Nuclear Human Resource Development (N-HRD) Studies in Turkey

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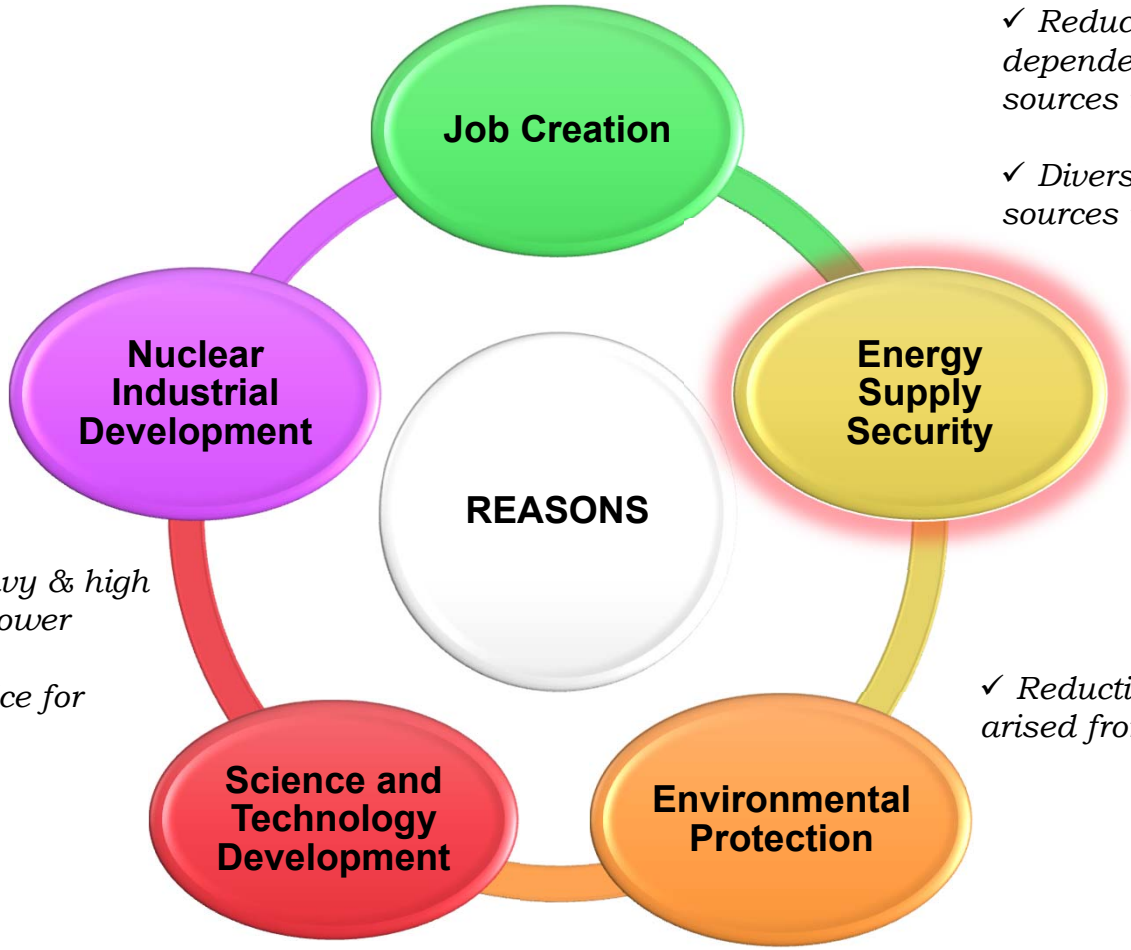
Content

Part 1:

Current Status of Turkey's Nuclear Power Program

Why NPP for Turkey?



