

WHITE PAPER ON NUCLEAR ENERGY

Malaysian Nuclear Society 23 August 2008

The Malaysian Nuclear Society (MNS), established 1988, welcomes the decision in the 2009 budget speech that Malaysia will be “exploring nuclear energy... to ensure long term energy security of the nation.”

The MNS also welcomes the positive statement by the Minister of Science, Technology and Innovation in support of nuclear energy as reported by Bernama, 19 August 2008:

- *“Nuclear energy is vital following the increase in the world fuel price and our limited oil reserve. Moreover, nuclear energy is clean and cheap”*
- The MNS views these developments as positive steps towards the attainment of secure and stable energy supply to ensure high technology and socio-economic development of Malaysia.

However, due to the long lead-time & narrow window of opportunity for the introduction of a nuclear energy, it is our considered opinion that the nuclear option should be urgently included in the national energy mix.

1. AIMS

This memorandum on nuclear energy option is prepared by the MNS to:

- present the views of the Malaysian scientific community on the need for Malaysia to urgently adopt nuclear power to secure its present and future energy requirements;
- present scientific views that renewable energy (solar power and wind power) in its current state of development is not expected to be able to fulfill the growing demand for electricity; and
- recommend action items for timely introduction of nuclear power plants in Malaysia.

2. BACKGROUND

Nuclear energy, the source of 17% of the world electricity need for the past decades, is witnessing tremendous resurgence as country after country decides to go nuclear. This renaissance is driven not just by the continuing development in many parts of the world, especially in our Asian region, but also due to the followings:

- dwindling resource of fossil fuel,
- limitation of hydro electric resources,
- inability of alternatives (solar, wind) to take up the slack in demand
- environmental concern (sulphur dioxide, nitrogen oxides from fossil, loss biodiversity for hydro)
- inadequate capability of renewable (biofuel, etc.) to supply bulk/ industrial power need
- nuclear energy has proven to be a reliable, clean, and safe source of energy

The introduction of nuclear energy however requires a long lead-time due to the sophistication of the technology, the need to set-up adequate supporting systems (human capital, hard and soft infrastructure) for it to be effectively implemented, and the need to timely secure technology transfer and supply in the face of competition from limited suppliers which could be exacerbated by the nuclear renaissance.

Due to the long lead-time and the competition for nuclear power plant worldwide there is a narrow window of opportunity to make decision to introduce NPP in the country.

Nuclear technology has been the driver of high technology growth in the economy (Korea, Japan, China). This cascade effect will also unleash high technology industrial development for Malaysia. Malaysia already has the experience to manage and operate sophisticated technology. In the field of nuclear technology, Malaysian Nuclear Agency has been operating for more than three decades and has accumulated a wealth of technical capabilities and experience.

Malaysia, therefore, is ready to make that decision. The decision in the 2009 Budget to 'explore nuclear energy' is most welcomed by the MNS. It is our considered opinion that Malaysia has a narrow window of opportunity to introduce NPP. It must not be missed.

This memorandum is intended to encourage the relevant parties to adopt the essence of peaceful use of nuclear energy and to consider the following issues and recommendations:

3. THE ISSUES

3.1 Energy supply - Conservation of fossil fuel for future generation

On a global scale, as demand for oil will drastically increase due to economic and population growth, mainly, in developing countries, it is forecast that the relation between supply and demand of fossil fuels will become tight, followed by consequent price hikes, and therefore the world may face intensified competition for the acquisition of fossil fuel sources. Thus, it is important for Malaysia to ensure stable and reliable energy supply by diversifying import sources, on supply side.

3.2 Human Capital Development

Since nuclear is an advance technology, this presents an ideal opportunity to upgrade the education system in the secondary schools, universities and postgraduate levels to develop Malaysia independent and capable nuclear manpower.

Together with the existing knowledge in Malaysian Nuclear Agency and the local institutions of higher learning, this human capital development will enable the fast track development of a broad range of nuclear technologies.

3.3 Economic and well being

Energy is the lifeblood of development and growth. Its security and stability of supply are essential ingredients for economic development, progress, and improvement of societal well being. Nuclear energy will continue Malaysia's good development in energy supply well into the future and spark a rapid industrial development thereby improving the overall standard of living. This could be the stepping-stone to move forward into the hydrogen economy to replace oil for transportation.

