NRI IRAN

Niroo Research Institute

Introduction to Tehran

- With a population of around 9.2 million in the city and 15 million in the larger metropolitan area of Greater Tehran, Tehran is the most populous city in Iran and Western Asia and has the second-largest metropolitan area in the Middle East.
- Tehran has an international airport (Imam Khomeini Airport), a domestic airport (Mehrabad Airport), a central railway station, the rapid transit system of Tehran Metro, a bus rapid transit system, trolleybuses, and a large network of highways.
- According to the Global Destinations Cities Index in 2016, Tehran is among the top ten fastest growing destinations



Introduction to Niroo Research Institute (NRI)

- NRI is Main research organization in Electric Power industry of Iran
- NRI is affiliated to the Ministry of Energy (MOE) of I.R. of Iran
- NRI started its activities in 1997
- NRI has played a leading role in developing new technologies and enhancing knowledge for Electric Power Industry of Iran
- NRI is performing the dual task of meeting the present and future demands of electric power industry, while making a better use of available resources, preserving the environmental and achieve its objectives

Missions

- Research Management in Electric Power Industry
- Performing Cutting Edge Researches in Electric Power Industry
- Implementation of Strategic, Macro, Long term & High risk Studies in Electric Power Industry
- Commercialization of Research Results
- Acquiring New Technologies in Electric Power Industry
- Preparation Standards, Providing Lab Services, Quality Assessment of Equipment/products used in Electric Power Industry

NRI Goals

- To solve the country's problems and restrictions in the fields related to the Ministry of Energy duties
- To cooperate with universities, research institutes and administrative organizations in research fields
- To develop the knowledge and technology related to the existing expertise in Ministry of Energy
- To transmit other countries experiences in the field of technology and achieving technical knowledge with the aim of self-sufficiency in relation to the Ministry of Energy's duties and necessities
- To publish different scientific books and research results and utilize the communication technology by establishing wide computer network to achieve the latest technical information in the world

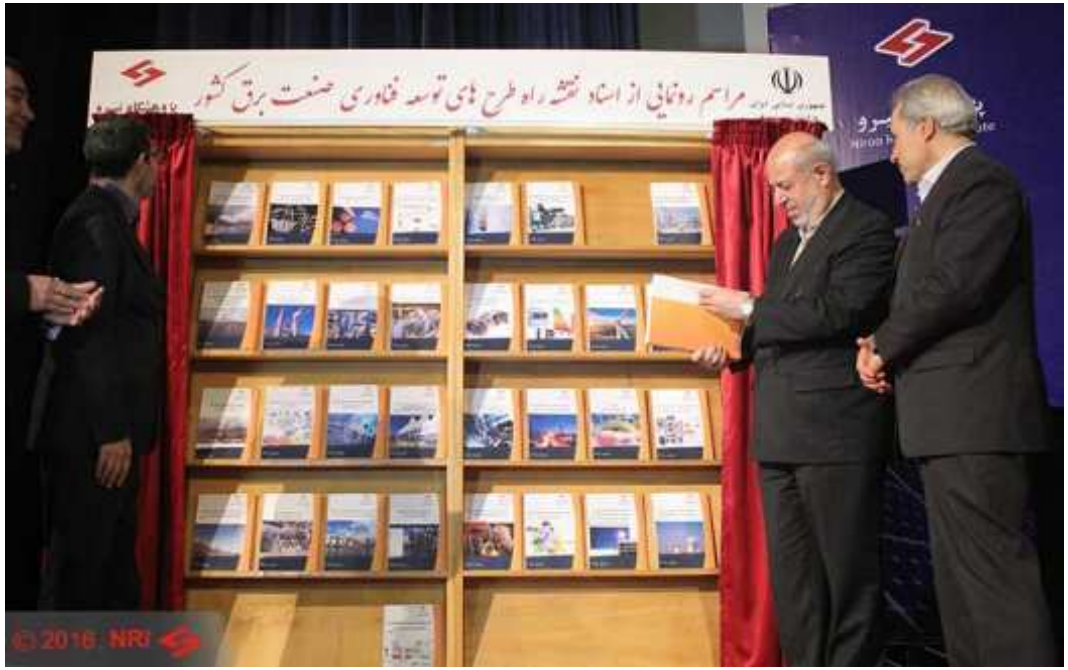
NRI Activities

- Performing basic, applied and developing research projects with the aim of achieving Ministry of Energy technical and required knowledge in the country regarding the stable development
- Recognizing different requirements of considered research plans in different fields of science and research and utilizing the facilities for the sake of planning research projects related to the Ministry of Energy requirements
- Performing necessary activities for the sake of applying research results
- Providing necessary facilities with the related research designs and plans
- Investigating, recognizing and settling the research requirements of Ministry of Energy
- Establishing active and constructive relations with other research and scientific institutes inside and outside the country by holding scientific conferences, exchanging researchers and carrying out joint research projects for achieving to the most recent technology and science in the fields related to NRI objectives and policies
- Establishing logical relations with professional and innovative forces in the country research and scientific centres and providing necessary facilities for the sake of assisting NRI objectives
- Utilizing the latest results of research and scientific progresses for the sake of social, economical and scientific development in order to improve NRI research plans objectives
- Studying and investigating about the construction and providing the technical and basic requirements of Power Plants, Substations, Transmission lines, and other related problems to the Ministry of Energy and companies affiliated to it

