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Nuclear Human Resources Development Studies in Turkey

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Outline

- Introduction
  - Current Situation of Nuclear Power Plant Projects in Turkey
  - Higher Education System in Turkey
  - Human Resources Development
- HRD Studies in Turkey
- Nuclear Power Human Resources (NPHR) Model and Model Prepared for Turkish Nuclear Power Plant Projects
- Possible Colloboration with JN-HRD Network
  - Turkish Japanese University

Introduction

- Building nuclear power plants in Turkey became an attractive alternative to obtain a new source to produce electricity:
  - increase in energy demand
  - lack of natural resources (such as high quality coal, natural gas and petroleum)
  - increasing public resistance to hydroelectric power plants

Introduction

- Turkey's Nuclear Power Plant (NPP) Projects:
  - Akkuyu Project
    - In 2010 an agreement between the Turkish Republic and Russian Federation was signed
    - Includes 4 VVER-1200 reactors
    - It is the first Build-Own-Operate project for building and operation of a nuclear power plant in the world
      - the site for the plant was licensed in year 1979, however, the new data and new analysis were required for the site due to new issues raised on after Chernobyl and Fukushima-Daiichi accidents.

Introduction

– Sinop Project
  - In year 2013, another deal to build Turkey’s second nuclear power plant in Sinop region, an agreement was signed.
  - New Project includes 4 units of ATMEA-1 reactors in the Sinop region.
  - In this project a consortium of Japan, French, Belgian and Turkish companies was established.

Introduction

- Higher Education System in Turkey
  - There are more than 180 universities in Turkey (-state and private universities)
  - All higher education organizations operate under Turkish Higher Education Council
    - ~30 students per faculty member
  - Almost all universities have Faculty of Engineering
  - There are 20 Technology Faculties

Introduction

- Higher Education System in Turkey-Colleges
  - The colleges offering 4 years of education accept students according to results of a national exam
  - Exam has 5 sessions: math and geometry, science, Turkish and literature, history and geography, foreign language
  - The students are placed to departments they pick (can pick 24) according to their exam grades and quota determined for the departments

Introduction

- Higher Education System in Turkey-Vocational Schools
  - The vocational high school graduates are given priority to enroll to higher vocational schools with or without taking the national exam
  - There is not any vocational school giving education on nuclear technology or nuclear applications

Introduction

- Human Resources Development (HRD)
  - Listed as part of the 19 infrastructure issues addressed by International Atomic Energy Agency (IAEA) for the newcomer countries
  - Becomes a challenging issue to deal with:
    - The two nuclear power plant projects are conducted almost concurrently in some stages of the projects and consecutively in a short time period for many stages

HRD Studies in Turkey

- IAEA Workshop following INIR studies
- NPHR Model Applications
- Localization Workshop
- IAEA Expert Mission to Turkey
- Strategy Report

HRD Studies in Turkey

- What has been done so far for Ministry of Energy and Natural Resources
  - Strategy Study
    - Work areas, work functions
    - Share holders of HRD planning, needs and gaps analysis
    - R&D-Academmia
    - Project Company, Operator
    - Power plant construction, commissioning
    - Industry
    - Training the trainers
    - NEPIO
    - Regulatory body, TSOs

HRD Studies in Turkey

- Strategy Study
  - Current situation in Education
  - International experience, certifications, trainings
  - Training centers that can be established in our country
  - Attracting good students to nuclear field

Introduction

- HRD planning is complicated:
  - two nuclear power plant projects with two different approaches with two different technological backgrounds
    - The supply chain management for the two projects will be different
    - Licensing and therefore making HRD plans for licensing authority is not a simple one due to two different technologies involved.
      - The need of the regulatory body to a technical support organization adds another dimension to HRD planning.

