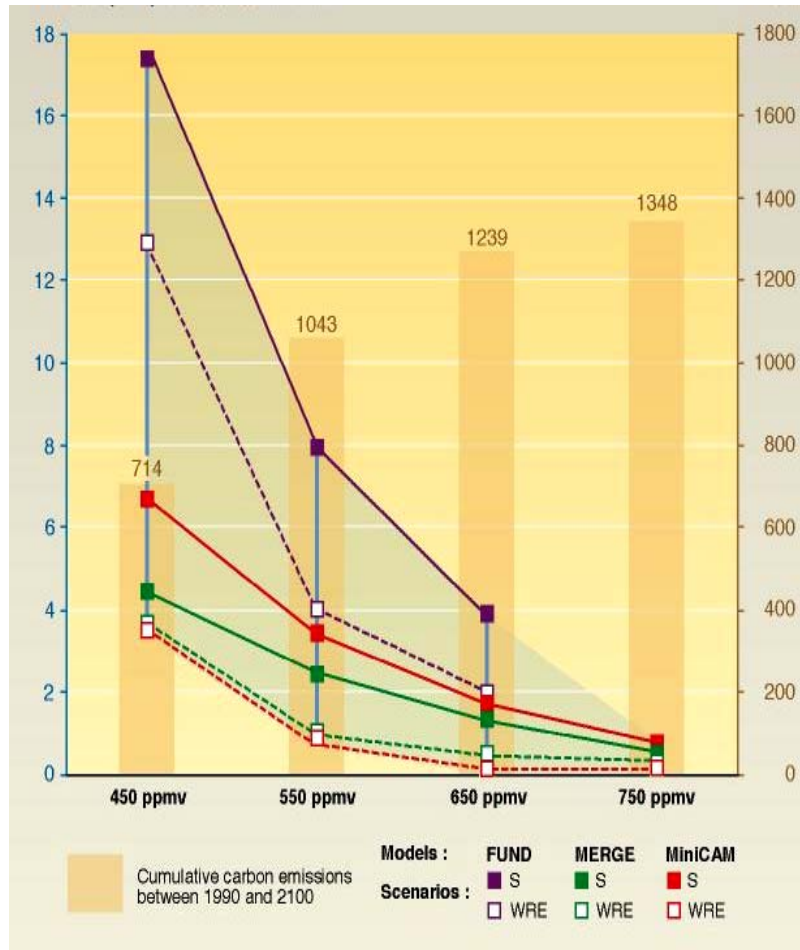
Introduction

- Significant amount of hydrocarbons in the form of coal, oil and gas has been burned to drive industrial revolution since it started in England in the mid 1700s to present boom in China and India.
- The combustion of these fuels for heating, transportation, refrigeration, industrial and household needs produces mainly carbon dioxide that is emitted to the atmosphere
- Increasing concentration of carbon dioxide and other greenhouse gases in the atmosphere are causing the average surface temperature of the earth to increase.
- This trend of rising GHG are expected to continue through this century and beyond.
- Correcting this situation as most of the world population are yet to satisfy their developmental desires (improve quality and standard of life), then the energy use must change.
- Existing knowledge shows that the more efficient these fuels are used, the less primary energy will be used, hence the less emissions so reducing the climate change problem.

Climate change is not just an environmental issue, but a development issue



The cost of compliance increases with lower stabilization levels



- Technology development and diffusion are important components of cost-effective stabilization
- The pathway to stabilization and the stabilization levels are key determinants of mitigation costs
- The lower the stabilization level or the higher the baseline scenario, the earlier and the deeper the reductions
- Approaches to mitigate climate change will be both affected by, and have impacts on, broader socio-economic policies and trends, those relating to development, sustainability and equity

