

Research, Development, and Peaceful Uses of Atomic Energy in Viet Nam

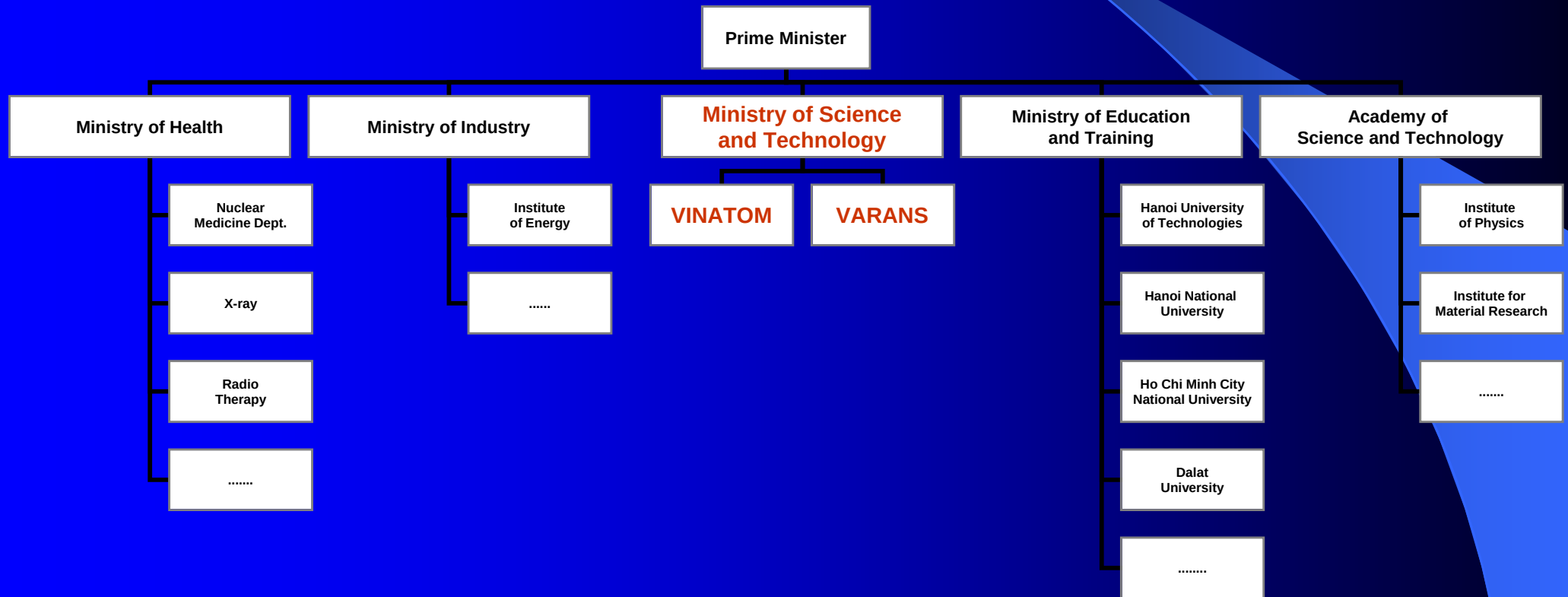
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1. General Information

Nuclear Organization Structure



Nuclear Related Organizations

- ❑ **The Ministry of Industry** (including subsidiary bodies: Electricity of Vietnam (EVN), Institute of Energy (IE), Energy Agency (EA)) is responsible for State management of development of nuclear power and applications of radiation in industry;
- ❑ **Ministry of Health, Ministry of Agriculture and Rural Development:** are responsible for State management of application radiation in their sectors
- ❑ **Ministry of Natural Resources and Environment:** is responsible for State management of application of radiation in natural resources and environment and State management for environment in general;
- ❑ **Ministry of Education and Training:** manpower preparation;
- ❑ **Academy of Science and Technology:** Fundamental and applied researches on nuclear energy.
- ❑ etc...

Ministry of Science and Technology (MOST)

- ❑ The Ministry of Science and Technology (MOST) is a State Management Body on the fields of nuclear energy and radiation protection & nuclear safety.
- ❑ Under the MOST are Vietnam Atomic Energy Institute (VINATOM, the former VAEC, 810 staffs); and Vietnam Agency for Radiation and Nuclear Safety (VARANS, 85 staffs); and Vietnam Atomic Energy Agency (VAEA, 25 staffs).
- ❑ In addition, there are 64 Department of Science and Technology (DOST) in the 64 cities and provinces. DOTs are responsible for provincial management activities on radiation protection and reports regularly to MOST via VARANS.

