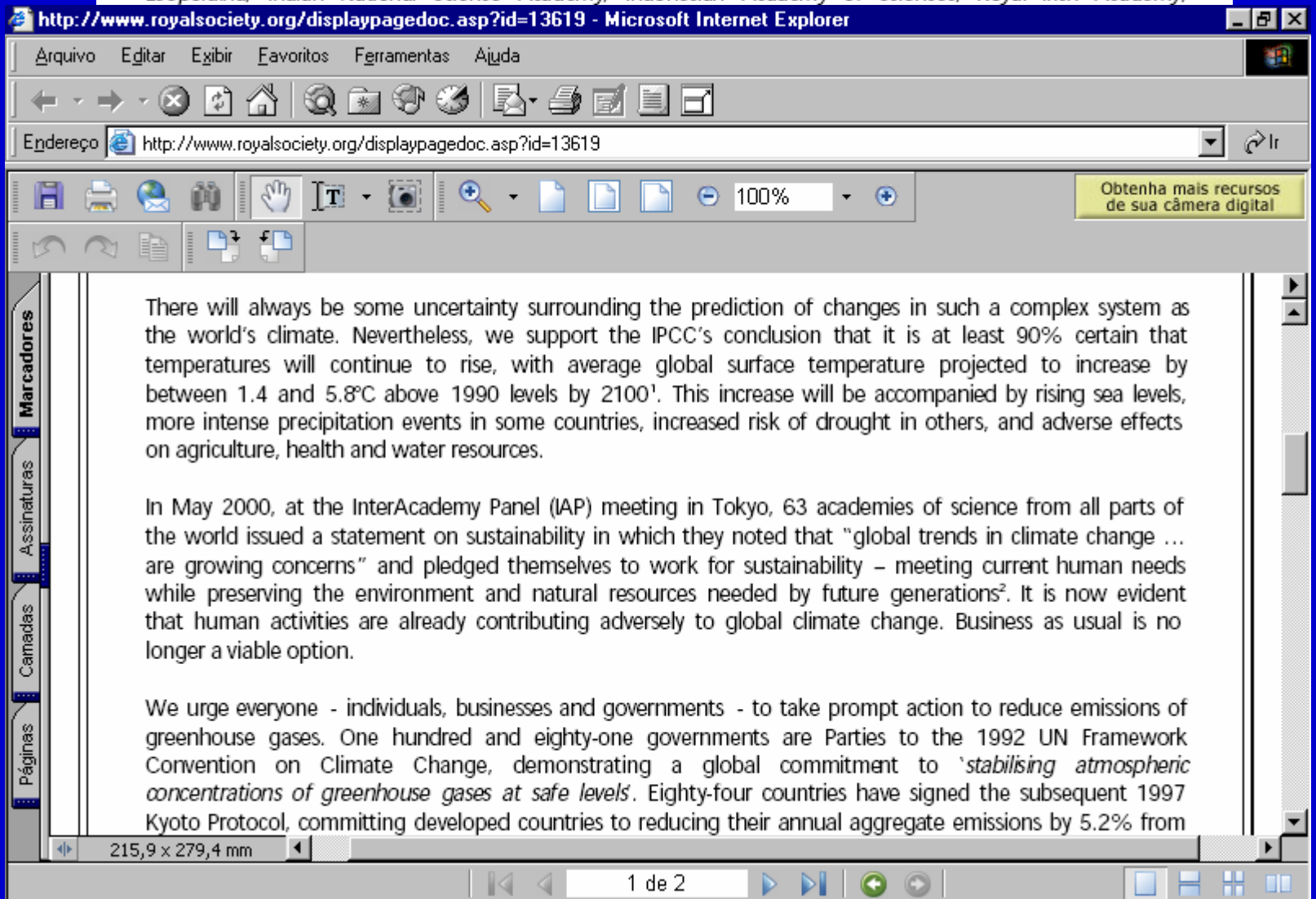
BRAZILIAN ACADEMY OF SCIENCES

CLIMATE CHANGE

THE SCIENCE OF CLIMATE CHANGE

A joint statement issued by the Australian Academy of Sciences, Royal Flemish Academy of Belgium for Sciences and the Arts, Brazilian Academy of Sciences, Royal Society of Canada, Caribbean Academy of Sciences, Chinese Academy of Sciences, French Academy of Sciences, German Academy of Natural Scientists Leopoldina, Indian National Science Academy, Indonesian Academy of Sciences, Royal Irish Academy,



1990 levels by 2008-2012.