NRI Research planning

Preparing scientific and technical road map of the country and also strategic plans of MOE of Iran in the fields of:

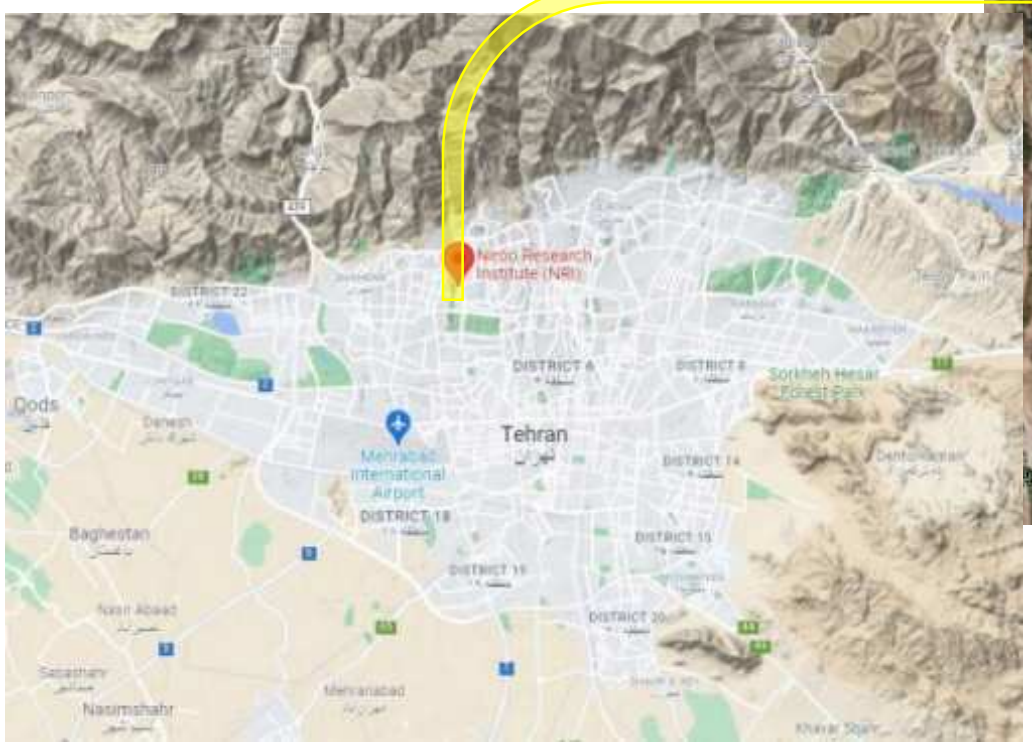
- **Power Generation**
- **Power Transmission**
- **Power Distribution**
- **Renewable & Environment**