Conclusions from WG1 Report

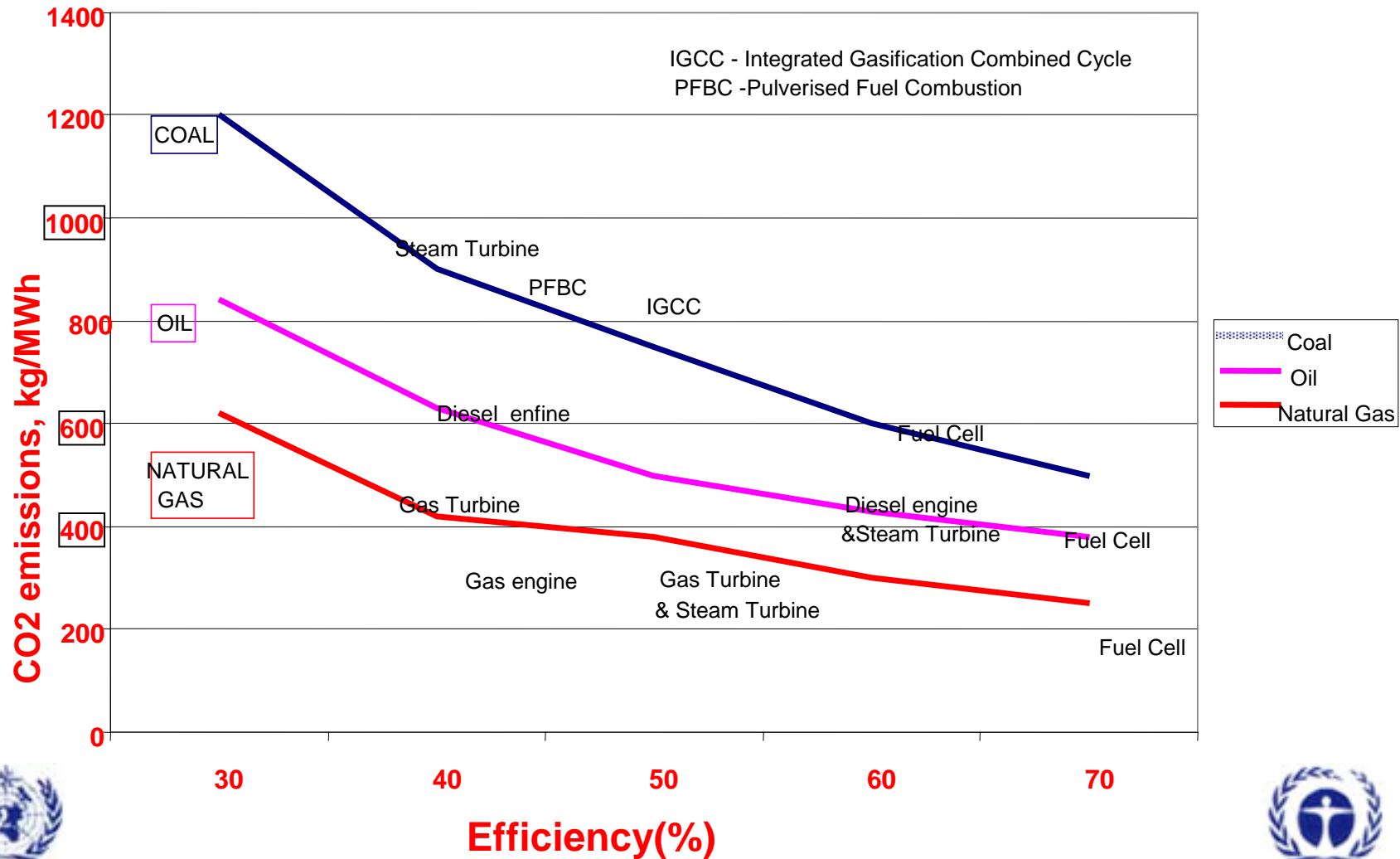
- It is very likely (over 90%) that human activities are causing global warming
- Probable temperature rise by the end of the century will be between 1.8C and 4C
- Possible temperature rise by the end of the century ranges between 1.1C and 6.4C
- Sea levels are likely to rise by 28-43cm
- Arctic summer sea ice is likely to disappear in second half of century
- It is very likely that parts of the world will see an increase in the number of heatwaves
- Climate change is likely to lead to increased intensity of tropical storms

Energy Supply Options

- It is cheaper to invest in energy efficiency improvements than in increasing energy supply
- There are several more efficient fossil-fuel conversion technologies
 - combined heat and power,
 - fuel switching from coal to gas,
 - nuclear power,
 - distributed energy,
 - Bio-energy,
 - renewable heat and power including hydropower,
 - improved supply and distribution efficiency
- Measures include:
 - Reduction of fossil fuel subsidies,
 - additional taxes on fossil fuels and market creation for low emission technologies through feed-in tariffs,
 - producer subsidies
- Opportunities
 - Developing countries need new energy supply investments
 - Developed countries need upgrades of energy infrastructure