Introduction

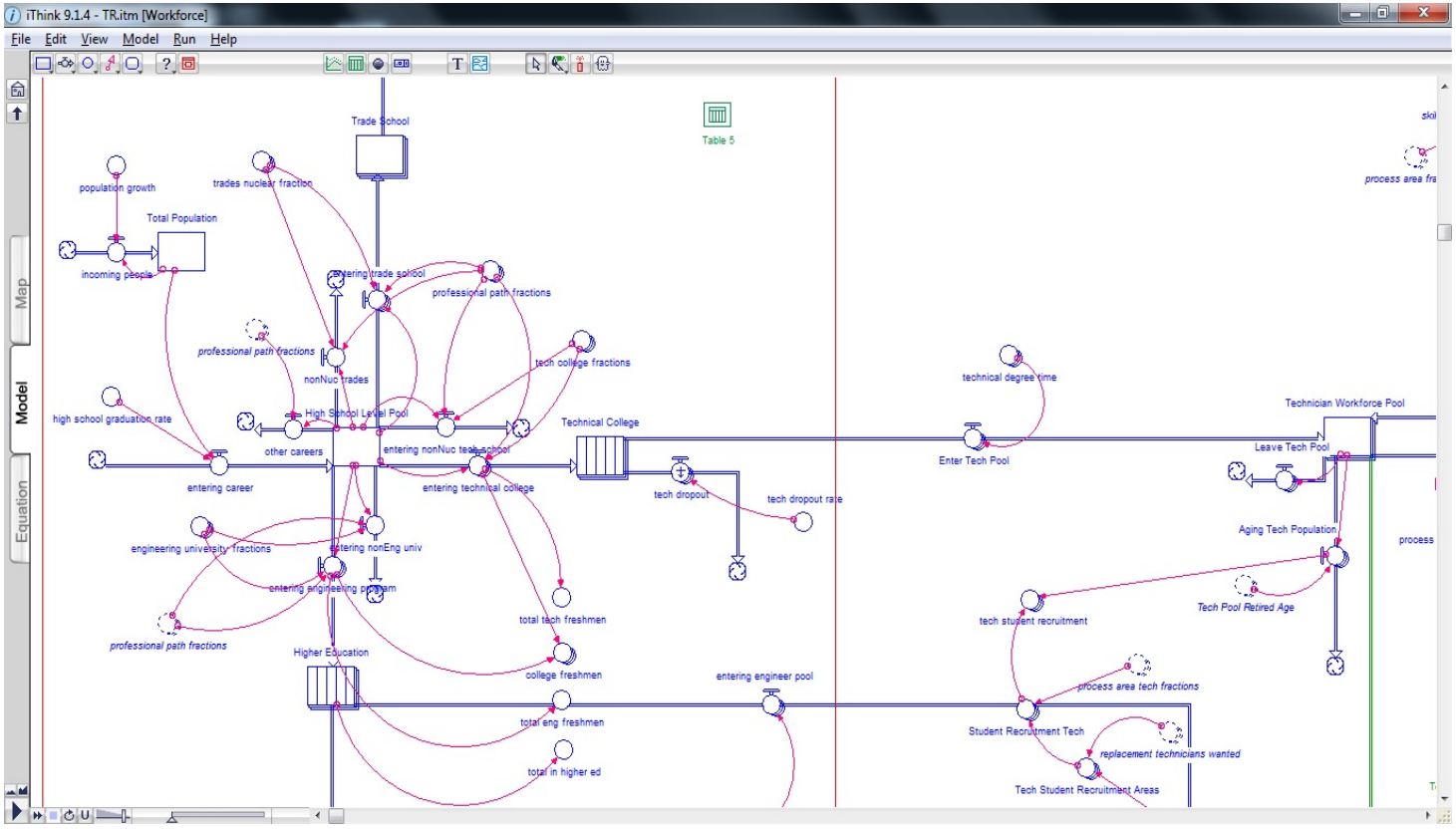
- More issues in HRD
  - Time periods required for education, training and competence building,
  - determining the needs for outsourcing,
  - involving Turkish citizens getting education and training abroad (such as about 600 Turkish citizens supported by the Akkuyu Project Company),
  - finding out the number of young people that can be involved in the projects (to find the gap between the needs and supply),
  - calculating the retirements or drop outs