Unveiling of roadmaps by the Minister of Energy of Iran in 2015

NRI Main site

- located in the northwest of Tehran
- 140,000 sqm area



Green space of the main complex

Green space of the main complex

Green space of the main complex






Green interior design of the main building

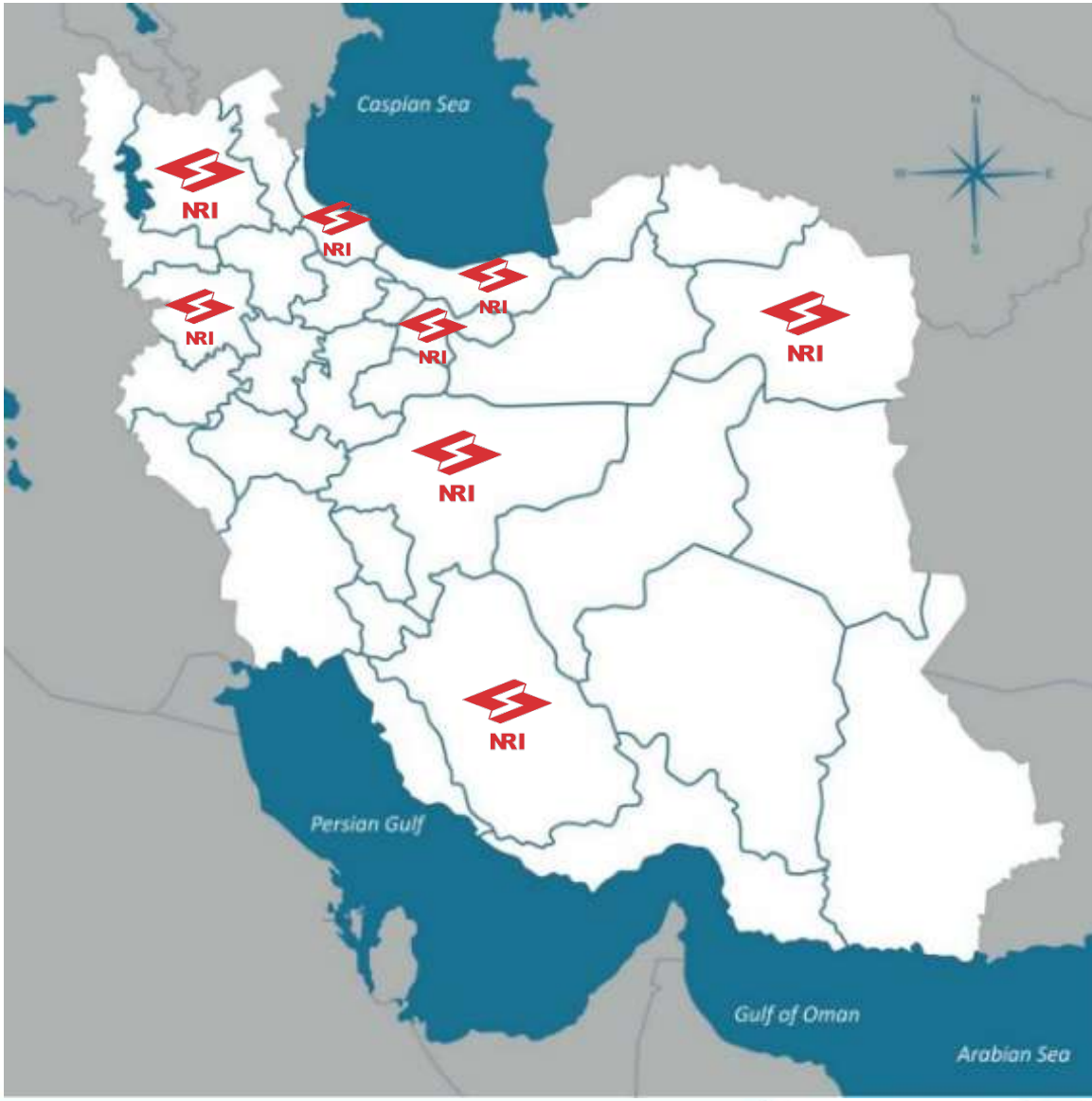
NRI Branches in Iran:

8 Educational and research complexes in other provinces of Iran:

1. **Tehran**
2. **Isfahan**
3. **Fars**
4. **Khorasan**
5. **Azerbaijan**
6. **Kermanshah**
7. **Mazandaran**
8. **Gilan**

Two test/pilot site:

1. **Arak (First 1 MW Solar pilot powerplant/Tower Test Station)**
2. **Zanjan(Wind Turbine Site)**