✓ *Reduction of energy dependence on imported sources in electricity generation*

✓ *Diversifying primary energy sources in the generation mix*

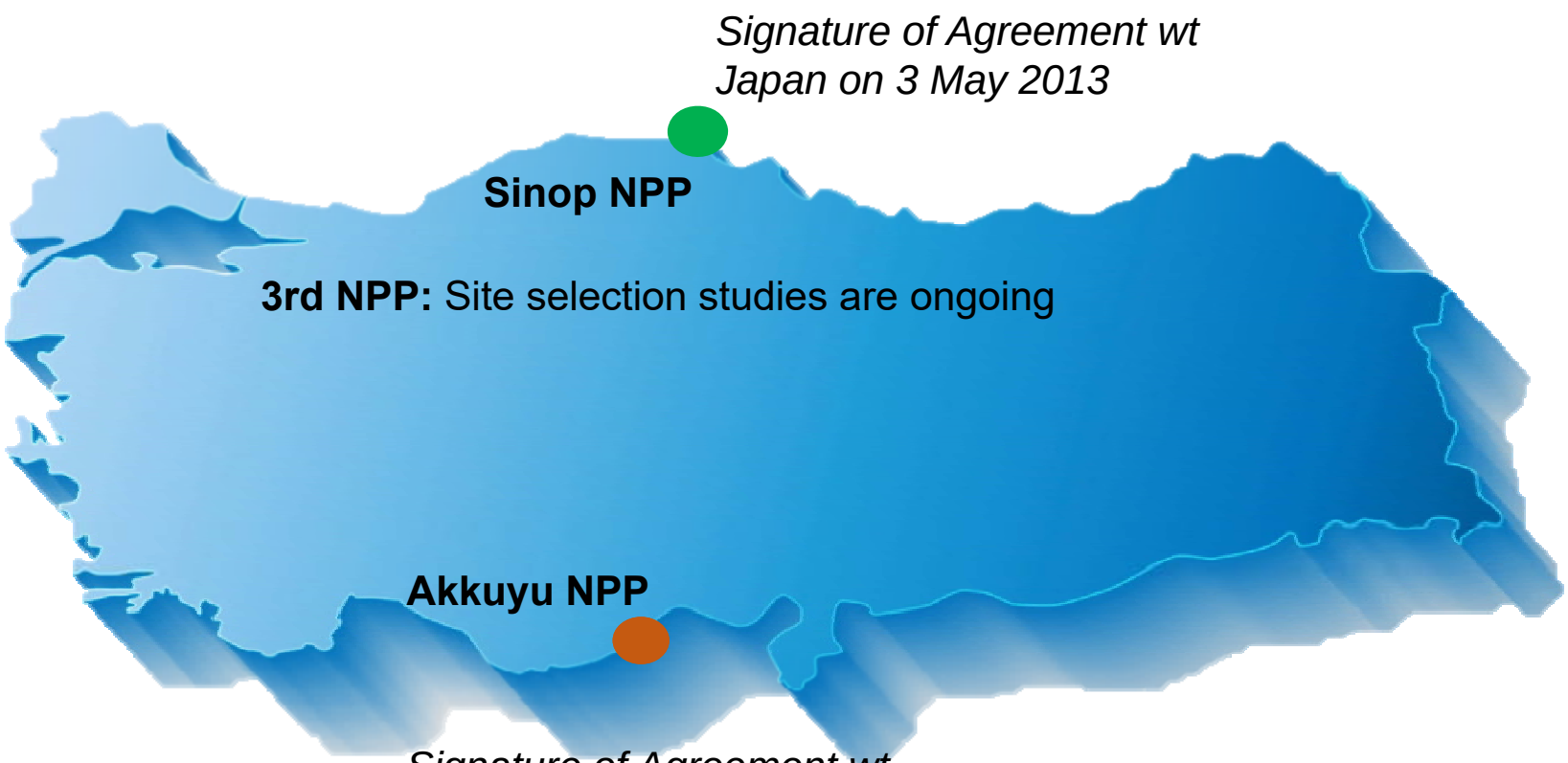
✓ *Development of heavy & high technology industry power*

✓ *Lower electricity price for industry*

✓ *Reduction of GHG emmission arised from energy sector*

Turkey's Nuclear Power Program

- 3 NPPs (12 reactors) to be installed in Turkey by 2030

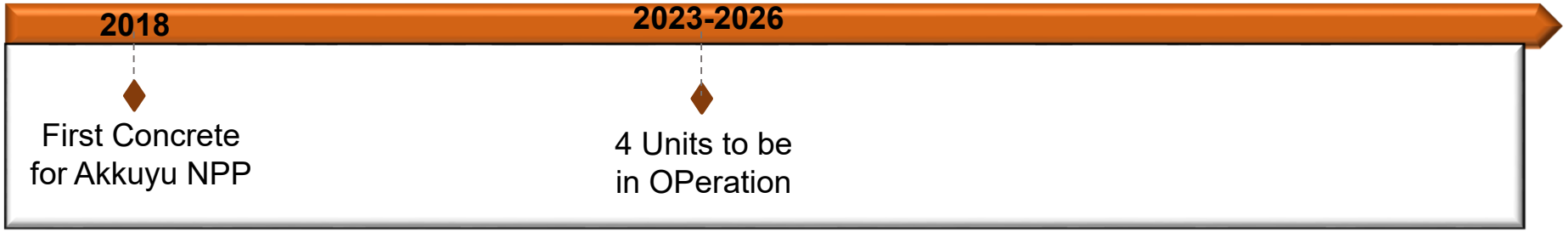


Technical & Economic Parameters

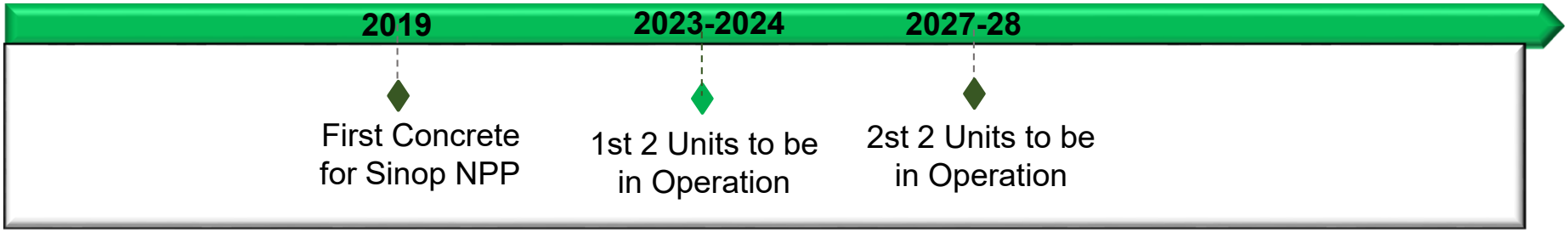
	Akkuyu NPP Project	Sinop NPP Project
Plant Type	VVER-1200	ATMEA1
Number of Unit	4	4
Total Installed Capacity	4800 MW (35 bn kWh/yr)	4500 MW (33 bn kWh/yr)
Operation Time for Each Unit	60 years	60 years
Estimated Cost of Project	20 billions USD	22 billions USD
Financial Model	Build-Own-Operate Rosatom affiliates = 100% (initial) Rosatom affiliates > 51%	Public-Private-Partnership (Shareholders: Itochu, MHI, GDF and EUAS) JAPCO (Ithocu, MHI, GDF) > 51%; EUAS = 30-49%
Power Purchase Guaranty	50% of electricity output 15 years Fixed price No escalation in the price After PPA, transfer of 20% of net profit to Turkish Treasury	100% of electricity output 20 years Fixed price Change in the price after the feasibility study