3.4 Environment

As we continue to develop more energy must be generated. According to an estimate Malaysia will need four times current electricity generation by 2050. Continuing to rely on fossil fuels is environmentally polluting due to the emission of toxic sulphur and nitrogen oxide gases.

Malaysia has the option of supplying electricity by increased hydroelectric. However, this would be at the expense of our vast rainforest biodiversity, which is likely to be the future source of economic progress.

Nuclear power, compared to the burning of coal and gas, is the least environmentally polluting source of energy. In comparison with other sources, it also has the highest power density per square meter of land used.

4. THE RECOMMENDATIONS

4.1 Energy supply and consumption

Rapid urbanization and industrialization of the nation since 1957 requires Malaysia to generate 2.6 times more electricity to lift the standard of living of

all Malaysians to the Australian level. With population expected to increase to 37 million by 2050 Malaysia will need 4 times its present electricity production. With nuclear electricity at a relatively cheaper cost, the mass electricity production able to be hooked up to the nation grid (as in France, USA, Korea) will provide secure and sustainable energy supply to the industrial sector.

While known gas reserve will last for another 30 years, by 2014 Malaysia is expected to import petrol for its transportation with all of its coal consumption is virtually imported. Oil extraction will be more expensive in the future and new oil should not be burned as fuel but used for higher value chemical feed stocks in industry.

As a source of secure energy supply, the refueling of an NPP after each 18 – 24 months cycle, makes its operation less sensitive to supply and cost, as compared to petrol which very volatile to market demand and speculation. Moreover, the abundant supply of nuclear fuel i.e. Uranium-235 (for thermal reactor), Plutonium-239 (for fast breeder reactor, recycled from Uranium-238) and Thorium-233, and the viability electricity from nuclear power plant to be hooked to the national grid, makes it very attractive as commercial source of energy.

As the global supply of oil, gas and coal is depleted, more oil producers are preserving the petrol for national consumption especially for transportation, and are looking for other alternative source of energy such as nuclear. For example, Iran as the world's fourth largest producer of crude oil and the second largest exporter of petroleum still going nuclear for strategic reason.

The demand for energy is increasing - in 1990, about 75% of the world's population (those in the developing countries) were responsible for only 33% of the world's energy consumption. By the year 2020, that 75% is likely to have risen to 85% and the energy consumption to around 55%. The world marketed energy consumption is projected to grow by 50 percent over the 2005 to 2030 period; China alone is expected to account for 71 percent of the increase in world coal consumption with its continuing strong economic growth. India, the world's fifth biggest energy consumer, is projected to surpass Japan and Russia to take third place by 2030. Thus it would be prudent to Malaysia to conserve its oil and gas reserves for future generation and to explore other alternative of energy, such as nuclear for its national consumption.

In Malaysia, half of its power plants run on gas other sources which include coal and hydropower. The use of gas and coal for electricity generation has been subjected to market speculation, pushing coal price to a record \$US300 (\$325) a tonne for coking coal in 2008-09 (up from \$US97 in 2007-08), while a [barrel](#) of crude oil rose above \$146 in (June 2008).

Thus to defend these general welfare gains, before the nation's oil and gas reserves run out and to fulfill the promise of the 21st Century, it is **recommended** that:

- Malaysia includes nuclear as the fifth component in the fuel mix policy, besides existing four i.e. coal, gas, hydro and renewable, energy to safeguard the depleting oil reserve in Malaysia
- To implement nuclear energy program as part of Malaysia effort to safeguard its national oil reserves for use by future generation
- Malaysia Initiates Uranium Mining as part of fuel secure supply policy for sustainable source of energy (economy & environment) for centuries (not for decades)
- To secure nuclear power programme as a viable future business opportunity for Malaysia (in services, component supply etc) to venture

Even if new oil field/reserves were found, Malaysia still need to go Nuclear as it needs to reserve oil for our transport and our future generation.

4.2 Human Capital Development

In NPP development, the human capital development form a very critical factor. Between 200-1000 skill workers are needed for operation and maintenance of NPPs. This factor need careful planning and lead time of at least 5 years. The post-independence of nuclear scientists, engineers and technicians are fast retiring at the age of 58 in the next 3-5years. Thus training of manpower starting from now is very critical.