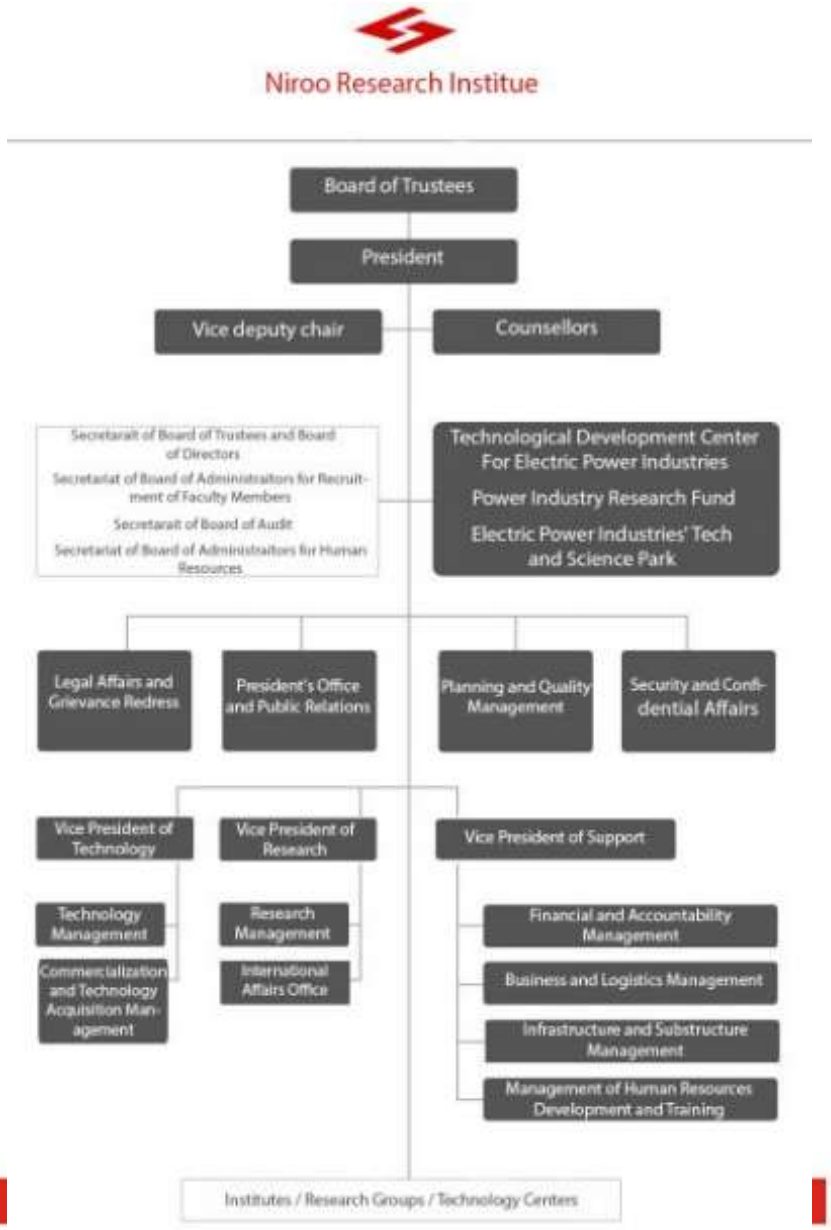


Human resources

Academic staff consisting of about one hundred faculty members and more than three hundred researchers in the fields:

- **Electrical engineering**
- **Mechanical engineering**
- **Civil Engineering**
- **Materials Engineering**
- **Chemical engineering**
- **Humanities(Social sciences and Economy)**

Organizational Chart



ISC Iran University Rankings

Niroo Research Institute (NRI) has been ranked within the top 10 Iran research institutes, according to ISC Rankings 2020.

TOTAL	NAME	RESEARCH	TECHNOLOGY AND INNOVATION	INTERNATIONALIZATION	ECONOMIC IMPACT	SOCIAL SERVICES, INFRASTRUCTURE AND FACILITIES
1-5 / 86.71-100	ROYAN INSTITUTE	10 / 78.46	4 / 81.18	12 / 49.21	5 / 80.48	2 / 97.05
1-5 / 86.71-100	ATOMIC ENERGY ORGANIZATION OF IRAN	1 / 100	11 / 56.11	4 / 79.19	1 / 100	1 / 100
1-5 / 86.71-100	IRAN POLYMER AND PETROCHEMICAL INSTITUTE (IPPI)	2 / 92.34	5 / 79.9	3 / 83.18	6 / 78.63	17 / 64.8
1-5 / 86.71-100	NULL	7 / 85.65	1 / 100	10 / 55.79	2 / 92.65	3 / 96.05
1-5 / 86.71-100	RESEARCH INSTITUTE OF PETROLEUM INDUSTRY	4 / 89.99	8 / 72.98	21 / 23.15	3 / 85.98	5 / 91.22
6-10 / 80.64-86.3	AEROSPACE RESEARCH INSTITUTE (ARI)	17 / 56.86	3 / 88.94	8 / 55.98	11 / 66.43	19 / 60.82
6-10 / 80.64-86.3	INSTITUTE FOR COLOR SCIENCE AND TECHNOLOGY (ICST)	3 / 90.56	6 / 76.31	17 / 31.28	16 / 55.9	13 / 71.38
6-10 / 80.64-86.3	MATERIALS AND ENERGY RESEARCH CENTER	6 / 89.01	7 / 73.77	15 / 41.37	12 / 66.33	9 / 84.92
6-10 / 80.64-86.3	NIROO RESEARCH INSTITUTE	25 / 38.22	2 / 91.34	17 / 31.33	10 / 66.85	6 / 88.75

Research Centers

NRI Research activities are carried out in 4 various research centers entitled:

1. **Power Generation Research Center**
2. **Power Transmission Research Center**
3. **Power Distribution Research Center**
4. **Energy and Environment Research Center**

Energy and Environment Research Center

Dependence of socioeconomic growth of country to the exports of fossil fuel supplies, limited amount of these supplies and environmental effects of fossil fuel consumption show the necessity of optimal energy consumption patterns. In this regard, it is necessary to carry out applicable research projects in these fields:

- Optimal and rational use in fossil fuels consumption patterns.
- Increasing renewable and new energies share in total energy consumption due to their high quantitative potential in our country.
- Controlling the water, air and solid pollutants in order to reuse and recycling of wastes