Time Schedule of NPP Projects

Application for construction license in 2017



Completion of feasibility studies, EcIA and EIA; obtaining of site license in 2018

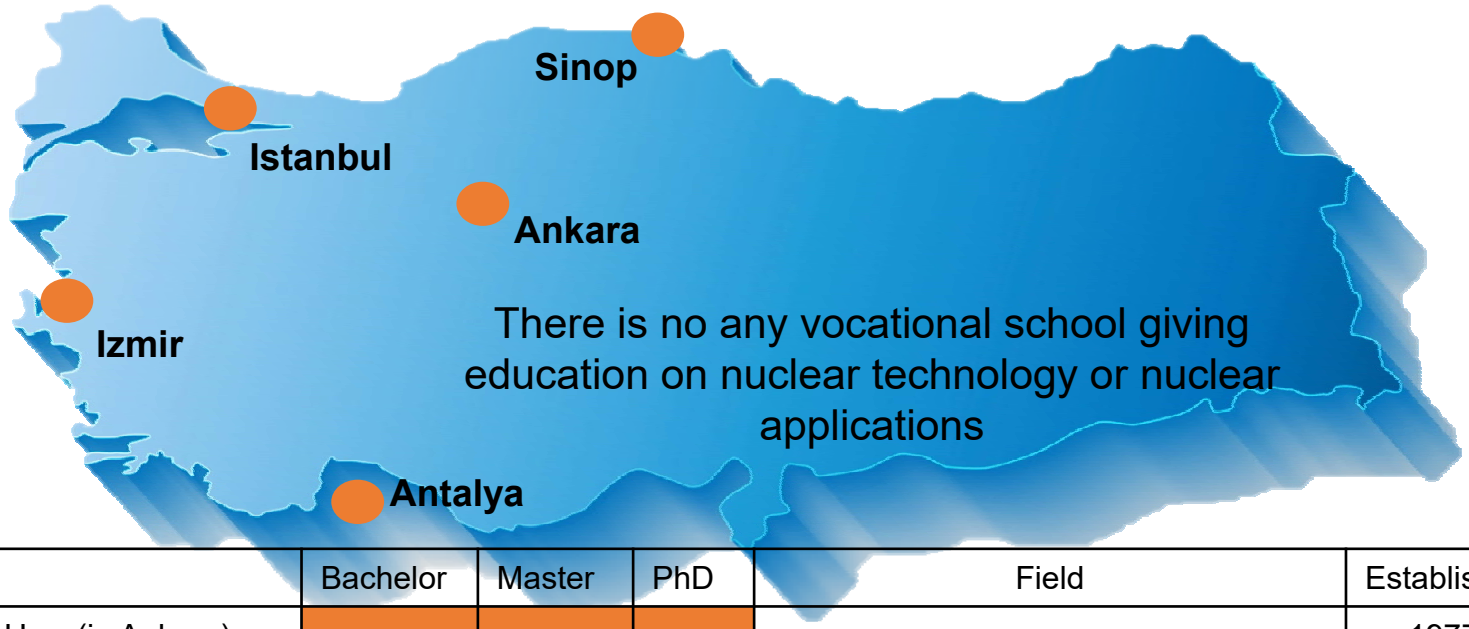


Completion of negotiations with vendor company in 2017

Part 2:

The Role of Project Companies in N-HRD

Nuclear Education & Training in Turkey



Name	Bachelor	Master	PhD	Field	Establishment
Hacettepe Unv. (in Ankara)	■	■	■	Nuclear Engineering	1977, 1982
Istanbul Technical Unv. **(Training-research reactor)**		■	■		1961, 2003
Sinop Unv.	■				2015
Ege Unv. (in Izmir)		■	■	Industrial applications of nuclear, environmental radiation detection	1966
Hacettepe Unv. (in Ankara)		■	■	Radiation physics and its applications	2003
Akdeniz Unv. (Antalya)		■	■	Radiation physics and its applications	2013
Ankara Unv.		■	■	Medical applications, health physics, radiation protection and monitoring	2006