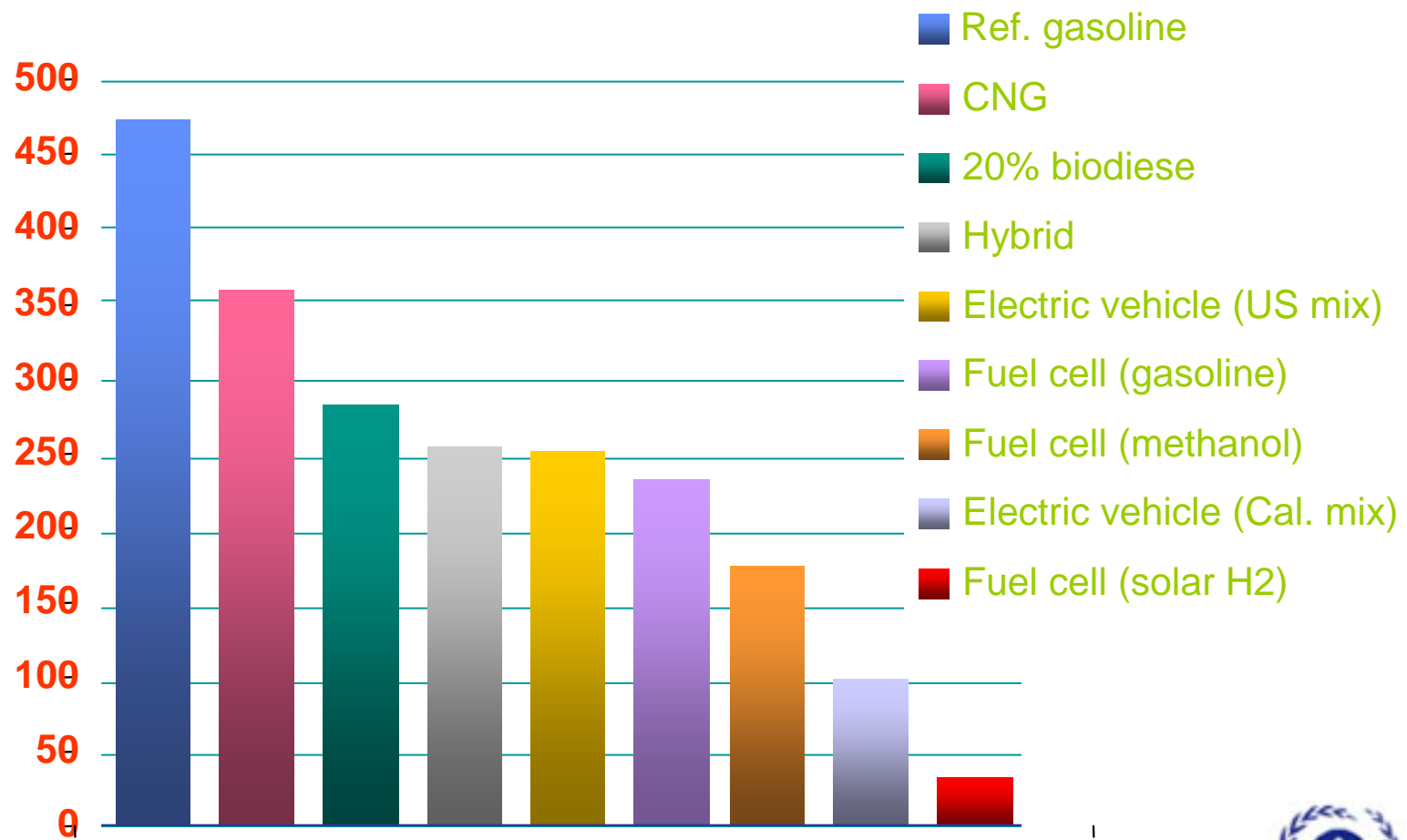
Efficiency and CO2 Emissions and Power Plants



Transport Options

- **The growth of transportation emissions is among the highest of all sectors.**
- **However, the economic potential of available options is large, but difficult to implement**
- **New options include**
 - **Efficient hybrid vehicles**
 - **Cleaner diesels as well as bio-fuels.**
 - **Hydrogen powered fuel cell vehicles and electric vehicles**
 - **Further efficiency improvements and a substantial increase of bio-fuel use**
- **Aviation, major policy intervention needed, options include**
 - **Aircraft and operational efficiency improvements**
 - **Introducing bio-fuels, relatively high costs,**
- **Measures include**
 - **mandatory fuel economy and CO2 standards**
 - **Taxes on vehicle purchase,**
 - **Registration, use and motor fuels,**
 - **Road and parking pricing policies**
- **Land use and infrastructure planning and policies**
- **Public transport facilities and non-motorised forms of transport**
- **Realising the emissions reduction potential in the transport sector will depend on government policies to create incentives for implementation and further technology development and will often be a co-benefit of addressing congestion, air quality and energy security.**

GHG emissions per kilometre for different vehicle technologies



Source: Moomaw et al, IPCC (2001)