Fields of activities and NRI research departments are as follows:

1. Power Systems Operation and Planning Research Department
2. Transmission Line and Substation Equipment Research Department
3. High Voltage Studies Research Department
4. Power Electronics Research Department
5. Electrical Machines Research Department
6. Power Plant Monitoring and Control Research Department
7. Electronic and Instrumentation Research Department
8. Information and Communication Technology Research Department
9. Smart Control Systems Research Department
10. Mechanical Rotary Equipment Research Department
11. Thermal Cycles and Heat Exchangers Research Department
12. Renewable Energy Research Department
13. Energy Management Research Department
14. Environment Research Department
15. Non-Metallic Materials Research Department
16. Metallurgy Research Department
17. Chemistry and Process Research Department
18. Power Industry Structures Research Department
19. Energy and Electricity Economics Research Department
20. Accounting and Financial Sciences Research Department
21. Management and Social Sciences Research Department
22. Foresight and Policy Research Department
23. Law Research Department

NRI International Cooperations:

- Joint research projects
- Co-funding Projects
- Research Services
- Human resource training and exchange
- Short and long-term scholarships
- Workshops and training courses
- Sharing infrastructures
- Laboratory Services
- Design and Know-how Transfer
- Joint conferences and publications
- Matchmaking between research institutes and industrial companies.

NRI Reference laboratories

- 29 advanced laboratories
- 18 Reference laboratories
- 11 research laboratories
- ISO/IEC 17025:2005 certificate


DAP Deutsches Akkreditierungssystem Prüfwesen GmbH

Deutscher AkkreditierungsRat

Accreditation

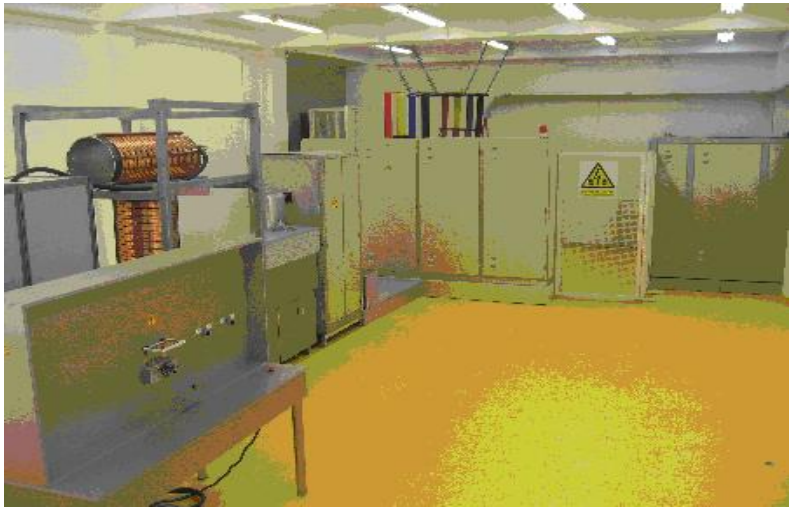
NRI Reference laboratories

- Short Circuit Laboratory
- Reference High Voltage Laboratory
- Relay and Protection Reference Laboratory
- Salt Fog Laboratory
- Miniature Circuit Breaker Laboratory
- Tower Test Station
- Power distribution and lightning poles laboratory
- Reference Electric Power Industry Communicaton
- Laboratory
- Quality test and smart meter Reference Laboratory
- Electric Machine Laboratory
- Industrial Electronics Laboratory
- Gas Fuel Analysis laboratory
- Wire and Cable Reference Laboratory
- Water And Steam Reference Laboratory
- Paint and Coating Reference Laboratory
- Oil and Fuel Reference Laboratory
- Metallurgy And Materials Laboratory
- Ceramic and Polymer Laboratory
- Electrical Hardware Laboratory
- Air and Physical Pollution Laboratory
- Fuel cell Fabrication and Testing Laboratory
- Calibration laboratory
- Industrial Automation Laboratory
- Manufacturing Workshop
- Performance Test Laboratory
- Thermo hydraulics Laboratory
- Vibration and Acoustic Laboratory