The ratification of this Protocol represents a small but essential first step towards stabilising atmospheric concentrations of greenhouse gases. It will help create a base on which to build an equitable agreement between all countries in the developed and developing worlds for the more substantial reductions that will be necessary by the middle of the century.

There is much that can be done now to reduce the emissions of greenhouse gases without excessive cost. We believe that there is also a need for a major co-ordinated research effort focusing on the science and technology that underpin mitigation and adaptation strategies related to climate change. This effort should be funded principally by the developed countries and should involve scientists from throughout the world.

The balance of the scientific evidence demands effective steps now to avert damaging changes to the earth's climate.

Notes:

[1] *Climate Change 2001: The Scientific Basis* Contribution of WG1 to the IPCC Third Assessment Report http://www.ipcc.ch. The average global surface temperature is predicted to increase by between 1.4°C and 3°C above 1990 levels by 2100 for low emission scenarios, and between 2.5°C and 5.8°C for higher emission scenarios.

[2] *Transition to Sustainability in the 21st Century: The Contribution of Science and Technology.* A Statement of the World's Scientific Academies (May 2000). http://interacademies.net/intracad/tokyo2000.nsf

Sources of information about the signatories:

Australian Academy of Sciences	http://www.science.org.au
Royal Flemish Academy of Belgium for Sciences and the Arts	http://www.kvab.be
Brazilian Academy of Sciences	http://www.abc.org.br
Royal Society of Canada	http://www.rsc.ca
Caribbean Academy of Sciences	http://www.e-caribtrade.com/cas/index.htm
Chinese Academy of Sciences	http://www4.nationalacademies.org/cia/iap/IAPacInfo.nsf
French Academy of Sciences	http://www.academie-sciences.fr
German Academy of Natural Scientists Leopoldina	http://www.leopoldina.uni-halle.de
Indian National Science Academy	http://www4.nationalacademies.org/cia/iap/IAPacInfo.nsf
Indonesian Academy of Sciences	http://www4.nationalacademies.org/cia/iap/IAPacInfo.nsf
Royal Irish Academy	http://www.ria.ie
Accademia Nazionale dei Lincei (Italy)	http://www.lincei.it
Academy of Sciences Malaysia	http://www4.nationalacademies.org/cia/iap/IAPacInfo.nsf
Academy Council of the Royal Society of New Zealand	http://www.rsnz.govt.nz
Royal Swedish Academy of Sciences	http://www.kva.se/eng
Royal Society (UK)	http://www.royalsoc.ac.uk

17 de maio de 2001.

The Science of Climate Change

2001 Science Academies:

Australian, Belgium, Brazilian, Canadian, Caribbean, Chinese, French, German, Indian, Indonesian, Irish, Italian, Malasian, New Zelandese, Swedish and British.

1. Stressed that in 2000, in Tokyo, 63 Academies (IAP) noted that "*global trends in climate changes are of growing concern*".

2. Emphasized that the conclusion of the studies of the *Intergovernamental Panel on Climate Change* (IPCC) is correct.
Increase 1.4 to 5.8º C above 1990 levels by 2100.

3. Urged individuals business and governments to reduce emissions of greenhouse gases and also that more nations need to ratify the Kyoto protocol.