The infrastructure for human capital development able to handle all aspects nuclear technology, needs clear government policy to be able to grow

sustainably. Malaysia's existing good baseline infrastructure give her an added advantage to train critical core experts in nuclear science and technologies. To develop the human capital capable of running, operating and maintaining NPPs, it recommended that:

- Malaysia have a policy in place to produce the right critical mass to support NPP; this policy need to be aligned between relevant agencies within the Government (e.g. KTAK, MOSTI and MOHE, others)
- Nuclear technology and engineering curriculum in tertiary level be strengthened to produce high calibre workers for NPP
- skilled workers training programmes be strengthened to support NPP
- Experts below 40 years were given priority in training, in expectation that these generation will operate, run and maintain future NPPs in 10-15years to come when the first NPP is commission in Malaysia
- The pool of nuclear knowledge people within AEAN countries be explored and utilized for optimum sharing of experts within AEAN framework
- The current level of capabilities for NPP be sustained and further improved

4.3 Socio-Economic development

The use of nuclear energy for electricity for economic development has been proved to activate other sector socio-economic development as well. Nuclear as investment in science and high technology (high technology investment. Japan and Korea has effectively utilized High state of Technology from its nuclear industry to up-lift its electronics, automotive and heavy industry sectors.

The migration from fission to fusion for clean energy as well as high technology industry requires a long term strategic planning (50 years and centuries to come). With

ITER (*International Thermonuclear Experimental Reactor*) dedicated towards research and engineering in future electricity-producing [fusion power](#) plants, the first commercial fusion-based reactor is expected by expected 2045 – 2050. The use of fusion-based power reactor is very attractive as very attractive as the best fuel for fusion i.e. isotopes, of hydrogen: deuterium and tritium, The can be derived from water and lithium respectively, with both abundant in nature. Thus the use of fission-based power industry for commercial purposes is a step forward towards the fusion-based science and technology in the long term.

- Thus, the adaptation of nuclear power industry in Malaysia will trigger the will provide the nation a mechanism to propagate towards a fully industrialise nation in the next decade. This will provide Malaysia with nuclear as the premiere technology as national technology supremacy, and provide a boost for the creation of knowledge society through nuclear science and technology (S&T)

To secure socio-economic development of Malaysia, it is recommended that Malaysia:

- Conduct industrial survey who will benefit & who needs to take action to support the NPP industry in Malaysia, e.g.:
 - SIRIM on industry standards (Pressure vessel) and Quality Standards as nuclear industry requires the highest standard
 - MIGHT – heavy industry etc
- Acquire High state of Technology from the nuclear power industry, to upgrade the Malaysian Industrial Sector
- Implement effective transfer of technology mechanism to indigenous man-power during the acquirement process of NPPs

- Position itself in competition/comparison with South Korea and Japan as emerging Nuclear Power Industry in the ASEAN region
- Within ASEAN, Malaysia is in better economic and technological state than , Indonesia, Thailand and Vietnam which had announced their intention in NPPs.
- Form smart partnership (to save cost and maximize development) within ASEAN framework to facilitate the development of NPP within the ASEAN region, e.g.
 - by forming consortium & joint program within ASEAN countries to develop nuclear grade components, nuclear fuel components & facilities, services etc.
- Set up NEPIO (*Nuclear Energy Program Implementation Organization*) to coordinate various agencies involved in the implementation of NPP, as recommended by IAEA and already implemented in Vietnam and Thailand.
- Have government sponsored bodies, within ASEAN framework, to coach the ASEAN level governments on how to form NEPIO

Benefits of Nuclear

The adaptation of nuclear industry in Malaysia will widely contribute to the advancement of the academic mission, to the prosperity of the industries, and to the improvement of the welfare of mankind and living standard of the people. It will spur the:

- industrial and technological advancement- in other fields (NDT, fabrication, manufacturing)
- creation of new knowledge, new research, new economic etc in Malaysia

- Other Industrial and capabilities development related to NPP (automotive, engineering, electronics, machinery etc) in Malaysia and in the region

The implementation of nuclear power industry will help the nation to be better prepared for the hydrogen economy in the future.