Reference High Voltage Laboratory

Tower Test Station

Short Circuit Laboratory



Relay and Protection Reference Laboratory

Salt Fog Laboratory

Miniature Circuit Breaker Laboratory

Reference Electric Power Industry Communication Laboratory

Power distribution and lightning poles laboratory

Quality test and smart meter Reference Laboratory

Electric Machine Laboratory

Industrial Electronics Laboratory

Wire and Cable Reference Laboratory

Gas Fuel Analysis laboratory

Water and Steam Reference Laboratory

Paint and Coating Reference Laboratory

Metallurgy and Materials Laboratory

Electrical Hardware Laboratory

Air and Physical Pollution Laboratory

Fuel cell Fabrication and Testing Laboratory

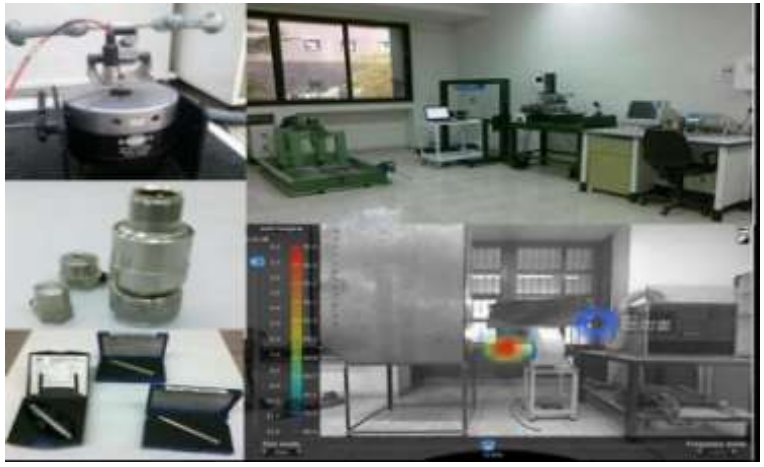
Calibration laboratory

Manufacturing Workshop

Performance Test Laboratory

Thermo hydraulics Laboratory

Vibration and Acoustic Laboratory



Oil and Fuel Reference Laboratory

Ceramic and Polymer Laboratory

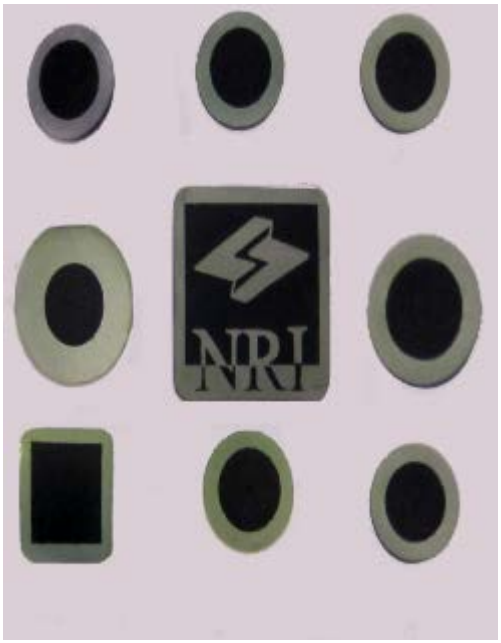
Renewable Energy Research Department

Since 1998

Several research projects have been implemented by this group and a number of projects are under investigation and execution.