Functions and Duties of the VINATOM

- ❑ Conduct fundamental and applied research on nuclear science and engineering, nuclear reactor technology, nuclear fuel and material, radiation protection and nuclear safety, and radioactive waste management technology in service of economic development of the country;
- ❑ Develop technology, production and technical services in atomic energy and related fields in service of social and economic development;
- ❑ Study and formulate directions, strategies, planning and plans for atomic energy development in Viet Nam, participate in the formulation of law projects and regulatory documents in relation to atomic energy, and in the implementation of nuclear policies approved by the Government;

Functions and Duties of the VINATOM (Cont'd)

- ❑ Perform international cooperation in the field of atomic energy, and participate in the implementation of international treaties pledged by Viet Nam;
- ❑ Provide technical support to the State management body on radiation protection and nuclear safety in the appraisal of radiation protection and nuclear safety, carry out environmental radioactivity monitoring, calibrate radiation facilities and dosimeters, develop technical infrastructures in the preparedness and response to radiological and nuclear incidents and accidents; and
- ❑ Participate in the planning and training of scientific and technical professionals in the field of atomic energy.

VINATOM Subsidiary Bodies

VINATOM is composed of

- ❑ Da Lat Nuclear Research Institute (DNRI);
- ❑ Institute for Nuclear Science and Technology (INST);
- ❑ Institute for Technology of Radioactive and Rare Elements (ITRRE);
- ❑ Center for Nuclear Technique in Ho Chi Minh City (CNT);
- ❑ Research and Development Center for Radiation Technology (VINAGAMMA);
- ❑ Center for Application of Nuclear Techniques in Industry in Dalat (CANTI);
- ❑ Hanoi Irradiation Center (HIC);
- ❑ Non-Destructive Evaluation Center (NDE); and
- ❑ Technology Application and Development Company

Technical Capability and Infrastructure

- ❑ Da Lat NRR: Pool-type, water-cooled, water moderated, original TRIGA MARK-II 250 kW and upgraded to 500 kW since 1984.
 - Production of radioisotopes and radio-pharmaceuticals;
 - Neutron activation analysis; and
 - Research & Training on neutron physics, reactor physics and dynamics, nuclear data measurement, neutron radiography, silicon doping.
- ❑ Gamma Irradiators:
 - At DNRI: Co-60, 16.5 kCi used for research, installed in 1981;
 - In Ho Chi Minh City: Co-60, 400 kCi used for sterilisation of medical products and foods, installed in 1999;
 - In Ha Noi: Co-60, 200 kCi used for food preservation and research, installed in 1990, upgraded in 2006

Technical Capability and Infrastructure (Cont'd)

- ❑ Waste Management: radwaste treatment facilities, interim storage;
- ❑ Secondary Standard Dosimetry Laboratory (SSDL) at INST: Equipped with standard X-ray machine, TLD reader – Harshaw 400, 500 phantom, Alpha spectrometers, Gamma spectrometers, Alpha-Beta measurement system.
- ❑ Radiation Protection Laboratories with radiation measurement and calibration equipment, Gamma spectrometer, X-ray fluorescence spectrometer;
- ❑ Nine (9) Radiotherapy Departments equipped with 14 Cobalt units, 22 LINACs and 3 X-ray machines;
- ❑ Brachy-therapy: 9 low dose rate Cs-137 systems, 1 high dose rate Co-60 system;
- ❑ One gamma knife and one cyber knife have been installed in Hue and Hanoi.

Technical Capability and Infrastructure (Cont'd)

- ❑ 25 nuclear medicine departments and laboratories;
- ❑ About 2,000 of X-ray diagnostic machines;
- ❑ More than 54 enterprises, factories using radioisotope sources and irradiation facilities (EB, Co-60);
- ❑ NDT laboratories in Ha Noi and HCM City, some enterprises doing NDT services;
- ❑ Isotope Hydrology laboratories in HCM City and Ha Noi;
- ❑ Environmental laboratories in Ha Noi, HCM City and Da Lat;
- ❑ Nuclear and related Analytical laboratories in Da Lat, Ha Noi; HCM city.
- ❑ Electronic and mechanical workshop for design, manufacture, and maintenance of nuclear instruments.

2. Utilization of Radiation and Radioisotopes

Utilization of Radiation and Radioisotopes

In Health Care

- ❑ DNRI produces and every year supply about 150 Ci with 20 radioisotopes and radio-pharmaceuticals;
- ❑ About 1/3 of cancer patients have been treated by radiotherapy techniques;
- ❑ Several hundreds thousands patients have been diagnosed by nuclear medicine techniques;
- ❑ Several technologies and equipments were transferred into Viet Nam, such as brachy-therapy, burn treating membrane, laser and magnetic resonance equipments for diagnose and treatment.
- ❑ Five PET-Cyclotron centers has been in operation in Hanoi, Hochiminh city, Kien Giang and Danang.

