Iran Basic Geographical & Population Data

- Iran has an area of 1.65 million km$^2$.
- Iran has a population of about 80 million, with an average population density of 48 persons per km$^2$.
- The population has increased from 39 million to 80 million between 1980 and 2017.
Iran Energy Consumption Facts

- Iran has consumed more than 270 million tons oil equivalent of primary energy in 2016.
- Natural gas and oil accounted for almost all (98%) of Iran’s total primary energy consumption, with marginal contributions from hydropower, coal, nuclear, and non-hydro power renewables.
- Iran’s primary energy consumption has grown rapidly over the past decade.
- Between 2006 and 2016, Iran’s primary energy consumption expanded by about 40%.
Important Points about Energy Issue in Iran

- Energy is the most important factor in socio-economic development.
- Electricity will be dominant in increasing energy demand.
- Role of electricity in development of industrial infrastructures, in economic development and in improving life styles and standards is considerable.
- Global approach has led policymakers to assess the different sources of energies which are safe and sustainable.
- Mixed energy or using combination of different power production methods is a suitable option, in order not to depend on one resource.
Exploitable Energy Resources in Iran

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Eq. Barrel of Oil ($\times 10^9$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>158</td>
</tr>
<tr>
<td>Gas</td>
<td>204</td>
</tr>
<tr>
<td>Coal</td>
<td>6</td>
</tr>
</tbody>
</table>
Exploitable Energy Resources Share in Iran

- Gas: 55%
- Oil: 43%
- Coal: 2%
Trend of Power Plants Nominal Capacity, by Power Plant Types (MW)
Power Plants Nominal Capacity Share (2015)

- Fossil: 83.08%
- Hydro: 15.30%
- Nuclear: 1.37%
- Solar: 0.01%
- Wind: 0.21%
- Biogas: 0.02%
Trend of Power Plants Operational Capacity, by Power Plant Types (MW)
Power Plants Operational Capacity Share (2015)

- **Fossil**: 80.76%
- **Hydro**: 17.55%
- **Nuclear**: 1.41%
- **Wind**: 0.24%
- **Solar**: 0.01%
- **Biogas**: 0.02%
Electricity Generation From Various Sources (GWh)
Electric Generation From Various Sources Share (2015)

- Fossil: 93.8566%
- Hydro: 5.0209%
- Nuclear: 1.0383%
- Wind: 0.1%
- Solar: 0.0003%
- Biogas: 0.0051%
By 2021, nominal capacity will increase to **100000 MW**

By 2030, nominal capacity will increase to **120000 MW**
Specific User’s Technical Requirement of Iran on SMR Design and Technology

April, 2018 – IAEA, TWG-SMR
Introduction

• Iran is a wide country with numerous localized necessities to utilize energy for various purposes. The population has been dispersedly distributed in different parts of the country.

• Notwithstanding rich amounts of oil and gas resources, Iran has been aiming for diversifying its utilizable energy resources and has endeavored to benefit from other and alternate types of resources especially nuclear and renewable energies, besides fossil fuels.

• In this regard, among the various non-fossil utilizable energy resources, the nuclear energy has special role.
SMRs Attractiveness and Intended Application Purpose in Iran

**Attractiveness**

- Multiple applications
- Suitability for electricity generation in small and limited areas
- Suitability for domestic participation in manufacturing and construction
- Shorter site construction period and easier project management
- Lower capital requirement per reactor unit, hence the expectation of easier financing
- Simplicity of power scale up along with demand increase

**Purpose**

- Nuclear power plants know-how development and promotion of domestic industrial capabilities
- Production of desalinated water in different south coastal areas
- Electrical power generation, in particular for high aridity or remote and difficult to access parts of the country
- Restricted agricultural applications
- Short time project implementation
- Easier Project Financing
Desired Features of Small Modular Reactors in Iran

- Lower production of radioactive waste, for easier waste management program
- Smaller decay thermal power versus large NPPs
- More effective decay heat removal compared with large NPPs
- Improved protection against exterior accident and reduced radioactive material release
- Allowable time interval for operator free post accident actions
- Passive severe accident prevention and mitigation action
Desired Technical Specification for SMRs in Iran

- Reactor type: LWR-PWR
- Fuel material: UO$_2$
- Fuel Enrichment: <4%
- Plant design life: >60 years
- CDF & LRF: as low as possible
- Earthquake acceleration Design Basis: 0.35-0.40 g
- ...

Specific User’s Technical Requirements of Iran on SMR ...
Licensing Requirements of SMRs in Iran

Iran is applying primarily its own national rules and regulations.

The highest Act in the nuclear field is the “Act of Atomic Energy Organization of Iran (1974)” and according to this Act, the regulatory functions were delegated to Iran Nuclear Regulatory Authority (INRA) by Iran Atomic Energy Council in 1999.

- INRA is the legal authority for granting the licenses and to regulate the siting, design, construction, commissioning and operation of Nuclear Facilities.
- The licensee should submit the application for licensing to the INRA according to the regulations for licensing of specific nuclear facility (for example NPP, Research Reactor, SMR…).

At present, this procedure for SMRs has not been provided yet.
Licensing Requirements of SMRs in Iran

- The application should be supported by documents such as Safety Analysis Report (SAR), Environmental Report (ER) and other related licensing documents.
- This procedure is meant to ensure the health and safety of the general public, nuclear workers and the environment against possible adverse effects.
Hierarchy of Codes, Standards and Regulation for SMRs in Iran

- At the top level, the “Act of Atomic Energy Organization of Iran (AEOI) is governing.

- At the next level, the design and construction of SMRs shall be in accordance with the INRA's regulations, guides and procedures or INRA’s adopted ones.

- When INRA documents are silent, the operating organization shall comply with the appropriate and latest versions of standards and guidelines of IAEA’s document.

- And if IAEA’s documents are silent, the Operating Organization shall comply with the appropriate regulations and guidelines of the internationally accepted ones.
Hierarchy of Codes, Standards and Regulation for NPPs in Iran

- Act of AEOI
- INRA Regulations
- Standards of IAEA
- Internationally accepted codes and regulations such as ASME, IEEE, ISO, IEC, ASHRAE, ...
Thank you