10kW Solar Dish/Stirling Engine System in NRI, Iran

Mashhad Land Fill Gas power plant in Iran

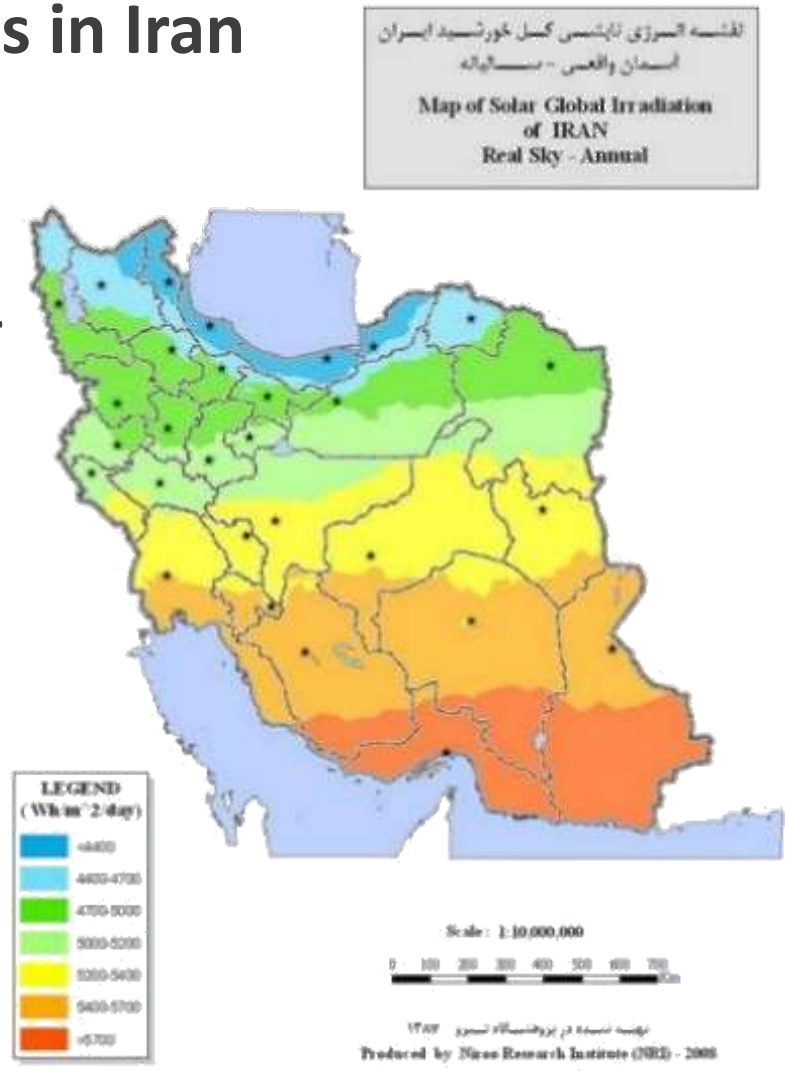


Solid Oxide Fuel Cells Fabricated by NRI

Solar Energy

Establishment of Solar Energy Atlas in Iran

- In this project at first, Iran meteorological data have been gathered and analyzed. Then an optimum model for calculation of total solar radiation for Iran was extracted.
- Also the software named "Iran Solar Radiation Calculator" has been written. This Software has a lot of capabilities in order to predict the main solar and meteorological parameters in selected area.
- GIS maps related to calculated solar and meteorological data for across Iran have been developed.



Solar Energy

The feasibility study of establishing the first solar power plant in Iran

- According to high solar radiation in Iran and good potential for solar energy, a feasibility study was implemented by cooperation with a German consultant company. This study resulted in selection of Yazd region as an appropriate site for installation of the first solar-thermal combined cycle power plant in Iran.

- The power plant includes 2*123 MWe gas turbine, 123 MWe steam turbine and 17 MWe solar field.

Solar Energy

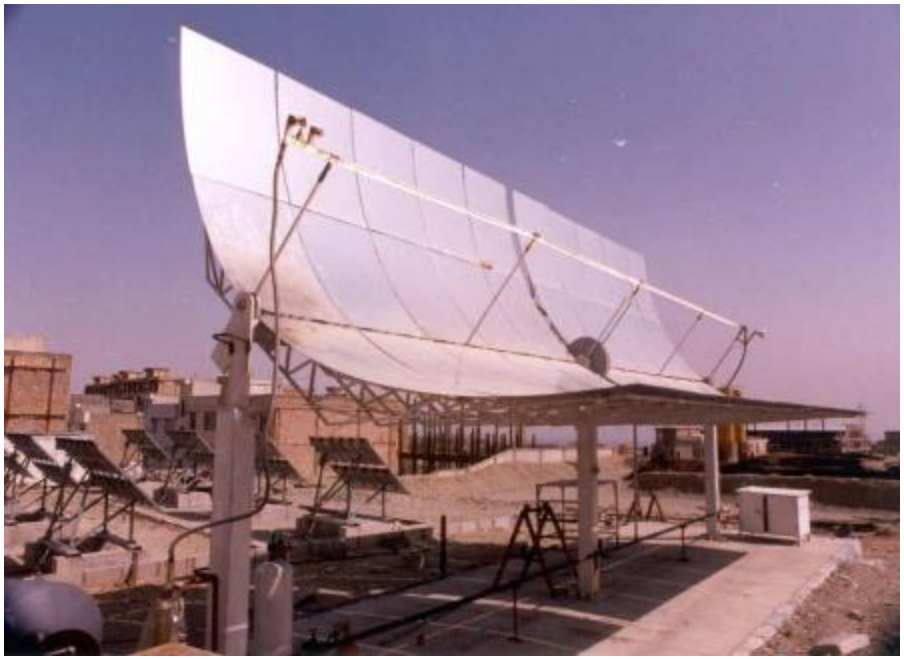
Design and Construction of 10kW Solar Dish/Stirling Engine System

- One of the current projects of this group is design and construction of a 10Kw-dish/stirling-engine system. It has a parabolic dish, which uses a bi-axial tracking system to concentrate the sunlight in its focal point. A Stirling engine uses this thermal energy to drive an alternator and produces electrical energy

Solar Energy

Design and construction of a Parabolic Trough solar concentrator

- A parabolic trough solar concentrator was constructed at 1995 and installed in Yazd City. It has a length of 10.5 m with 5 m span. This system is utilized with a one-axis solar tracking system..