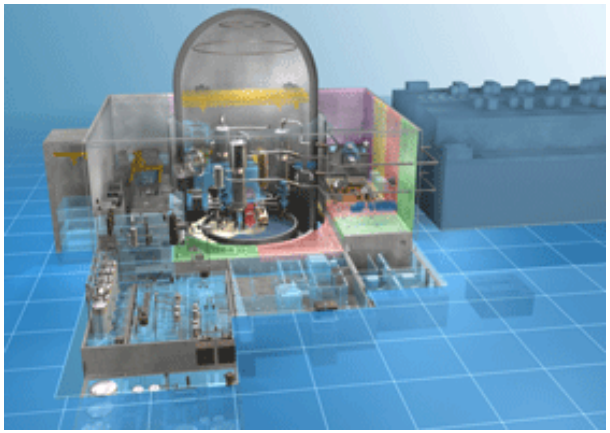
N-HRD Activities in Akkuyu NPP Project

AKKUYU NÜKLEER

- 30% of plant staff will be Turkish personnel.
- 600 Turkish students will be trained in Russia (at MEPhI University) by Akkuyu Project Company. (262 students were sent to Russia between 2011-2016)
- The training program includes:
  - ✓ 5-yrs undergraduate program (1-yr Russian language, 4-yrs nuclear engineering education)
  - ✓ 6 months to 2 yrs master's degree program
  - ✓ on the job training at nuclear plants in Russia during summer months

- After they complete their education in Russia, they will work at Akkuyu NPP as operators and engineers.
- Akkuyu Project Company will establish an onsite nuclear training center for training of Turkish people (especially for initial training of technician and qualified crafts; continuing training of operators and engineers)

N-HRD Obligations in Sinop NPP Project

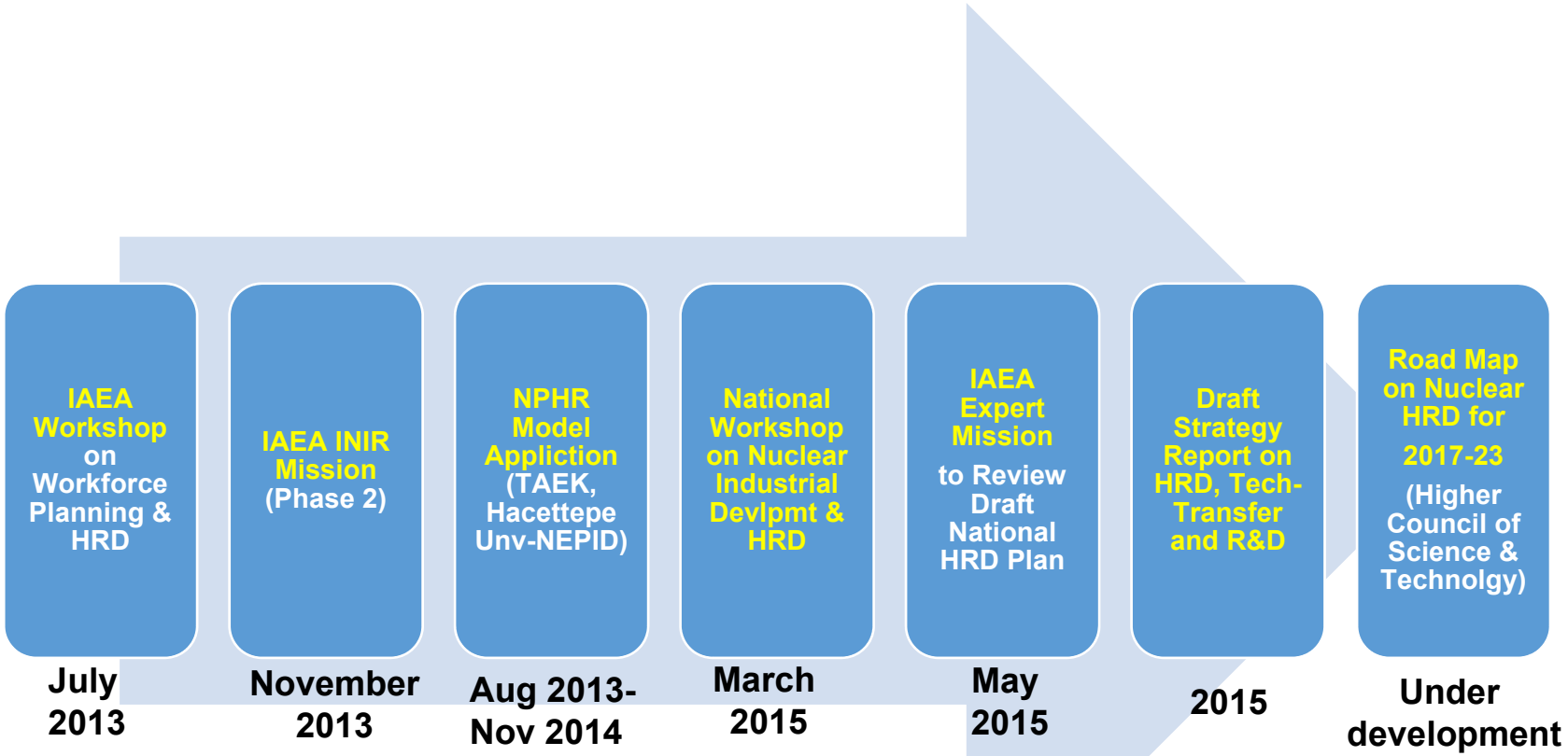


- Sinop Project Company will prepare a nuclear human resources development (N-HRD) plan as well as localization and technology transfer plans for Sinop Project.
- N-HRD plan will include a local participation rate at the construction and operation stages of the Sinop NPP and a roadmap to achieve this rate.
- A large nuclear training center will be established near plant site for training of Turkish people .
- A Turkish-Japanese University (including nuclear enginering and science education programmes) will be established in Turkey.