Utilization of Radiation and Radioisotopes (Cont'd)

In Agriculture

- ❑ Plant mutation breeding by gamma irradiation to create new rice varieties (DT10, VND-95-19, VND-95-20, TNDB, THDB), corn, and legume;
- ❑ Using tracer techniques in management of the soil, water, and fertilizer to optimize cultivated techniques;
- ❑ Investigate soil erosion and reservoir sedimentation by using Cs-137 and Pb-210 measurement techniques;
- ❑ Produce plant promoters and protectors using radiation technology.

Utilization of Radiation and Radioisotopes (Cont'd)

In Industry

- ❑ NDT: used to inspect bridge piers, road and building foundations, weld defects, piping and concrete quality, etc.;
- ❑ NCS: applied for control of industrial product quality (cement, glass, paper, beer...);
- ❑ TRACER: used to determine optimum process for the mixing of materials in glass production for manufacturing light bulb, to enhance oil recovery in oil & gas industry, etc.

Utilization of Radiation and Radioisotopes (Cont'd)

In Geology, Hydrology and Environment

- ❑ Exploration and evaluation of mineral potential by using carota drilling techniques, nuclear analytical techniques,...
- ❑ Investigation and evaluation of reserves, age, origin, movement, salinization and pollution of groundwater in Ha Noi and the Mekong delta;
- ❑ Study on dam and dyke leakage; on sedimentation at river estuary and seaport
- ❑ Study on environmental pollution; and
- ❑ To monitor environmental radioactivity (Three national stations have been established and several preliminary databases on environmental radioactivity have been created).

3. Study on Nuclear Power Development

Current Status of Economic, Energy and Electricity Development

- ❑ By 2011, population is more than 86 millions and projected 98 millions and 101 millions in 2020, 2025 respectively;
- ❑ The average GDP growth rate in the period 2006-2010 reached 6.5%. The GDP per capita is more than 1,000 USD in 2012.

Power Development Scheme

2010

2015

Generation	112.6 Bill kWh	190 Bill kWh
Peak Demand	19,117 MW	31,495 MW
Installed Capacity	25,879 MW	42,341 MW
<i>of which: Hydropower</i>	<i>~ 9222 MW (35.6%);</i>	<i>13,601 MW (32.1%)</i>
<i>Gas & Oil thermal:</i>	<i>~ 9425 MW (36.4%);</i>	<i>3,241 MW (31.3%)</i>
<i>Coal thermal:</i>	<i>~ 5,975 MW (23.1%);</i>	<i>2,130 MW (28.6%)</i>
<i>Import:</i>	<i>~ 820 MW (3.2%);</i>	<i>2,102 MW (5.0%)</i>
<i>Renewable Energy</i>	<i>~ 467 MW (1.7%)</i>	<i>1,267 MW (4.0%)</i>