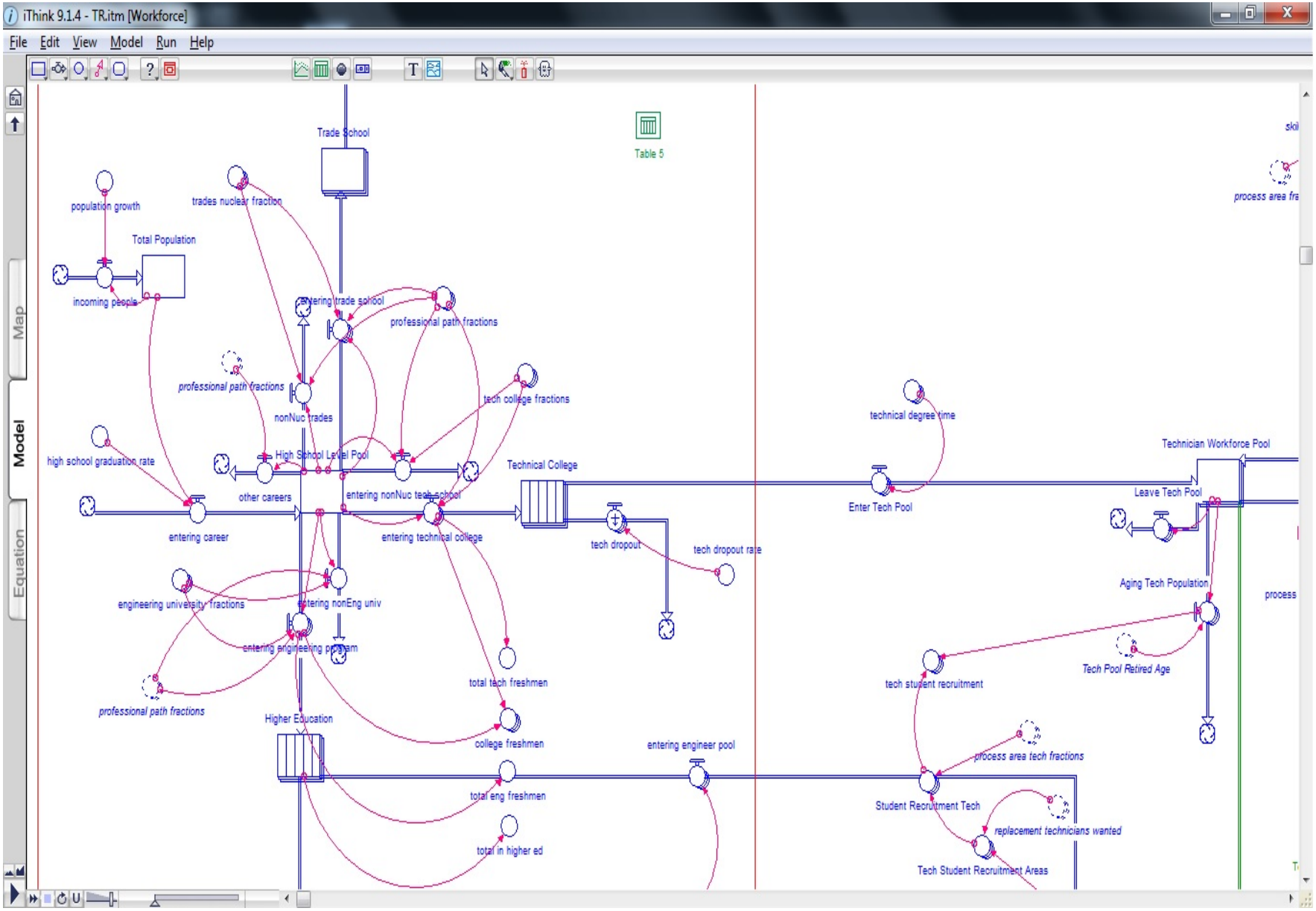
Nuclear Power Human Resources (NPHR) Model

- NPHR Model
  - Can be used to calculate the needs and supply of workforce for nuclear projects for different time periods involving different organizations and different project models
  - Developed by Los Alamos National Laboratory in USA by using iThink tool
  - Opened to International Atomic Energy Agency (IAEA)
  - Given to Turkey (to the Nuclear Energy Project Implementation Department of Ministry of Energy and Natural Resources) by IAEA