Part 3:

Key Steps in National N-HRD Studies

Key Steps in National N-HRD Studies



NPHR modelling tool was used to determine workforce needs (2014-2035) for:

✓NEPID
✓TAEK (new regulatory authority)
✓Project companies
✓Nuclear power plants (construction & operation stages)
✓Universities and research centers

Recent Developments on National N-HRD

ADA Meeting on «Nuclear Training Center» (April 2016)

Signature for Establishment of Turkish - Japanese University (June 2016)

- Ankara Chamber of Industry (ACI) is studying on the establishment of a pilot training center and high school in Ankara for training of «middle man» (technicians and crafts) required for nuclear industry.
  - ✓ Ankara Development Agency (ADA) will provide financial support to the project.
  - ✓ ACI signed a cooperation agreement with I2EN (International Institute of Nuclear Energy) in France to develop education programs and certifications to be given in the nuclear training center. (In addition, cooperation with Rosatom)
- Establishment Law of Turkish-Japanese Science and Technology University was ratified by Turkish Parliament in 2016.

Recent Developments on National N-HRD

- Ministry of Energy initiated a study to get in touch with Turkish nuclear experts living abroad.
- Gedik University (a private university) decided to start an advanced welding education program to be needed for nuclear industry.
- Turkey joined to Human Resources and Knowledge Development Networks Initiative of IAEA along with Malaysia and Japan. (in the future with Poland)

Near Future Works on National N-HRD

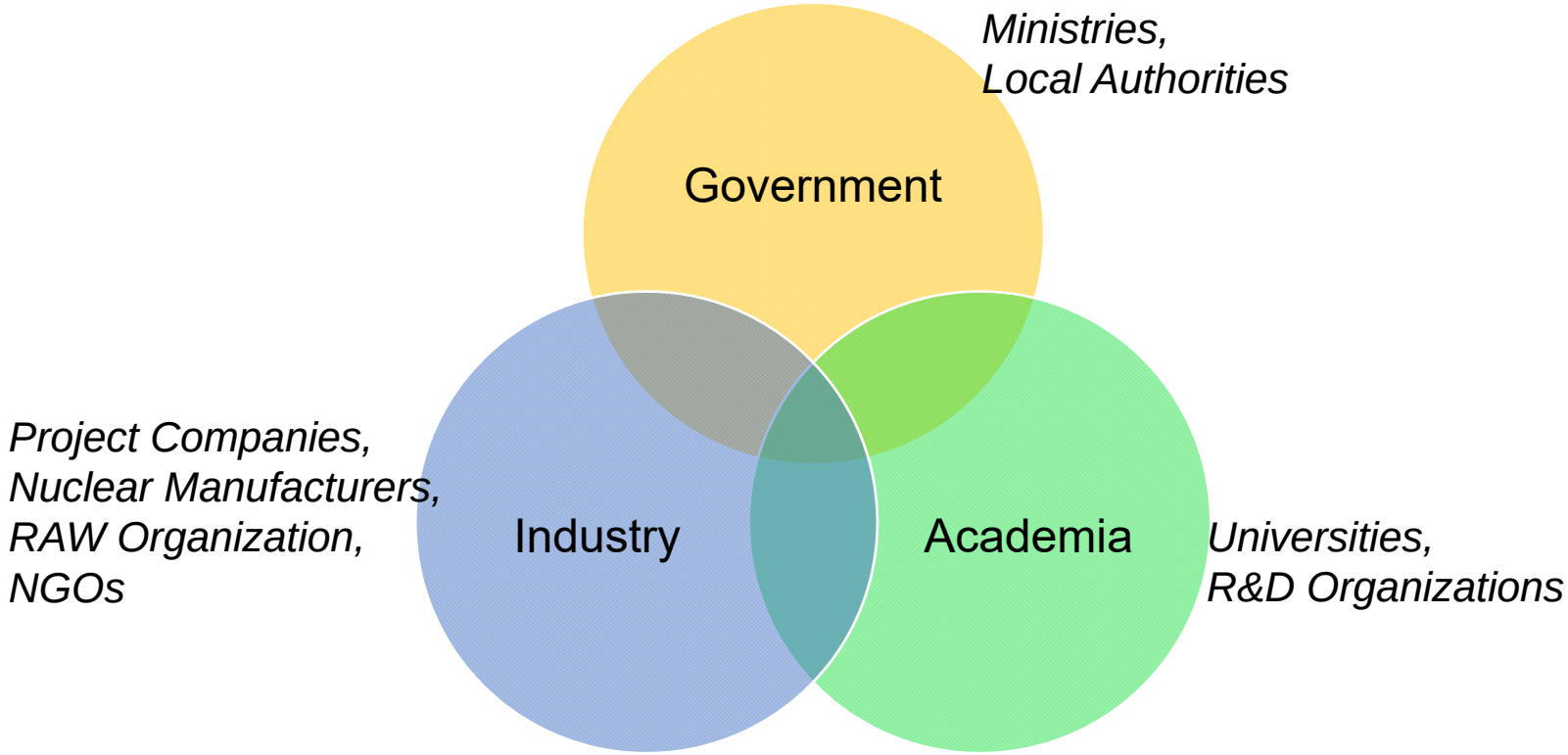
- Overview of existing national secondary and higher education programmes for nuclear industry and updating them if necessary
- Opening new nuclear engineering programs at undergraduate and graduate levels
- Training of trainers (especially for trainers of «middle-men»)
- Establishing a nuclear training center for training of “middle man” on safety culture & radiation protection
- Establishing an effective strategy for attracting good Turkish students to select study on nuclear field
- Establishing an effective reverse brain drain mechanism which attracting Turkish nuclear experts working abroad to work at nuclear industry to be established in Turkey