4.4 Legal Framework/Safety Development

For the nuclear power industry to be sustained and maintained safely within the safety and operation limits, the infrastructure of the legal, regulatory and safety framework has to be strengthened to suit the needs of the sophisticated technology, high demand and stringent control of the nuclear power industry.

- Enhancement of Act 304
 - Current law governing the activities of nuclear energy in Malaysia is Atomic Energy Licensing Act 1984 is in place and the introduction of Nuclear Power Plant will be subjected to license under the Act (Section 2 and Section 12(a), Act 304).
- Safety Culture
 - Safety culture is already practiced/adopted in heavy industries (aeronautical, oil & gas, petrochemical etc) proven by its safety records
 - Malaysia Nuclear Agency – operated more than 25 years with very good safety record
 - We will not start from zero – we have had a very good foundation to go further

It is recommended that existing law to include:

- Law establishing powers of regulatory bodies;
- National law on nuclear security;
- Law on radioactive materials and radiation;
- Law on nuclear liability;
- Nuclear waste, spent fuel and decommissioning law;
- Non proliferation treaty and additional protocol obligations;
- Legislation to implement international conventions and agreements;
- Environmental protection law;
- Law on emergency notification of nuclear accidents;
- Law on foreign investment; and
- Law on safety of nuclear installations.

The major components of nuclear legislation can be identified as dealing with the following topical areas

- Constitution of a NRB by enactment of nuclear law.
- Radiological protection, nuclear safety and connected matters such as environmental
- protection, transport of radioactive materials, radioactive waste management.
- Liability to third parties for nuclear damage and financial security.
- Physical protection of nuclear materials and facilities.
- State system of accounting and control of nuclear materials.

Within the ASEAN framework, the partner countries may analyze the existing applicable laws and regulations for further additions and deletions. Necessary implementation of legal framework may need the following reviews:

- The possible organizational structures for nuclear activities, including ownership of NPPs, radiation protection, nuclear safety, R&D, waste management, disposal and safeguards.
- The possible alternatives of nuclear safety policies (acceptance of supplier's country regulations or adoption of other alternatives).
 - (a) IAEA safety standards or other regulations; and
 - (b) Prescriptive or commitment based regulation methodology, etc.
- Legislation requirements for ownership of nuclear plants and nuclear material radiation
- protection (ICRP recommendations, IAEA safety standards).
- Possible options for waste management and disposal, including the back end of the fuel cycle.

4.3 Environmental effect and hazards

Malaysia is a small nation but may contain half of the world's estimated 50 million species. While the set of Hydro-electric power plants sacrifice valuable land and biological resources, the use of fossil fuel for electricity generation often causes the release of toxic gasses such as carbon monoxide, sulphur dioxide and nitrogen dioxide being release into the air, besides the emission of carbon dioxide that arguably cause the green house effect.

Fossil fuels, and hydroelectric dams, all of which threatens nature, produce over 99% of world energy. Without sufficient energy for earth's 6.7 billion people and more in the next decade, industrial and domesticated development will grind to standstill.

With solar and wind power provide but a fraction of the need, nuclear-based electricity generation will provide very efficient energy supply for the industrial development and domestic consumption. One NPP with 1000MW equals to 3 hydro sub-stations of 300MW. A modest size 300MW nuclear power plant on 100 acres of land, will help to preserve Malaysia most precious rainforest and supply uninterrupted, reliable electricity supply to the whole Klang Valley for 60 years.

Nuclear-based electricity such as from fission reaction, and with good prospect, fusion reaction in the next 30 years, will continuously contribute stable energy supply and to the measures against global warming. Fission, as well as fusion, provides clean energy and contributes to the measures against global warming

With the recyclable nature of spent fuel (Uranium-238, Plutonium-239, fission products I-131, Mo-131, Tc-131, Cs-137), efficient system for nuclear waste technology and management are well developed to handle nuclear waste.

4.4 Public Acceptance/ Public support

One of the most important aspect of successful implementation of the nuclear power programme for electricity is public support. Public consultation should be held to provide adequate and satisfactory response to legitimate safety, economic and environmental concerns of the public. The public should be assured that the issues of nuclear project, i.e. safety, cost, and environmental management of nuclear waste management, are well addressed to and outlined in a rational manner.