Joint science academies' statement: Global response to climate change

Climate change is real

There will always be uncertainty in understanding a system as complex as the world's climate. However there is now strong evidence that significant global warming is occurring[1]. The evidence comes from direct measurements of rising surface air temperatures and subsurface ocean temperatures and from phenomena such as increases in average global sea levels, retreating glaciers, and changes to many physical and biological systems. It is likely that most of the warming in recent decades can be attributed to human activities (IPCC 2001)[2]. This warming has already led to changes in the Earth's climate.

The existence of greenhouse gases in the atmosphere is vital to life on Earth – in their absence average temperatures would be about 30 centigrade degrees lower than they are today. But human activities are now causing atmospheric concentrations of greenhouse gases – including carbon dioxide, methane, tropospheric ozone, and nitrous oxide – to rise well above pre-industrial levels. Carbon dioxide levels have increased from 280 ppm in 1750 to over 375 ppm today – higher than any previous levels that can be reliably measured (i.e. in the last 420,000 years). Increasing greenhouse gases are causing temperatures to rise; the Earth's surface warmed by approximately 0.6 centigrade degrees over the twentieth century. The Intergovernmental Panel on Climate Change (IPCC) projected that the average global surface temperatures will continue to increase to between 1.4 centigrade degrees and 5.8 centigrade degrees above 1990 levels, by 2100.

Reduce the causes of climate change

The scientific understanding of climate change is now sufficiently clear to justify nations taking prompt action. It is vital that all nations identify cost-effective steps that they can take now, to contribute to substantial and long-term reduction in net global greenhouse gas emissions.

Action taken now to reduce significantly the build-up of greenhouse gases in the atmosphere will lessen the potentially cost-effective technological options that could contribute to stabilising greenhouse gas concentrations. These are at various stages of research and development. However barriers to their broad deployment still need to be overcome.

Carbon dioxide can remain in the atmosphere for many decades. Even with possible lowered emission rates we will be experiencing the impacts of climate change throughout the 21st century and beyond. Failure to implement significant reductions in net greenhouse gas emissions now, will make the job much harder in the future.

Prepare for the consequences of climate change

Major parts of the climate system respond slowly to changes in greenhouse gas concentrations. Even if greenhouse gas emissions were stabilised instantly at today's levels, the climate would still continue to change as it adapts to the increased emission of recent decades. Further changes in climate are therefore unavoidable. Nations must prepare for them.

The projected changes in climate will have both beneficial and adverse effects at the regional level, for example on water resources, agriculture, natural ecosystems and human health. The larger and faster the changes in climate, the more likely it is that adverse effects will dominate. Increasing temperatures are likely to increase the frequency and severity of weather events such as heat waves and heavy rainfall. Increasing temperatures could lead to large-scale effects such as melting of large ice sheets (with major impacts on low-lying regions throughout the world). The IPCC estimates that the combined effects of ice melting and sea water expansion from ocean warming are projected to cause the global mean sea-level to rise by between 0.1 and 0.9 metres between 1990 and 2100. In Bangladesh alone, a 0.5 metre sea-level rise would place about 6 million people at risk from flooding.

magnitude and rate of climate change. As the United Nations Framework Convention on Climate Change (UNFCCC) recognises, a lack of full scientific certainty about some aspects of climate change is not a reason for delaying an immediate response that will, at a reasonable cost, prevent dangerous anthropogenic interference with the climate system.

As nations and economies develop over the next 25 years, world primary energy demand is estimated to increase by almost 60%. Fossil fuels, which are responsible for the majority of carbon dioxide emissions produced by human activities, provide valuable resources for many nations and are projected to provide 85% of this demand (IEA 2004)[3]. Minimising the amount of this carbon dioxide reaching the atmosphere presents a huge challenge. There are many

Developing nations that lack the infrastructure or resources to respond to the impacts of climate change will be particularly affected. It is clear that many of the world's poorest people are likely to suffer the most from climate change. Long-term global efforts to create a more healthy, prosperous and sustainable world may be severely hindered by changes in the climate.

The task of devising and implementing strategies to adapt to the consequences of climate change will require worldwide collaborative inputs from a wide range of experts, including physical and natural scientists, engineers, social scientists, medical scientists, those in the humanities, business leaders and economists.