NPHR Model

– Flow of manpower similar to the flow between pools which are connected to each other by pipes and valves




iThink 9.1.4 - TR.itm [Workforce]
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Map
Model
Equation
Trade School
Table 5
population growth
trades nuclear fraction
Total Population
incoming people
entering trade school
professional path fractions
professional path fractions
nonNuc trades
tech college fractions
high school graduation rate
High School Level Pool
other careers
Technical College
entering nonNuc tech school
entering career
entering technical college
tech dropout
tech dropout rate
technical degree time
Enter Tech Pool
Technician Workforce Pool
Leave Tech Pool
Aging Tech Population
Tech Pool Retired Age
engineering university fractions
entering nonEng univ
entering engineering program
professional path fractions
total tech freshmen
Higher Education
college freshmen
entering engineer pool
tech student recruitment
process area tech fractions
Student Recruitment Tech
replacement technicians wanted
Tech Student Recruitment Areas
total eng freshmen
total in higher ed

NPHR Model

- The model requires data for both nuclear projects and workforce.
  - The input data required for the model are the
    - Details for power plant projects (the number of reactor units, duration of construction etc.),
    - Demographic data,
    - Education and training data,
    - The data on the construction and operation of the plant, regulations and outsourced workforce.

Model Prepared for Turkish NPP Projects

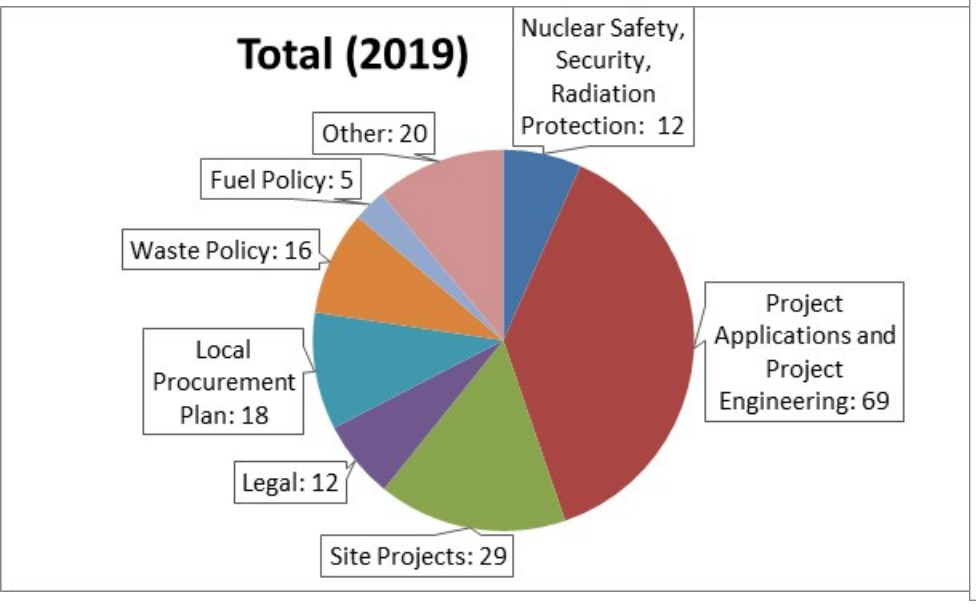
- Assumptions
  - For technical jobs, percentage of engineers is assumed higher than technicians
  - For job functions, requiring highly experienced personnel, outsourcing was assumed
  - Number of personnel working at NPP operation was assumed 850, peak number of workers was assumed 2200 for the construction
  - TSO was modeled similar to US NRC
  - The training and military service periods were taken into account
  - The retirement age for the workers was determined by taking Turkish law into account
  - The drop out rate for the personnel was assumed similar to the rate for thermal plant personnel
  - The work areas and work functions were defined by using the sample model for NPHR model for plant operations and construction