The environmental assessment process for the specific site and project should also engage the public, in particular, the public in the area surrounding the potential site. They should be consulted in the early stages of the process so that their views are fully considered by the project sponsors prior to the start of the project. However, once the legitimate public concerns are addressed to the satisfaction of the government and regulatory approvals for the project are granted, the legal framework should be in place to protect the project against unnecessary interruption due to frivolous use of the public input process.

As nuclear power projects have a long duration of development and implementation and it is necessary for the government to provide assurances through policy and legislation that the long term interests of the investors are not adversely affected by political changes

For successful implementation of NPP, it recommended that:

- The public and the policy makers be educated regarding various issues regarding nuclear project, i.e. safety, cost, and environmental management of nuclear waste management
- More improved writings and events be held to educate the public, policy makers and various stake holders of NPP
- A broader society/audience is targeted for public information/acceptance programmes.

4. 5 National participation

For effective implementation of NPP, all stakeholders, whether direct or indirect, must be geared towards state of readiness. As nuclear industry requires national participation, all stakeholders must be ready to embrace and responsive towards the call for nuclear industry, including:

- The licensing and regulation/legal bodies
- Transparency bodies
- Sufficient and able manpower in the following sectors:
 - government
 - regulator/technical support service
 - R&D
 - Experience, manpower planning/over plan to allow attrition
 - University
 - Sustainable manpower production

- R&D
- Private and industry
 - Project Management/O&M
 - Industry Support
- Power plant expertise and experience
- Policy makers

With good basic infrastructure and economy, Malaysia is in best position in ASEAN region, to take advantage of being the one of the first to take off with NPP and develop successfully its own nuclear industry.

5. CONCLUSION

With the present Nuclear Renaissance, Malaysia should ride on current regional and world interest in nuclear energy to become the leader in nuclear industry among the ASEAN region.

While the small window of opportunity left to go nuclear and train the next generation, grab this opportunity in the soonest, or by 2020 Malaysia may not have sufficient supply of electricity to push its industrial sector towards fully industrialized nation.

Cheap and abundant Nuclear generated electricity and hydrogen economy for Malaysia in the next decade and century with nuclear powered cities producing advanced goods for national and international markets is very welcoming indeed.

Malaysian Nuclear Society (MNS) with all its members, affiliates and associates therefore fully urged the Government to fully adopt nuclear as its one of its energy source.

Appendices

Appendix 1. Malaysian Nuclear Society (MNS)

Malaysian Nuclear Society (MNS), established in 1988, is a non-governmental organization committed to promote the peaceful use of

nuclear science and technology. Currently it has over 500 members comprising professionals from the private and public sectors, academics, institutions of higher learning, corporate and industrial sectors. The objective of MNS are ----. This memorandum is part of that on-going effort to meet that objective.

Thus, MNS has taken the initiative to draft this memorandum to highlight to relevant parties and authorities on the various important aspects on the implementation for nuclear energy in Malaysia.

This memorandum shall present the opinions and recommendations from the perspective of the Malaysian Nuclear Society (MNS) as a professional nuclear NGO , and endorsed by other representatives of scientific communities and NGOs, and other parties who deem it necessary and timely for Malaysia to go for nuclear power.

Appendix 2. LEGAL FRAMEWORK – ACT 304?

- Current law governing the activities of nuclear energy in Malaysia is Atomic Energy Licensing Act 1984 is in place and the introduction of Nuclear Power Plant will be subjected to license under the Act (Section 2 and Section 12(a), Act 304).
- The Radiation Protection (Licensing) Regulations 1986 is in place and will answer issues regarding NPP. Therefore, for a NPP to operate in Malaysia, it shall need :
 - License Class A as the NPP will be associated with radioactive materials;
 - License Class B as the NPP will be associated with nuclear materials;
 - License Class D to transport nuclear and radioactive materials;
 - License Class E to export or import nuclear and radioactive materials;
 - License Class F for siting, constructions and operating a NPP. A specific license shall be issued based on the status of the NPP

and the Class F Operating License shall be issued in two states i.e. the temporary operation stage and the full operation stage.