June 2005

Conclusion

We urge all nations, in the line with the UNFCCC principles[4], to take prompt action to reduce the causes of climate change, adapt to its impacts and ensure that the issue is included in all relevant national and international strategies. As national science academies, we commit to working with governments to help develop and implement the national and international response to the challenge of climate change.

G8 nations have been responsible for much of the past greenhouse gas emissions. As parties to the UNFCCC, G8 nations are committed to showing leadership in addressing climate change and assisting developing nations to meet the challenges of adaptation and mitigation.

We call on world leaders, including those meeting at the Gleneagles G8 Summit in July 2005, to:

- Acknowledge that the threat of climate change is clear and increasing.
- Launch an international study[5] to explore scientifically-informed targets for atmospheric greenhouse gas concentrations, and their associated emissions scenarios, that will enable nations to avoid impacts deemed unacceptable.
- Identify cost-effective steps that can be taken now to contribute to substantial and long-term reduction in net global greenhouse gas emissions. Recognise that delayed action will increase the risk of adverse environmental effects and will likely incur a greater cost.
- Work with developing nations to build a scientific and technological capacity best suited to their circumstances, enabling them to develop innovative solutions to mitigate and adapt to the adverse effects of climate change, while explicitly recognising their legitimate development rights.
- Show leadership in developing and deploying clean energy technologies and approaches to energy efficiency, and share this knowledge with all other nations.
- Mobilise the science and technology community to enhance research and development efforts, which can better inform climate change decisions.

Notes and references

1 This statement concentrates on climate change associated with global warming. We use the UNFCCC definition of climate change, which is 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'.

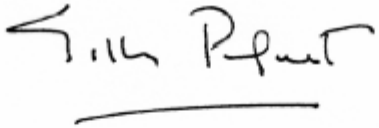
2 IPCC (2001). Third Assessment Report. We recognise the international scientific consensus of the Intergovernmental Panel on Climate Change (IPCC).

3 IEA (2004). World Energy Outlook 4. Although long-term projections of future world energy demand and supply are highly uncertain, the World Energy Outlook produced by the International Energy Agency (IEA) is a useful source of information about possible future energy scenarios.

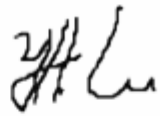
4 With special emphasis on the first principle of the UNFCCC, which states: 'The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof'.

5 Recognising and building on the IPCC's ongoing work on emission scenarios.

Academia Brasiliera de Ciências
Brazil



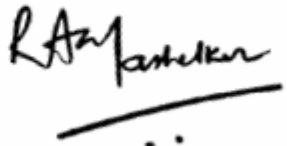
Royal Society of Canada,
Canada



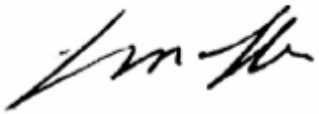
Chinese Academy of Sciences,
China

Académie des Sciences,

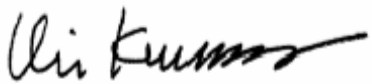
Deutsche Akademie der Naturforscher



Indian National Science Academy,



Accademia Nazionale dei Lincei,
Italy



Science Council of Japan,
Japan

Russian Academy of Sciences,
Russia

Royal Society,
United Kingdom

National Academy of Sciences,
United States of America

Joint Scientific Academy Statement
Global Response to Climate Change

2005 (Glenaegle, UK) G8 + China, India e Brazil:

1. **Climate change is real.**
2. **Reduce the causes of climate change (especially CO_2 emission).**
3. **Prepare for the consequences of climate change.**
4. **Call on world leaders:**
   - ✓ **acknowledge the threat of climate change**
   - ✓ **launch international study to reduce emission**
   - ✓ **mobilize S&T community**
   - ✓ **develop and deploy clean energy technologies**
   - ✓ **identify cost-effective steps to reduce gas emission**
   - ✓ **work with developing nations to build indigenous S&T capacity in the area.**

Joint Science Academies' Statement: Energy Sustainability and Security

Broad international consensus recognizes three principal, inter-related components of sustainable development: economic prosperity, social development, and environmental protection. Sustainable and reliable supply of energy is one of the major conditions for achieving these three goals, for all countries of the world: if energy sustainability and security fail, the primary human development goals cannot be achieved.