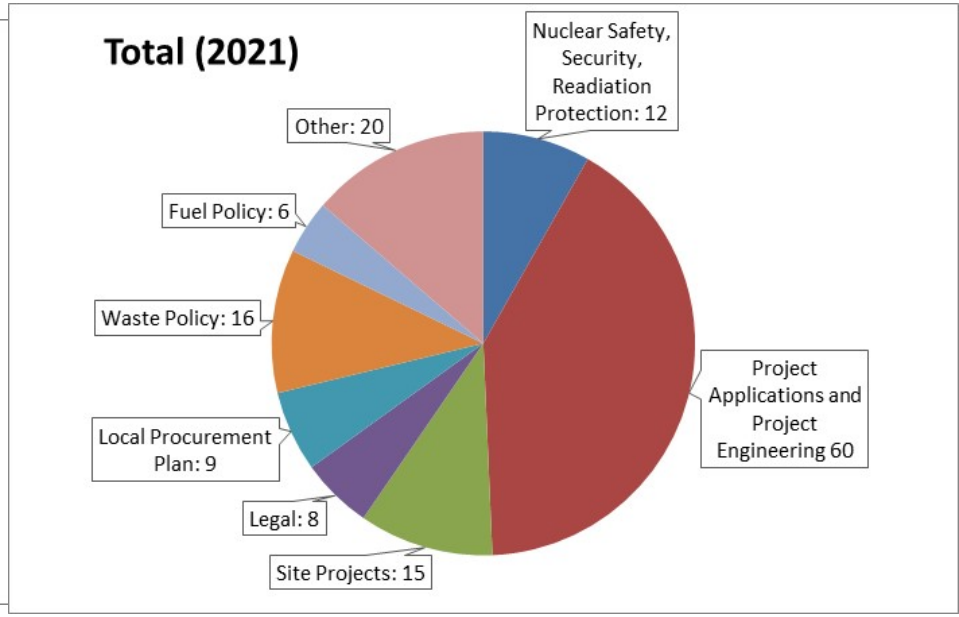
Model Prepared for Turkish NPP Projects

Plant	Unit	Preparation for Construction - Start	Preparation for Construction – End	Start of Construction	End of Construction	Commissioning
Akkuyu	Unit 1	2014	2015	2015 (last quarter)	2020	2021
	Unit 2	2015	2016	2016 (last quarter)	2021	2022
	Unit 3	2016	2017	2017 (last quarter)	2022	2023
	Unit 4	2017	2018	2018 (last quarter)	2023	2024
Sinop	Unit 1	2016	2018	2018	2023	2024
	Unit 2	2017	2019	2019	2024	2025
	Unit 3	2020	2022	2022	2027	2028
	Unit 4	2021	2023	2023	2028	2029
Plant 3	Unit 1	2020	2022	2022	2027	2028
	Unit 2	2021	2023	2023	2028	2029
	Unit 3	2024	2026	2026	2031	2032
	Unit 4	2025	2027	2027	2032	2033

Model Prepared for Turkish NPP Projects

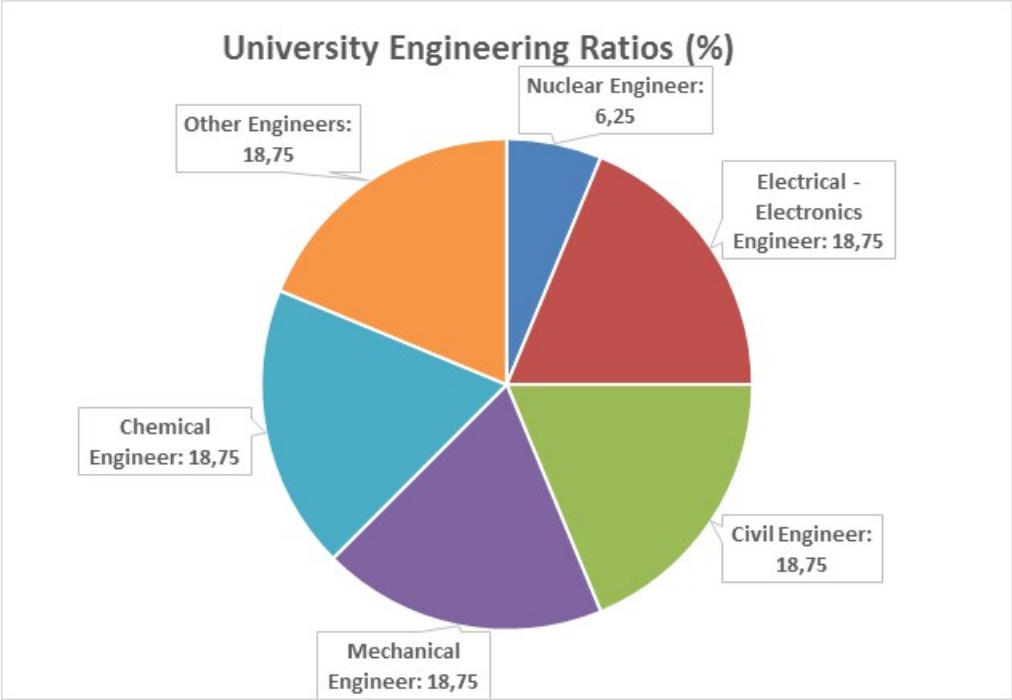
- Sample Results - NEPIO
  - The NEPIO of Turkey is rather a special organization which is different than the ones in other newcomer countries. Therefore it required special attention to model.