Part 4:

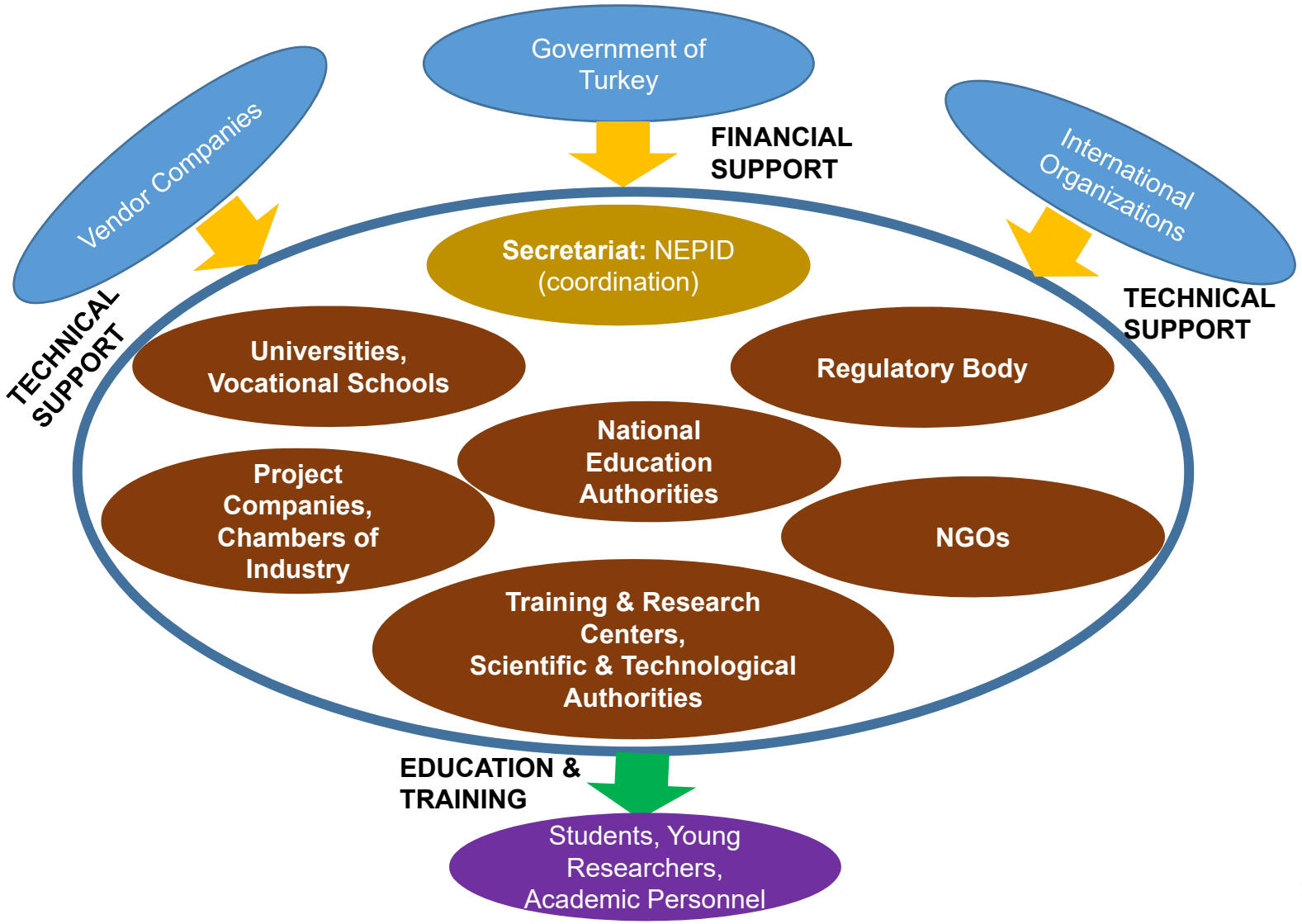
Possible Structure of National N-HRD Network for Turkey

National N-HRD Network

- The network will ensure «close cooperation among …» in the solution of problems regarding with N-HRD.
- **Purpose:** To develop nuclear workforce with a sustainable way



Possible Structure of N-HRKD Network



Possible Structure of N-HRKD Network

- Financial support may be get from:
  - ✓ Ministry of Development
  - ✓ Ministry of Science, Industry & Technology
  - ✓ Ministry of Economy

- Technical support (training including on-the-job training, establishment of a training center, etc.) may be get from:
  - ✓ Vendor companies
    - Rosatom, MHI, Areva, etc.
  - ✓ International organizations
    - IAEA, JICC, I2EN, CICE&T, etc.