- License Class G to dispose and store nuclear and radioactive materials and decommission a nuclear installation.
 - License Class H can be issued for control of activities not covered by the other classes; for example, the licensing maintenance work by contractors, licensing of Radiation Safety Training Centers
- The Radiation Protection (Licensing) Regulations 1986 has also specify further information required for Class F License under Regulations 19, 20, 21 and 22.

Appendix 3. MALAYSIAN ENERGY SCENARIO

The Need for Nuclear Energy to sustain Malaysian Economic Development

Electrification of Malaysia

The electrification of Malaysia during its 50 years of Independence powered the urbanization and industrialization of the nation, allowing the population to increase three fold whilst greatly improving the overall standard of living in terms of housing, health, nutrition, education and disposable income.

To defend these general welfare gains, before the nation's oil and gas reserves run out and to fulfill the promise of the 21st Century, Malaysia must Go Nuclear !

Malaysia's present Electricity Production

Half of Malaysia's power plants run on gas other sources include coal and hydropower

- Known gas reserves will last 30 years
- Malaysia has to import virtually all of its Coal

- By 2014 Petrol for transportation will be imported
- Malaysia is a small nation but may contain half of the world's estimated 50 million species. Hydro-electric sacrifices valuable land and biological resources. Hydropower can be held in reserve as a last resort.
- Even if new oil field/reserves found – still need to go Nuclear as we need to reserve for our transport and our future generation
- Coal issues & LNG

Appendix 4. ASEAN ELECTRICITY REQUIREMENTS

The ten ASEAN Countries with 10% of world population currently need about 18 times more electricity to lift the standard of living to the present Australian level representing a modern civilized life for the whole ASEAN region.

Appendix

5.

TRANSPORTATION

Maglev Malaysia

A 'flying on land' 450kph Malaysian Maglev Railway, powered by cheap nuclear electricity can overcome the urban-rural divide

- KL → Seremban 15 mins
- KL → Kuantan 40 mins
- KL → Butterworth 1 hour
- KL → Terangganu 1 hr 10 mins
- KL → Kota Baru 1hr 40 mins
- Johor → Thai Border 2 hrs 20 mins

Reducing Road deaths with Hi-Technology

Cheap, fast & efficient urban and intercity maglev passenger and freight trains will dramatically reduce road fatalities. Due to high motorbike usage

Malaysia's road deaths per million population are excessive, **2.5 to 3.9** times higher than Australia, Japan or UK

Worldwide Deaths per million passenger kilometers traveled:-

- 170 for motorbikes, 12 for cars but only 1 for planes and trains

Reducing Road deaths with Hi-Technology

Cheap, fast & efficient urban and intercity maglev passenger and freight trains will dramatically reduce road fatalities. Due to high motorbike usage

Malaysia's road deaths per million population are excessive, **2.5 to 3.9** times higher than Australia, Japan or UK

Worldwide Deaths per million passenger kilometers traveled:-

- 170 for motorbikes, 12 for cars but only 1 for planes and trains

Appendix 6. NUCLEAR FACTS SHEET

6.1. The world's leading expert

"It is impossible to meet the needs of developing countries for electricity transportation and desalinated water without nuclear power"

Dr. Mohammad El-Baradei Nobel Peace Prize Laureate and Director-General

UN International Atomic Energy Agency at a public lecture

Academy of Sciences Malaysia, 18 July 2007

6.2. The Anti-nuclear Green Environmentalists

Greenpeace and the World Wildlife Fund for Nature are opposed not only to nuclear energy for peaceful purposes but also to fossil fuels, and hydroelectric dams, all of which they say threatens nature. These three technologies produce over 99% of world energy. Without them the world population will crash to the level of the Middle Ages. It seems the green environmentalists love nature but hate mankind.

6.3 Solar versus Nuclear

Solar cells only produce tiny amounts of electricity but only when the sun shines!

Solar is a sad alternative to the uninterrupted 100% reliable supply of electricity from nuclear power stations. A modest size 300MW nuclear power plant on 100 acres of land, operated by a few hundred skilled staff, will supply the whole Klang Valley with electricity for 60 years

“Solar panels are not viable as industrial energy sources.

