

# ISTANBUL TECHNICAL UNIVERSITY

## Energy Institute

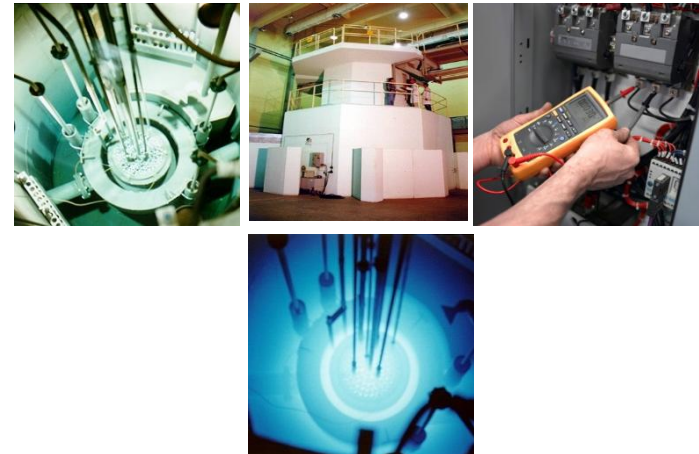
[www.energy.itu.edu.tr](http://www.energy.itu.edu.tr)

## Development of Educational Programs for Turkish Nuclear Industry

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- Current status of NPPs in Turkey
- History of nuclear engineering education in Turkey
- Challenges for nuclear engineering education in Turkey
- Plans to increase educated and skilled personnel for Turkish nuclear industry

- **Current status of NPPs in Turkey**

- Akkuyu Site

- Russian Federation

- 4 units VVER-1200

- BOO –built, own, operate- model

- Expected grid connection in 2023, 2024, 2025 and 2026

- Sinop Site

- France & Japan consortium

- 4 units ATMEA-I

- 30-40 % belongs to Turkey

- Details not known yet

- Third site ?

- Turkey plans to design and build it by itself !

- **History of nuclear engineering education in Turkey**

- 1956, Signature of Atom for Peace
- 1961, Istanbul Technical University (ITU) Institute of Nuclear Energy, Istanbul
- 1966, Ege University (EU) Radioisotope Research Center, Izmir
- 1977, Hacettepe University (HU) Institute of Nuclear Engineering, Ankara
- 1982, HU Department of Nuclear Engineering, Ankara
- 1983, Transformation to EU Institute of Nuclear Science, Izmir
- 2002, Transformation to ITU Energy Institute, Istanbul
- 2006, Ankara University (AU) Institute of Nuclear Science, Ankara
- Sinop University and Akdeniz University plan to establish nuclear engineering department
- Turkey and Japan signed an agreement to establish Turkish-Japanese University in Turkey
- ITU Energy Institute is planning an international program on nuclear technology

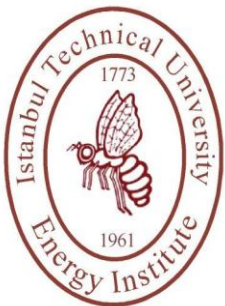
- **Hacettepe University Department of Nuclear Engineering**
  - The first and only department in Turkey which offers an undergraduate degree in the field of Nuclear Engineering.
  - Higher education on Nuclear Sciences and Nuclear Technology.
  - Approximately 400 graduates
    - working in Turkey and abroad
    - seeking higher education in Turkey and abroad.



- **Education**

- All the courses are in English.
- First two years
  - mathematics, computer programming, classical, modern and nuclear physics, electronics, thermodynamics, and materials science.
- Third year
  - numerical analysis, heat transfer and fluid mechanics, introductory courses in nuclear engineering
- Fourth year
  - detailed analysis of reactor systems, nuclear fuel cycle, nuclear materials, nuclear reactor analysis, control and design
- Research projects by use of computer codes
- Experimental studies
  - in radiation detection and measurement laboratory
  - thermal-fluid laboratory
- International level highly theoretical education

- **Istanbul Technical University Energy Institute**
  - The first institute in Turkey in the field of Nuclear Technology.
  - It is an advanced research and education center on different aspects of energy.
  - Approximately 300 graduates
    - working in Turkey and abroad



### ➤ **Education**

➤ Courses are in Turkish and English.