Possible Structure of Steering Committee

- **Position in the Network:** It is the highest decision-making body of the network.
- **Role:**
  - Discussion and evaluation of network activities,
  - Planning working group and sub-working groups according level of activities and problems
- **Possible Chairman:** Deputy Undersecretary of Energy Ministry (MENR) – related with nuclear energy programme
- **Possible Secretariat:** NEPID

Members of Steering Committee

GOVT

- Ministry of Energy & Natural Resources (as policy maker on nuclear energy)
- Ministry of Science, Industry & Technology (as responsible on development of industry)
- Ministry of Economy (as responsible authority on investment incentives)
- Ministry of Development (as financial supporter to local companies)
- Ministry of National Education (as secondary education authority)
- Turkish Atomic Energy Authority (as regulatory body on nuclear safety & radiation protection)

INDUSTRY

- Project Companies
  - ✓ Akkuyu Nuclear JSC (as owner & operator of Akkuyu NPP)
  - ✓ Sinop Nuclear JSC (as owner & operatör of Sinop NPP)
  - ✓ 3rd Nuclear JSC (as owner and operatör of 3rd NPP)
- Chambers of Industry (in the name of local nuclear manufacturers)
- Radioactive Waste Management Organization (to be established for disposal of RAW)
- Turkish Electricity Generation Company (EUAS) including EUAS International ICC
- Radiation Protection Experts Society
- Nuclear Industry Association of Turkey
- Nuclear Engineers Society of Turkey

ACADEMIA

- Higher Education Council
- Universities
  - ✓ Hacettepe University (in Ankara), Istanbul Technical University (in Istanbul), Sinop University, Ankara University, Ege University, Turkish-Japanese Nuclear Science & Technology University (to be established)
- Turkish Scientific and Technological Council
  - ✓ Marmara Nuclear Reserach Center to be established in Istanbul
- Nuclear Education & Research Centers under TAEA
  - ✓ Cekmece Nuclear Education & Research Center (in Istanbul),
  - ✓ Saraykoy Nuclear Education & Research Center (in Ankara)

Possible Sub-Working Groups

- **SWG-1:** Development of nuclear education at secondary & higher education levels.
- **SWG-2:** HRD for manufacturing and construction of NPPs
- **SWG-3:** HRD for operation of nuclear power plants
- **SWG-4:** HRD for government
- **SWG-5:** HRD for academia
- **SWG-6:** Establishment and implementation of an attractive mechanisms for good Turkish students to study on nuclear energy, and Turkish and foreign nuclear experts working abroad to work at nuclear industry in Turkey.

Part 5:

Conclusions

Conclusions

- Turkey considers nuclear energy as inevitable for its electricity generation mixture.
- In addition, Turkey is aware that the development of manpower with a sustainable way is chief pillars of its nuclear power program.
- To achieve this, Turkey should establish an effective national network on N-HRD to coordinate activities and solve the problems effectively and efficiently.
- Therefore, Turkish Energy Ministry gives a great importance to next meeting to be held in Turkey since this meeting is considered as the first golden step for the establishment of the network.

Thank You Very Much For Your Kind Attention

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Challenges/Opportunities in N-HRD

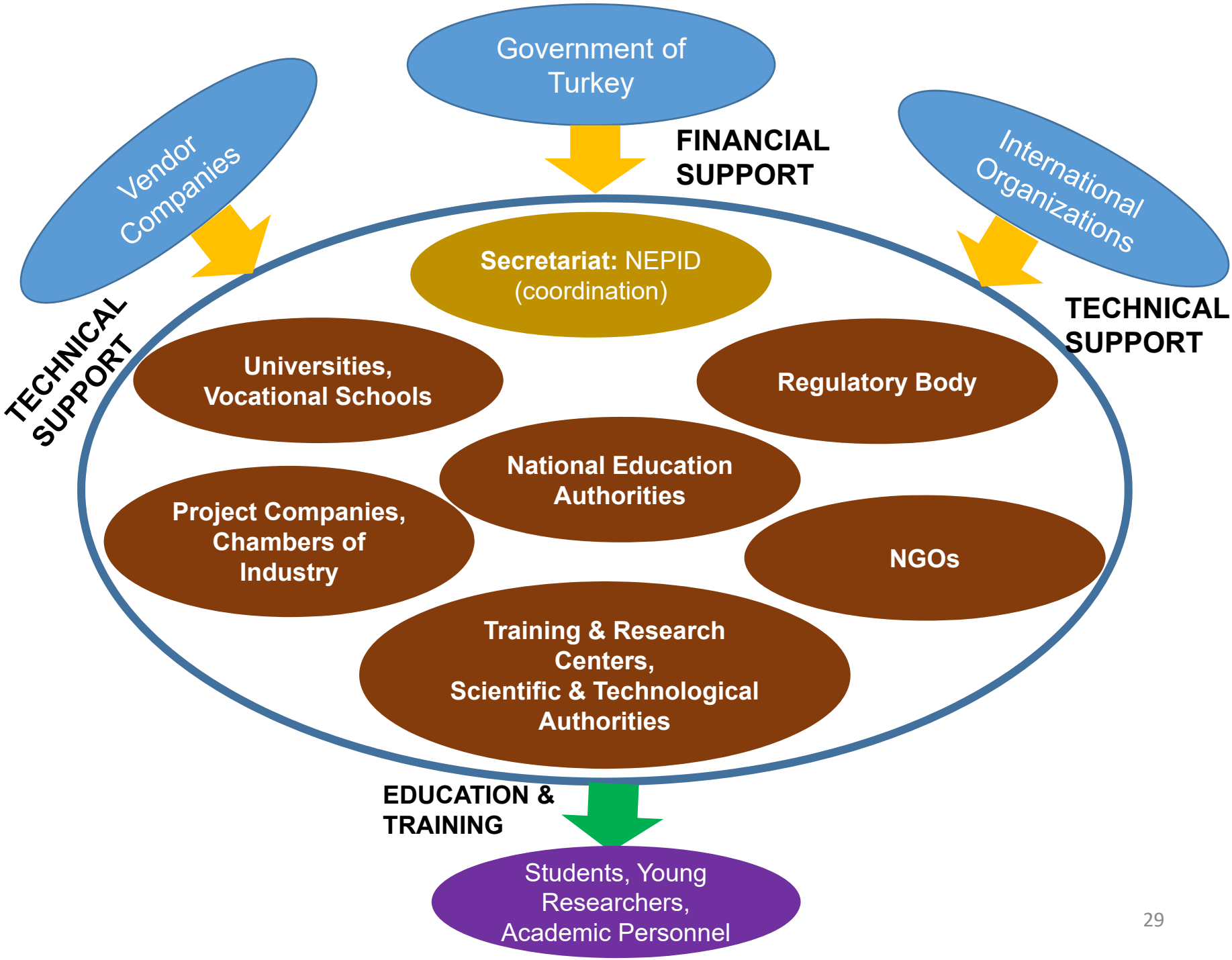
Challenges:

- Unsuccessful attempts for the installation of a nuclear power plant at the past caused
  - ✓ Many Turkish nuclear experts prefered to work abroad
- Lack of experience for construction and operation of a nuclear power plant cause
  - ✓ Lack of on-the-job training opportunity (no training center) in the country for «middle men» who work at manufactruring, construction and operation stages
  - ✓ Lack of nuclear safety culture incuding radiation awareness for Turkish people who work at relevent nuclear organizations
- At least two different operator, reactor design and operating language in Turkey's nuclear power plant projects may cause
  - ✓ Non-common education & training language
  - ✓ Non-common education program and certification for a specific job position

Challenges/Opportunities in N-HRD

Opportunities:

- Having nuclear engineering education at undergraduate and graduate levels and operating nuclear research & training reactors since 1970s
- Having a strong government support for nuclear energy in Turkey (also opposition parties support nuclear energy)
- Having potential to employ a significant amount of Turkish nuclear experts if the effective policy is applied for reverse brain drain
    - ✓ Germany which plans to phase out nuclear energy by 2022 is the first potential country for Turkey on this issue because most Turkish people live there outside of Turkey, approximately 6 millions.
    - ✓ USA is the second potential country for Turkey on this issue because almost 20% of alumni from nuclear engineering department in Turkey is working there (in universities, designers, operators etc.)


Government of Turkey
FINANCIAL SUPPORT
Vendor Companies
International Organizations
TECHNICAL SUPPORT
TECHNICAL SUPPORT
Secretariat: NEPID (coordination)
Universities, Vocational Schools
Regulatory Body
National Education Authorities
Project Companies, Chambers of Industry
NGOs
Training & Research Centers, Scientific & Technological Authorities
EDUCATION & TRAINING
Students, Young Researchers, Academic Personnel

SWG-1: Development of Nuclear Education at Secondary & Higher Education Levels

- New undergraduate on nuclear engineering to be opened at universities.
- New graduate programs on specific issues in the field of nuclear engineering to be opened for non-nuclear engineers at universities.
- 2 or 3 years higher technician programs for construction, operation and maintanance stages of NPPs to be opened at universities. For instance;
  - ✓ Radiation protection technician
  - ✓ Radiochemical technician
  - ✓ Nuclear instrumentation & control technician
- New apprenticeship education programs specific to nuclear industry to be opened if it is necessary.

SWG-2: HRD for Manufacturing and Construction of NPPs

- Determination of training needs for personnel of potential local suppliers.
- Ensuring cooperation with foreign nuclear manufacturers on the job training abroad for Turkish workers (consists of engineers & technicians) in order to teach advanced manufacturing methods in the nuclear field (training of trainers) to them.
- Establishment of nuclear training centers for Turkish technicians and engineers who will work at manufacturing and construction stages of the NPP projects.
- Development of nuclear training programs & tools and also certification for nuclear training centers.

SWG-3: HRD for Operation of Nuclear Power Plants

- Project companies to established nuclear training centers including full-scope control room simulator near plant sites for training of operating staff.
- An accreditation agency to be assigned or established to accredite nuclear education programs to be given at these training centers.

SWG-4: HRD for Government

- Ensuring cooperation with foreign regulatory bodies and international agencies for training of Turkish engineers and managers working at regulatory body, NEPIO, and other government organizations.
- A refundable scholarship program to be developed and implemented for nuclear education abroad at graduate level. (Students have to work at government organizations after graduation over a significant time)

SWG-5: HRD for Academia

- Ensuring cooperation with foreign universities and research centers for project based post-doctorate education of Turkish academic personnel.
- Ensuring exchange lecturer program between Turkish and foreign universities which are from USA, France, England, Japan, China, Russia, South Korea and Canada.

SWG-6: Establishment and Implementation of an Attractive Mechanisms…

- Establishment and implementation of an attractive mechanisms for good Turkish students to study on nuclear energy. (Such as giving scholarship to students who choose to study at nuclear engineering.)
- Establishment and implementation of an attractive mechanisms for Turkish and foreign nuclear experts working abroad to work at nuclear industry in Turkey. (Such as giving non-refundable scholarship to them until they find a job in nuclear industry in Turkey.)
- A nuclear science museum may be opened in Turkey for elementary school students.
- Nuclear energy management courses which giving brief information on all issues related with nuclear energy may be added to some engineering curriculums.