Maybe they are good for small-scale applications such as parking meters or street lamps”

Dr Nahrul Khair, Deputy Director General

Nuclear Malaysia Agency, The Star 15 June 2008

6.4 Giant Wind Farms versus Nuclear

WIND Farms for Malaysia will be totally useless for electricity generation.

The wind speed is too low. Just like the wind turbines on Malaysian houses, they will remain motionless for most of the time.

Even in high wind areas such as Texas the North Sea, wind fluctuates greatly and will always need back up power plants using fossil fuels.

A Nuclear power plant is a continuous source of heat for generating electricity, desalinated water or hydrogen until the nuclear fuel is spent. When this occurs after 2-30 years depending on the type of nuclear reactor, the fuel is replaced.

6.5 Nuclear terrorism

In his 'Atoms for Peace' speech to United Nations on 8 Dec 1953, President Eisenhower

pledged that Nuclear Material will not get into wrong hands. The United Nations would be made responsible for safeguarding nuclear material.

In 2007 Dr ElBaradai, International Atomic Energy Agency made the same United Nations commitment.

6.6 Nuclear is the world's safest energy technology

For electricity production, immediate deaths worldwide (1970-1992) were

- 1200 using Natural Gas,
- 4000 using Hydro
- 6400 using Coal
- but only 31 using Nuclear

Normalised to equal quantities of electricity produced

Nuclear generation caused 1 death, compared to 11 for gas, 43 for coal and 110 for hydro

In 2006, more than 5000 miners died in China producing 1 billion tons of coal that power its economy. Source www.world-nuclear.org

6.7 There is no such thing as nuclear waste

“Modern nuclear plants are inherently safe. The so called nuclear waste problem is a fraud.

Efficient systems for reprocessing nuclear waste were developed and used since the 1950s but shut down in the 1970s”

- Always recyclable.
- How has the waste disposed now? (Need to convince the government)
 - need to give real life examples and figures since 50 yrs ago (how many NPPs, how much waste has been generated, the technology utilized to manage it)
- “There’s a half life to radioactive waste but no half life to toxic waste”

6.8 Atoms for Peace

The proposal to Go Nuclear is not new. It is a return to the 1950’s-1960’s ‘ATOMS for PEACE’ program

- *Nuplexes- Nuclear powered cities with own agriculture & industries*
- *Greening the deserts using cheap nuclear desalinated water*
- *‘Green Revolution’ in agriculture to overcome world hunger*

6.9 Last Chance to Go Nuclear

In the 1960s and early 1970s Malaysia sent its best students overseas and had the technical ability and trained manpower to go nuclear. But the world went anti-nuclear.

Now this generation of nuclear scientists, engineers and technicians are fast retiring.

Meanwhile Malaysia imports its coal, will become a net importer of oil by 2014 and gas reserves run out in 30 years.

We only have a small window of opportunity left to go nuclear and train the next generation.

6.10 The Nuclear Future

With the present Nuclear Renaissance a whole new world becomes possible.

All the pent-up technology of the last 40 years can now be exploited.

- Cheap and abundant Nuclear generated electricity, fresh desalinated water and hydrogen economy for every nation
- Electric & Hydrogen powered cars, trucks, planes
- Maglev trains connecting cities to world railway
- Nuclear powered cities producing their own food with modern agriculture and manufacturing advanced goods for national and international markets.

6.11 Maglev Malaysia

A 'flying on land' 450kph Malaysian Maglev Railway, powered by cheap nuclear electricity can overcome the urban-rural divide

KL → Seremban 15 mins

KL → Kuantan 40 mins

KL → Butterworth 1 hour

KL → Terangganu 1 hr 10 mins

KL → Kota Baru 1hr 40 mins

Johor → Thai Border 2 hrs 20 mins

6.12 Reducing Road deaths with Hi-Technology

Cheap, fast & efficient urban and intercity maglev passenger and freight trains will dramatically reduce road fatalities. Due to high motorbike usage

Malaysia's road deaths per million population are excessive, **2.5 to 3.9** times higher than Australia, Japan or UK

Worldwide Deaths per million passenger kilometers traveled:-

- 170 for motorbikes, 12 for cars but only 1 for planes and trains

6.13 The world's leading expert

"It is impossible to meet the needs of developing countries for electricity transportation and desalinated water without nuclear power"

Dr. Mohammad El-Baradei Nobel Peace Prize Laureate and Director-General

UN International Atomic Energy Agency at a public lecture

Academy of Sciences Malaysia, 18 July 2007

6.14 The Anti-nuclear Green Environmentalists

Greenpeace and the World Wildlife Fund for Nature are opposed not only to nuclear energy for peaceful purposes but also to fossil fuels, and hydroelectric dams, all of which they say threatens nature. These three

technologies produce over 99% of world energy. Without them the world population will crash to the level of the Middle Ages. It seems the green environmentalists love nature but hate mankind.