➤ 2 graduate programs (MSc. & PhD)

➤ Energy science and technology

➤ Radiation science and technology

### ➤ **Laboratories**

➤ Energy Storage Technologies Test & Research

➤ İnci Akü Battery

➤ Ericom Flow Battery

➤ Ground Source Heat Pump Test & Research

➤ Energy Efficiency and Illumination Techniques Laboratory

➤ Cryogenic Energy Storage

➤ Thermal Test

➤ New Energy Technologies

➤ Renewable Energy Data Analysis and Signal Processing

➤ Material Characterization and Production

➤ Energy Efficiency and Lighting Techniques

➤ Computational Nano Energy Research

➤ Triga Mark-II Training and Research Reactor

➤ Gamma Spectroscopy

➤ Low Level Radiation Measurement

➤ Industrial Radiography



- It has Turkey's First Thematic Technopolis: **ENERGY TECHNOPOLIS**

Number of expected R&D Companies: 35-40



- **Collaboration Models with Energy Institute**
  - Industrially **S**upported **R**esearch **P**rojects (**ISRP**)
  - Industrially **S**upported **R**esearch **A**ssistants (**ISRA**)
  - Industrially **S**upported **E**ducation **A**ctivities (**ISEA**)

- **Ege University Institute of Nuclear Science**

- Post graduate education on
  - nuclear science, technology, and applications
- Nuclear techniques on
  - earthquake researches
  - sea and lake sedimentation velocity determination
  - earth erosion
  - radioecology
  - dosimetry
- Studies on
  - uranium and thorium mining and characterization
- Nuclear spectroscopy
- Radiation detection

- **Ankara University Institute of Nuclear Science**

- Post graduate education on
  - Health physics (MSc.)
  - Medical Physics (PhD)
- Studies on
  - radiation physics
  - radiation protection
  - radiation detection
  - medical applications of radiation
- Services for
  - routine quality control and acceptance tests of imaging modalities
- Radiation measurements of
  - all kinds of food and environmental samples

- **Challenges for nuclear engineering education in Turkey**
  - Nuclear Engineering education is highly theoretical in Turkey.
  - There isn't any nuclear industry in Turkey.
  - Absence of real world applications cause tackling generally with pure theoretical problems in research studies.
  - Limited facilities for practical training in terms of nuclear engineering
    - Turkish Atomic Energy Authority Cekmece Nuclear Research and Training Center (5 MW pool type reactor)
    - ITU Energy Institute Triga Mark II reactor (250 kW steady-state, pulse 1200MW for 20 ms)
  - Applications are limited to radiation detection.
  - Limited international student exchange opportunities.
  - Lack of employment opportunities in Turkey in the field of nuclear technology.

- How ROSATOM be instrumental
  - With providing practical training opportunities in Russian Universities or Russian Industrial facilities
  - With facilitating government funding opportunities for Russian Institutions to collaborate with Turkish counterparts (academic exchange and joint research activities)
  - With organizing scientific and technical meetings to gather students and academics from both countries

- **Plans to increase educated and skilled personnel for Turkish nuclear industry**
- ITU Energy Institute's international program aims to have graduates that
  - know the nuclear industry well – not nuclear engineers
  - can work in NPPs or local suppliers
  - can perform design and analysis
- How to achieve this
  - Joint scientific or R&D projects and thesis with international institutions
  - Invitation of 2 or more foreign lecturers to ITU per semester (financed by ITU)
  - Establishment of nuclear technology R&D center
  - Focusing on skills development (welding, NDT, radiation protection, nuclear safety etc.)
- ITU is in contact with
  - MEPHI, Moscow State University, Moscow Power Engineering Institute and Tomsk University
  - Tokyo University and Kyoto University
  - CEA France

- Joint conference with Russian Universities MEPhI, Moscow State University, Moscow Power Engineering Institute and Tomsk University in December 2013
- memorandum of understanding will be signed between ITU and MEPhI for collaboration in nuclear field (joint projects, joint thesis, student and faculty exchange)
- Expected to be signed in July 2014

**Thank you for your attention....**