Power Development Scheme

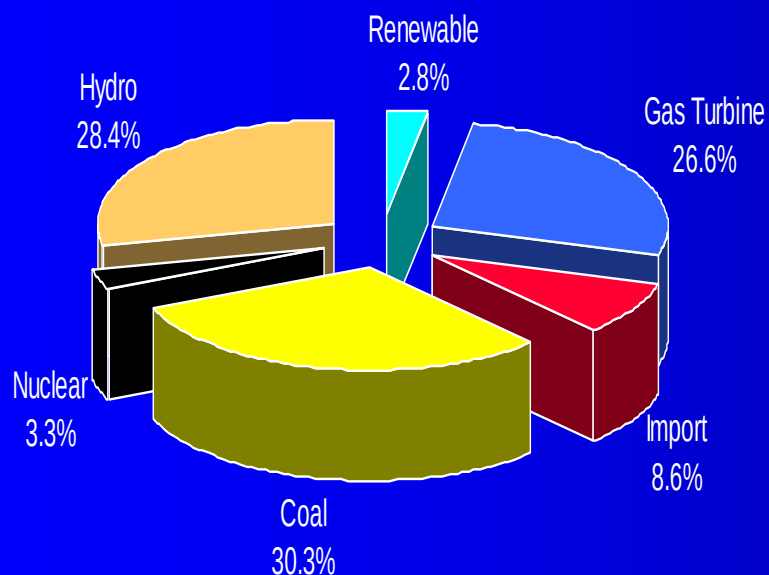
2020

2025

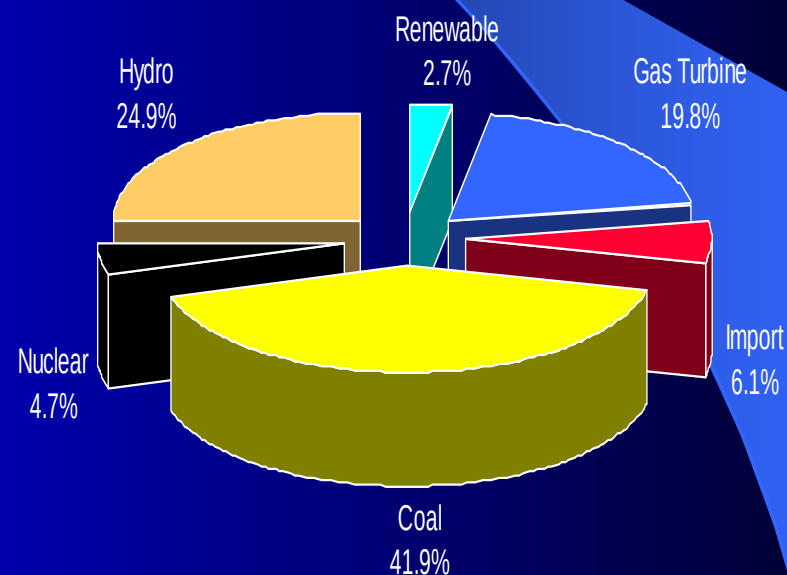
Generation	294 Bill kWh	432 Bill kWh
Peak Demand	47,607 MW	68,440 MW
Installed Capacity	60,611 MW	85,411 MW
Of which: Hydropower	~ 17,195 MW (28.4%)	21,295 MW (32.1%)
Gas & Oil thermal:	~ 16,151 MW (26.6%)	16,901 MW (19.8%)
Coal thermal:	~ 18,350 MW (30.3%)	35,750 MW (41.9%)
Import:	~ 5,198 MW (8.6%)	5,198 MW (6.0%)
Renewable Energy	~ 1,717 MW (2.8%)	2,267 MW (2.7%)
<u>Nuclear Power</u>	<u>~ 2,000 MW (3.3%)</u>	<u>4,000 MW (4.7%)</u>