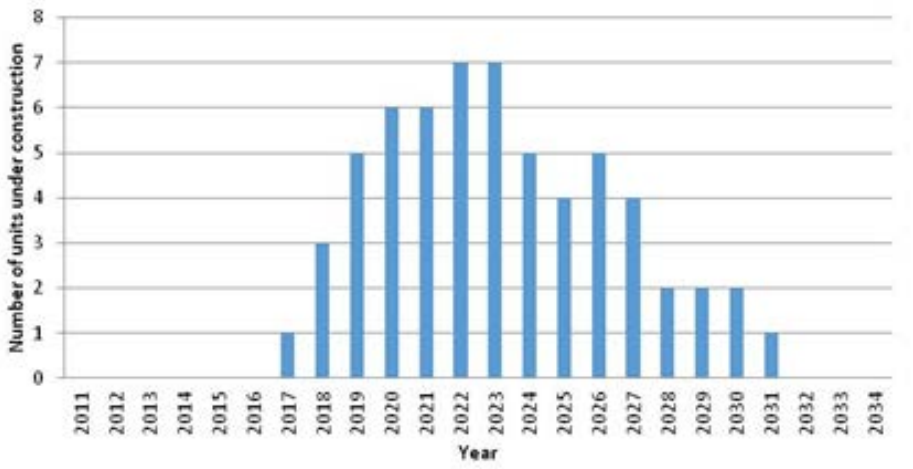
Model Prepared for Turkish NPP Projects

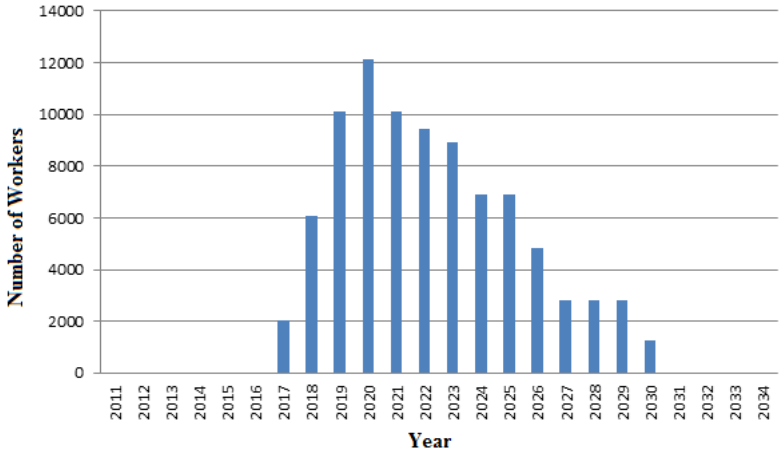
- Sample Results – Academia
  - It has been envisaged that 304 doctorate holding engineers will be employed at the universities