Their 'green renewable alternative' to support the earth's 6.7 billion people are solar power and wind power but neither are serious solutions to the world's energy needs

6.15 Solar versus Nuclear

Solar cells only produce tiny amounts of electricity but only when the sun shines!

Solar is a sad alternative to the uninterrupted 100% reliable supply of electricity from nuclear power stations. A modest size 300MW nuclear power plant on 100 acres of land, operated by a few hundred skilled staff, will supply the whole Klang Valley with electricity for 60 years

"Solar panels are not viable as industrial energy sources.

Maybe they are good for small-scale applications such as parking meters or street lamps"

Dr Nahrul Khair, Deputy Director General

Nuclear Malaysia Agency, The Star 15 June 2008

6.16 Giant Wind Farms versus Nuclear

WIND Farms for Malaysia will be totally useless for electricity generation.

The wind speed is too low. Just like the wind turbines on Malaysian houses, they will remain motionless for most of the time.

Even in high wind areas such as Texas the North Sea, wind fluctuates greatly and will always need back up power plants using fossil fuels.

A Nuclear power plant is a continuous source of heat for generating electricity, desalinated water or hydrogen until the nuclear fuel is spent. When this occurs after 2-30 years depending on the type of nuclear reactor, the fuel is replaced.

6.17 Nuclear terrorism

In his 'Atoms for Peace' speech to United Nations on 8 Dec 1953, President Eisenhower

pledged that Nuclear Material will not get into wrong hands. The United Nations would be made responsible for safeguarding nuclear material.

In 2007 Dr ElBaradai, International Atomic Energy Agency made the same United Nations commitment.

6.18 Nuclear is the world's safest energy technology

For electricity production, immediate deaths worldwide (1970-1992) were

- 1200 using Natural Gas,
- 4000 using Hydro
- 6400 using Coal
- but only 31 using Nuclear

Normalised to equal quantities of electricity produced

Nuclear generation caused 1 death, compared to 11 for gas, 43 for coal and 110 for hydro

In 2006, more than 5000 miners died in China producing 1 billion tons of coal that power its economy. Source www.world-nuclear.org

6.19 There is no such thing as nuclear waste

“Modern nuclear plants are inherently safe. The so called nuclear waste problem is a fraud.

Efficient systems for reprocessing nuclear waste were developed and used since the 1950s

but shut down in the 1970s”

Dumping the spent radioactive fuel is idiotic. It can be recycled through nuclear reactors to produce 20 times more useful energy. Very little radioactive material remains and is valuable for medical & scientific use

“Imagine taking ashes from a spent fire and burning them a second time, and the a third, and so on” L.Hecht, Editor, 21st Century Science & Technology (Washington) August 2008

6.20 Forth Generation 100% Safe Nuclear Reactors

A German nuclear scientist, Prof Schulten, designed a nuclear reactor in the 1950s that was scientifically impossible to melt down and did not rely on man made safety switches. It became the Pebble Bed Modular Reactor and is starting to be mass produced in South Africa. It promises to lift Africa and developing countries out of medieval poverty.

The small 200MW reactors can be sited exactly where needed to produce abundant electricity and water.

6.21 The Minister of Science supports Nuclear Energy

Datuk Dr Maximus Ongkili, made the following remarks

reported by BERNAMA August 19, 2008

- *“Nuclear energy is vital following the increase in the world fuel price and our limited oil reserve. Moreover, nuclear energy is clean and cheap”*
 - *“Malaysia has experts who have studied & researched nuclear technology as a safe new source of power”*
 - *“The Nuclear Malaysia Agency is the lead agency to coordinate and manage the planning, preparations and development for the use of nuclear energy”*
-