Building Options

- **A wide range of low-cost energy efficiency options for new and existing buildings that could significantly reduce CO2 emissions at low and negative cost.**
 - **New Options include**
 - **Efficient lighting,**
 - **More effective building envelopes,**
 - **Efficient electric appliances and heating and cooling systems**
 - **Measures**
 - **Appliance standards,**
 - **Building codes,**
 - **Appliance and building labelling**
 - **Pricing measures and other financial incentives, and public sector procurement policies**
- Overcoming the many barriers to realise the economic mitigation potential in the building sector without large public expenditures, requires a coherent set of policies that encourages private initiatives, such as energy service companies**

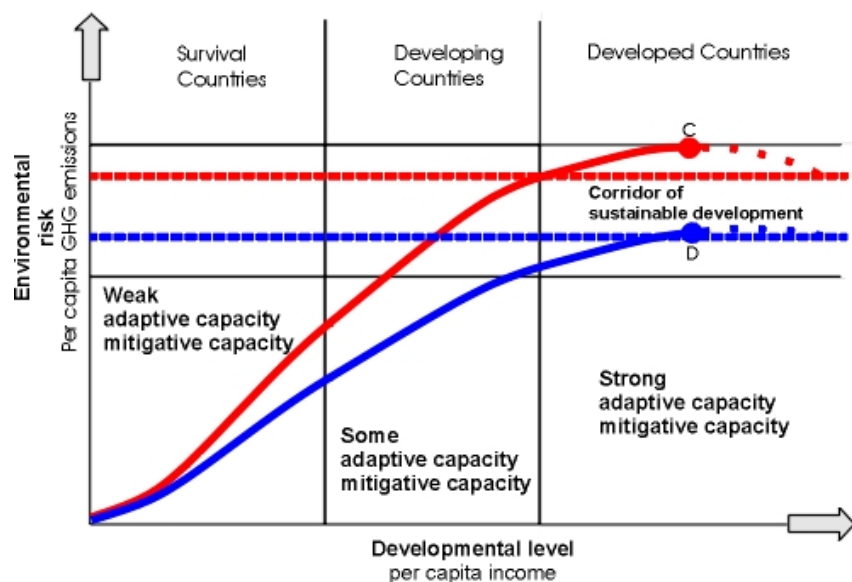
General Opportunities to be exploited

- Changes in efficient lighting – 1 candle produces 1 lumen for every 6 watts of candle burnt, incandescent electric lights produces 17 lumens with each watt of electric input, fluroscent produces 100 lumens per watt.
- Power consumed in refrigerator went down by 75% between 1972 and 2001 and central A/C down by 40%, gas furnaces by 25% all through standards
- The power generated to satisfy 150 million refrigerators declined from about 55GW to under 15GW between 1974 and 2001, about 40GW saved (USA).
- Worldwide energy intensity is dropping at 1.3% per year – In China energy intensity reduced by 2.5 times between 1980 and 2001.

Industry Options

- **A large number of sector wide, process-specific and operation related industrial measures are available**
 - **Efficient use of fuels and electricity,**
 - **Combined Heat and Power**
- **Implementation of mitigation options in the industry sector requires a national policy**
 - **Measures for stimulating technology uptake (information, performance standards, and economic incentives).**
- **Constraints: competitiveness**
- **Emissions trading is also an effective policy instrument, but it does not necessarily create incentives for technology development.**

Technologies needs differ by developmental status of countries



- The world is in three groups of countries with different technology needs
- Government support of technology innovation:
 - through financial contribution
 - Taxation measures
 - Standard setting
 - Market creation
- Technology needs:
 - Partnerships and networking
 - Joint R&D, D programmes
 - Capacity development & building

Conclusions 1

- Payback time for appliances are short and can be half of life time but for energy supply –power plants, transmission lines, refineries, dams, mines, etc the pay back time of 20-40 years
- Technological improvements that have lead to enhanced energy efficiency, energy intensity and reduced carbon efficiency (carbon intensity of energy use) can be useful in addressing climate change.
- Tax credits and other incentives to purchase (produce) energy efficiency products and equipment, public private-partnerships aimed at developing and deploying energy efficient standards and technologies and products
- Climate change will have far reaching negative impacts on the economy, society and the environment, but there are also social, economic and environmental benefits in combating climate change

Conclusions 11

- Options available include using fossil fuels more efficiently, substitute with less carbon fuels and promote energy efficiency and the use of renewable energy. Studies have shown that these options might prove more expensive but with the world getting richer, a better distribution of resources can lessen the burden
- Developed countries need to continue to reduce their low energy intensity further insisting on extending and enforcing the energy standards
- Developing countries to practice these standards and acquire the technologies for improve energy intensity.
- LDCs lack adequate energy supply and so should be assisted on programs that practice high standards of efficiency. They need technical assistance and training