Share of Installed Capacity in 2020 (*left*) and in 2025 (*right*) by Fuel Types

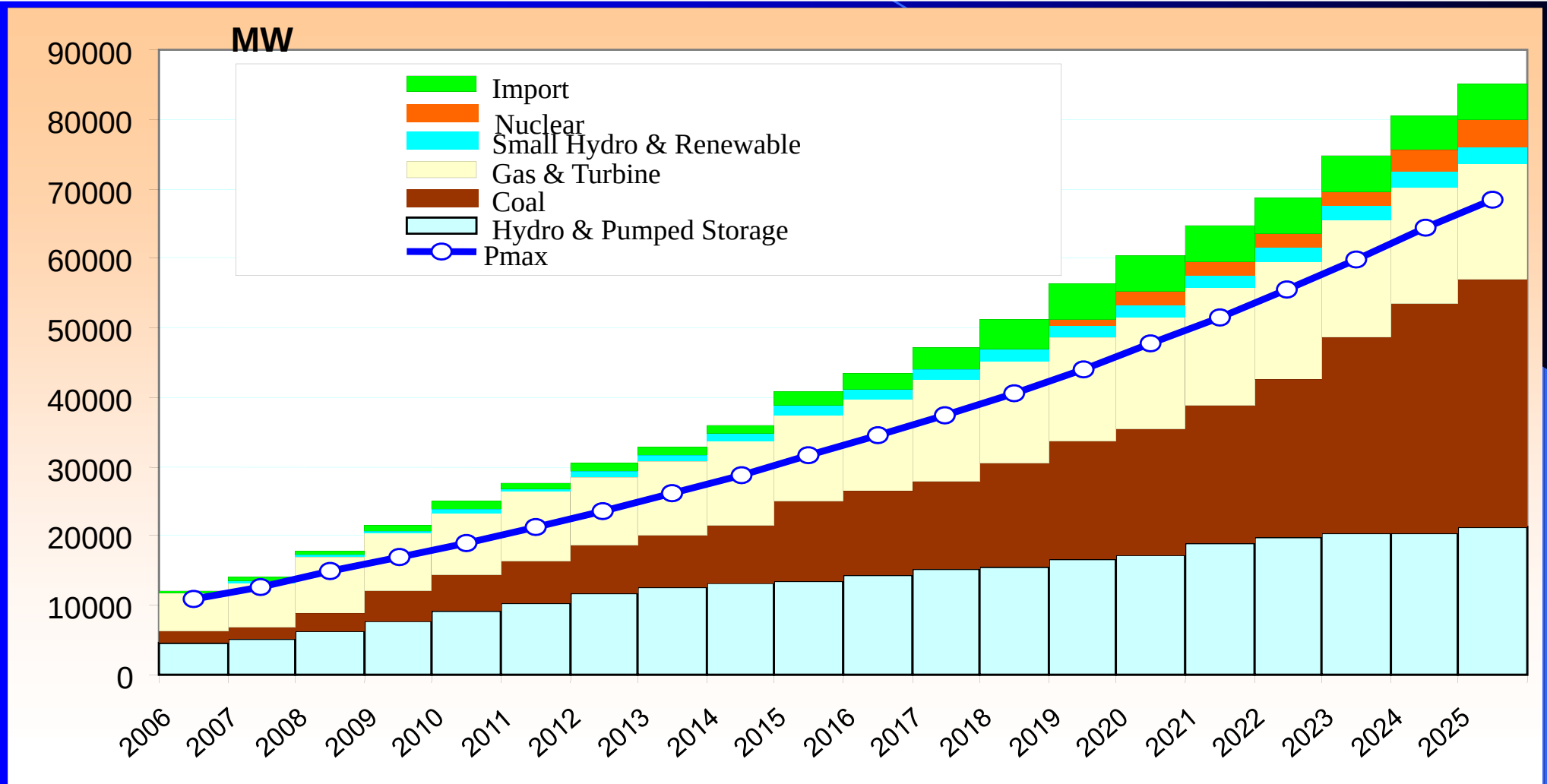
60,611 MW - 294 Bill kWh



85,441 MW - 432 Bill kWh



Planning for Electricity Development Period 2006-2025 (Base Scenario)



4. Directions of Atomic Energy Development in Viet Nam

Directions of Atomic Energy Development

Documents determining Directions

1. Atomic Energy Law (2008)
2. Strategy for Peaceful Utilizations of Atomic Energy (2006)
3. The Master Plan on the Atomic Energy Development (2010)
4. Orientations for Nuclear Power Development (2010)
5. Planning of Radiation Applications in Industrial Sectors (2010)

Directions of Atomic Energy Development

6. Planning of Radiation Applications in Agriculture (2010)
7. Planning of Radiation Applications in the Fields of Natural Resources and Environmental Protection (2010)
8. Orientations for the Candidate Sites of Radioactive Waste Storage and Disposal (2010)
9. Planning of Radiation Applications in Health Care (2011)
10. Project on Deployment of Security Measures in the Field of Atomic Energy (2011)

Directions of Atomic Energy Development

11. Project on Strengthening the Capacity of Research and Development (R&D) and Technical Support (2012)
12. Project on Strengthening the Capacity of State Management Agencies (2013)
13. Master Plan on Infrastructure Development for Nuclear Power (2013)

Directions...

In comparison with other countries in the region, Vietnam has built a relatively comprehensive program on development of atomic energy application, assurance of nuclear safety, security and non-proliferation. This is the basis for elaborating the cooperation framework with the IAEA in the future, especially in the field of nuclear power development.

5. International Cooperation

International Cooperation

- ❑ Viet Nam has been being aware of the importance of international nuclear cooperation and considers it as a very important resource for promotion and development of research, development and assurance of safety and security in uses of nuclear energy for peaceful purposes in Viet Nam;
- ❑ At present, Viet Nam is Member State of IAEA, RCA and FNCA; and
- ❑ Viet Nam signed 7 Governmental Agreements for Cooperation on Peaceful Uses of Nuclear Energy with Russia, China, India, Korea, Argentina, France and Japan; and has close nuclear cooperation with US, Canada,...

International Cooperation...

- ❑ Participation in the international nuclear conventions and treaties, Viet Nam is signatories to:
 - Nuclear Weapon Non-Proliferation Treaty (NPT), 1982.
 - Safeguards Agreement, 1989.
 - Convention on Early Notification of a Nuclear Accident, 1986.
 - Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, 1987.
 - Bangkok Treaty: South East Asia Nuclear Weapons Free Zone, 12/1995.
 - Comprehensive Nuclear Test Ban Treaty (CTBT), 1996, ratified in early 2005.
 - Additional Protocol (2007)
 - Nuclear Safety (2010)

Thank you for your attention!