Last year we addressed the major challenges of climate change. These challenges are predominantly related to energy systems and use. We therefore welcome the opportunity to address energy sustainability and security on the occasion of the 2006 G8 Summit — and we expect to continue our focus on these critical issues in future years. The InterAcademy Council, established by the Academies of the world, is now engaged in an in-depth examination of this energy technology transition challenge, to be completed within a year.

Problems and Challenges of Energy Sustainability and Security

It has become increasingly clear that there are very serious difficulties related to sustainability and security of energy. These include:

- Major global and regional impacts on the environment, climate change and health from an extrapolation of current energy sources and systems
- A clear projection that demand for affordable and clean energy sources will increasingly grow, requiring investments to create an efficient system of global energy supply
- Tensions, especially in energy supplies for transport systems
- Increasingly poor geographical correlations between energy sources and users

be necessary to develop and deploy new sources and systems for energy supply, including clean use of coal and unconventional fossil resources, advanced nuclear systems, and renewable energy. Diversification of engine fuels, increased use of low-emissions technologies in personal transport, and a greater emphasis on deployment of urban mass transit would introduce much-needed flexibility and economy in a rapidly urbanizing world.

The necessary changes and transitions in energy systems and paradigms will not be possible without achievement of many challenging scientific, technical and economic objectives, and will require the investment of enormous resources in a sustained way over decades. They will also require major openness and transfer of knowledge, technology and capital.

Achieving an acceptable level of global energy sustainability and security will therefore require sustained governmental focus and international cooperation on identifying strategic energy policy priorities, and the sustained implementation of corresponding policies, actions, and national investments. It will also be critical to involve the public and industry leadership in setting and achieving the key priorities, if we are to collectively deal with threats to energy sustainability and security in time to avoid major economic, environmental, and political damage.

The common strategic priorities should include:

- Promotion of energy efficiency, including improving the energy efficiency and economic effectiveness of the energy system in a holistic way
- Diversification of energy supply and demand, as diversity of energy mix, sources, markets, transportation routes and means of transportation decrease vulnerability related to single or predominant sources and systems
- Development of global energy infrastructure with attention to its resilience

- Inefficient and wasteful use of energy resources
- Sharply rising and fluctuating oil and gas prices
- Providing fuels and electricity to a significant portion of the world's population to help improve their quality of life
- Impacts of natural disasters, systems breakdowns, and human acts on energy infrastructure

Resolving Energy Sustainability and Security Challenges

Providing for global energy sustainability and security will require many vigorous actions at national levels, and considerable international cooperation. These actions and cooperative steps will need to be based on widespread public support, especially in exploring avenues for increased efficiency of energy use. Secondly, it will note of the areas in which international cooperation, substantial research and development, and innovation, will be critical. Important examples of such areas are:

- Energy efficiency for buildings, devices, motors, transportation systems and in the energy sector itself, which has a great capacity for boosting energy efficiency
- Systems analysis to find efficient strategies for various conditions
- Clean coal systems, including potential for sequestering of CO_2
- Advanced nuclear systems, addressing the problems of safety, waste, and non-proliferation
- Pollution control
- Unconventional fossil fuels and related environmental protection
- Biomass production and conversion, gas-to-liquid conversion
- Renewable energy sources for the long-term, such as geothermal, wind, tidal and solar, and energy storage technologies
- Promotion of clean and affordable energy sources and systems, including advanced nuclear technologies and renewable systems
- Decentralization of energy production through development of local energy resources and systems
- Promotion of cost-effective economic instruments that can help to reduce the emission of greenhouse gases
- Addressing the urgent human needs of approximately a third of the world population which does not have access to modern energy

Innovation, Research, Development and Deployment

We recognize the special responsibility of the science and engineering community to help implement transitions to sustainable and secure energy systems. We take special leading role in assuring global energy sustainability and security.