Model Prepared for Turkish NPP Projects

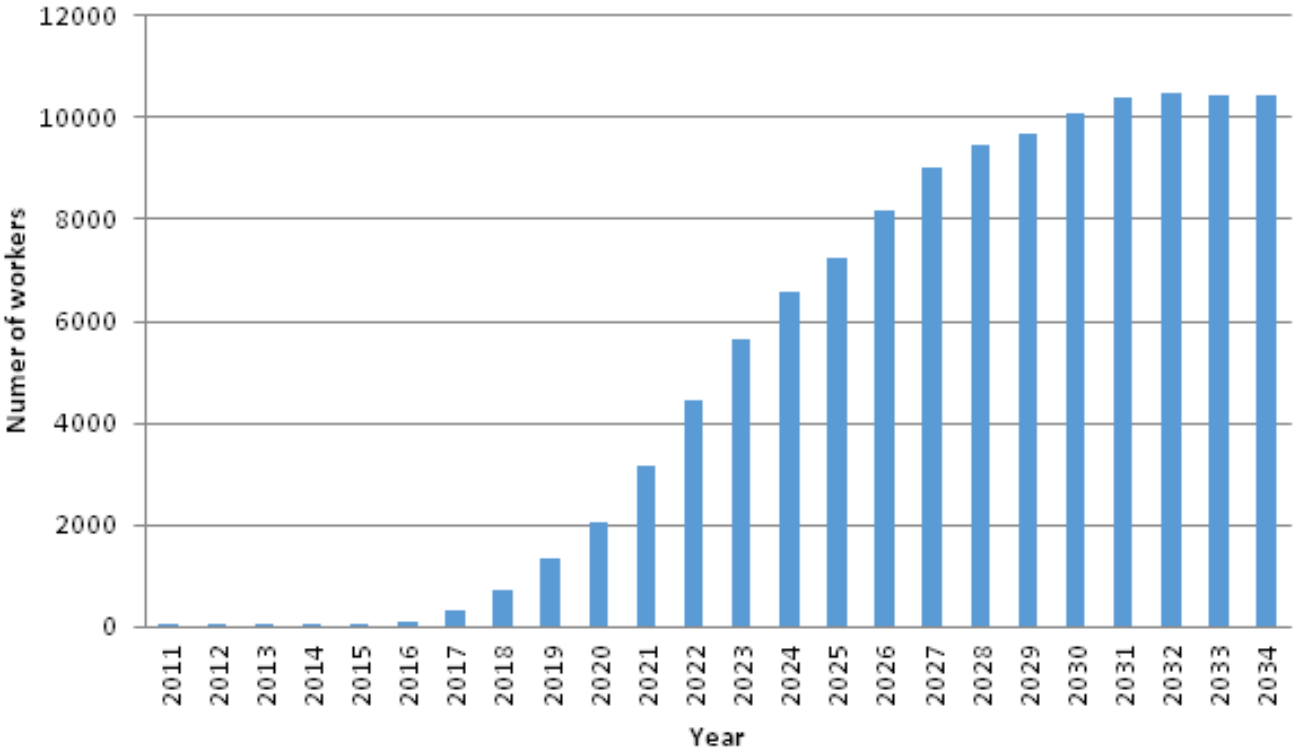
- NPHR Model- Sample Results- Construction





Model Prepared for Turkish NPP Projects

- NPHR Model- Sample Results-Operations



Possible Colloboration with JN-HRD Network

- In Turkey, all entities are open to collaboration
  - Expert support is needed in all areas

Possible Colloboration with JN-HRD Network

- Plans for Japanese Turkish University
  - Asia Seed and Higher Education Council of Turkey

Atsuko Toyama (President, Toyota Foundation; Former Minister of Education, Culture, Sports, Science and Technology), Kiyoshi Araki (Ambassador, Special Assistant to the Minister for Foreign Affairs), Shinji Yamada (Chief of Cultural and Press Section) and Sawako Kanai (Dr.; Advisor to Ambassador on Cultural and Press Affairs, Embassy of Japan)

Possible Colloboration with JN-HRD Network

In strategy study collaboration with JAEA was suggested in:

- For training of the trainers
- For regulatory body
- For R&D