We call on world leaders, especially those meeting at the G8 Summit in July 2006, to:

- Articulate the reality and urgency of global energy security concerns
- Plan for the massive infrastructure investments, and lead times required for a transition to clean, affordable and sustainable energy systems
- Intensify cooperation with developing countries to build their domestic capacities to use existing and innovative energy systems and technologies, including transfer of technologies
- Promote by appropriate policies and economic instruments the development and implementation of cost-competitive, environmentally beneficial, and market acceptable clean fossil, nuclear, and renewable technologies
- Ensure, in cooperation with industry, that technologies are developed and implemented and actions taken to protect energy infrastructures from natural disasters, technological failures, and human actions

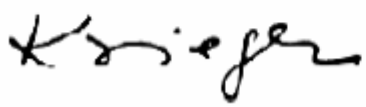
- Small decentralized systems addressing needs of poor, rural, and isolated systems, and examination of wider application of such systems

Conclusions

We call on all countries of the world to cooperate in identifying common strategic priorities for sustainable and secure energy systems, and in implementing actions toward those strategic priorities.

G8 countries bear a special responsibility for the current high level of energy consumption, and should play a

- Address the serious inadequacy of R&D funding and provide incentives to accelerate advanced energy-related R&D, also in partnership with private companies
- Implement education programs to increase public understanding of energy challenges, and to provide for energy-related expertise and engineering capabilities
- Focus governmental research and technology efforts on energy efficiency, non-conventional hydrocarbons and clean coal with CO_2 sequestration, innovative nuclear power, distributed power systems, renewable energy sources, biomass production, biomass and gas conversion for fuels.



Academia Brasileira de Ciéncias,
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Royal Society of Canada,
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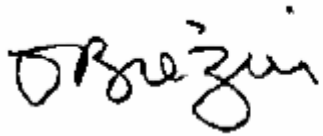
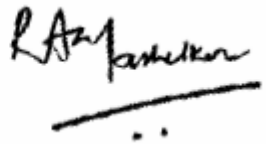
Chinese Academy of Sciences,
China

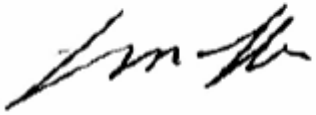


Académie des Sciences,
France

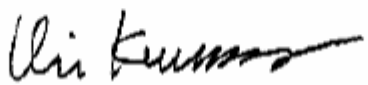
Deutsche Akademie der Naturforscher
Leopoldina, Germany



Indian National Science Academy,
India



Accademia Nazionale dei Lincei,
Italy



Science Council of Japan,
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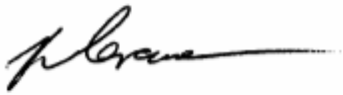
Russian Academy of Sciences,
Russia



Academy of Science of South Africa,
South Africa

Royal Society,
United Kingdom

National Academy of Sciences,
United States of America

Joint Science Academies Statement
Energy, Sustainability and Security

2006 (St Petersburg, Russia) G8 + China, India, Brazil e South Africa:

1. **Emphasize three principal inter-related components of sustainable development: economy prosperity, social development and environmental protection. Sustainable and reliable supply of energy is a major condition for achieving these three goals.**
2. **Problems and challenges of energy sustainability and security.**
3. **Resolving energy sustainability and security challenges**
   - ✓ **increase energy efficiency**
   - ✓ **systems analysis to find efficient strategies**
   - ✓ **clean coal systems (sequestering of CO_2)**
   - ✓ **advanced nuclear systems**
   - ✓ **pollution control**
   - ✓ **biomass production**
   - ✓ **renewable energy sources for the long-term (geothermal, solar, wind, tidal)**
   - ✓ **decentralization of energy production**