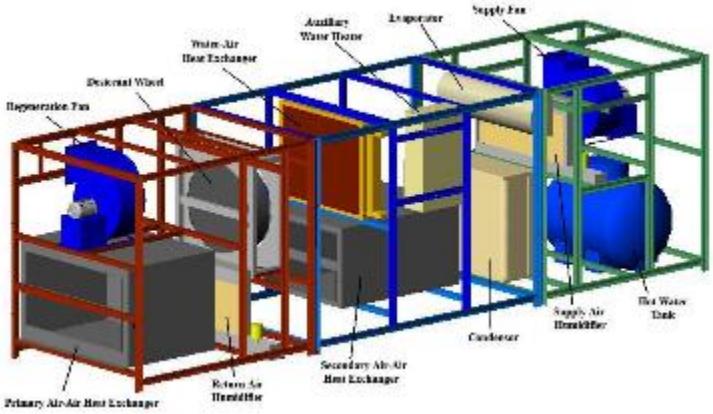
Solar Energy

Design and Construction of the 5RT Solid Desiccant Air-Conditioning System

- **In traditional air-conditioning systems, cooling and consequently condensing the water vapor of the air is used to reduce humidity. Thus a large quantity of electrical energy consumes just for humidity reduction. Therefore these systems are not economical in hot and humid climates.**

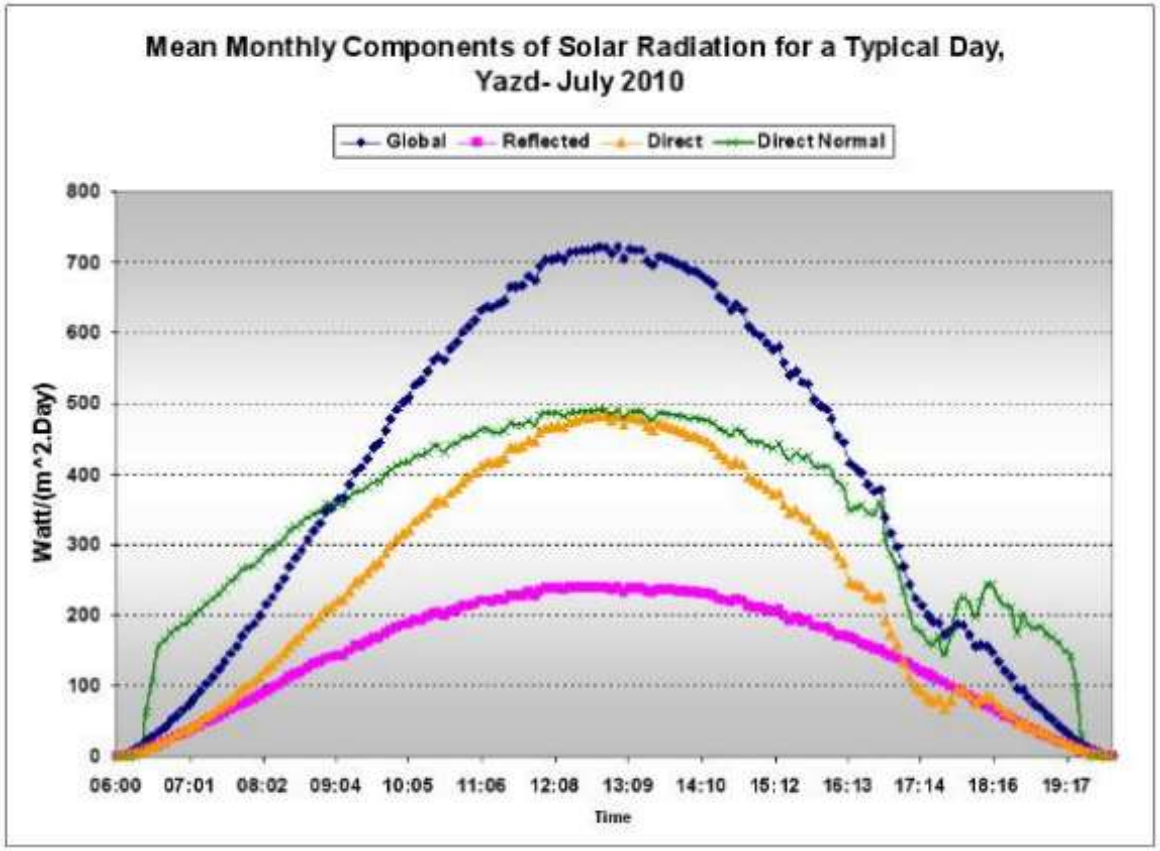
- **In desiccant air-conditioning systems, air humidity is reduced by desiccant materials and then, the required electrical energy for air conditioning will be decreased significantly. The desiccant will be saturated after water absorption and it should be heated for regeneration. Thus solar energy is used for regenerating of desiccant material.**

- **The designed system reduces 40% electrical energy consumption in comparison with commercial air-conditioning systems in hot and humid climates. This System was installed in a conference hall in Kish Island**



Solar Energy

Feasibility Study of 17 MW Solar Thermal Power Plant in Yazd (Parabolic Trough)
Solar Potential Assessment and Consulting Services



Solar Energy

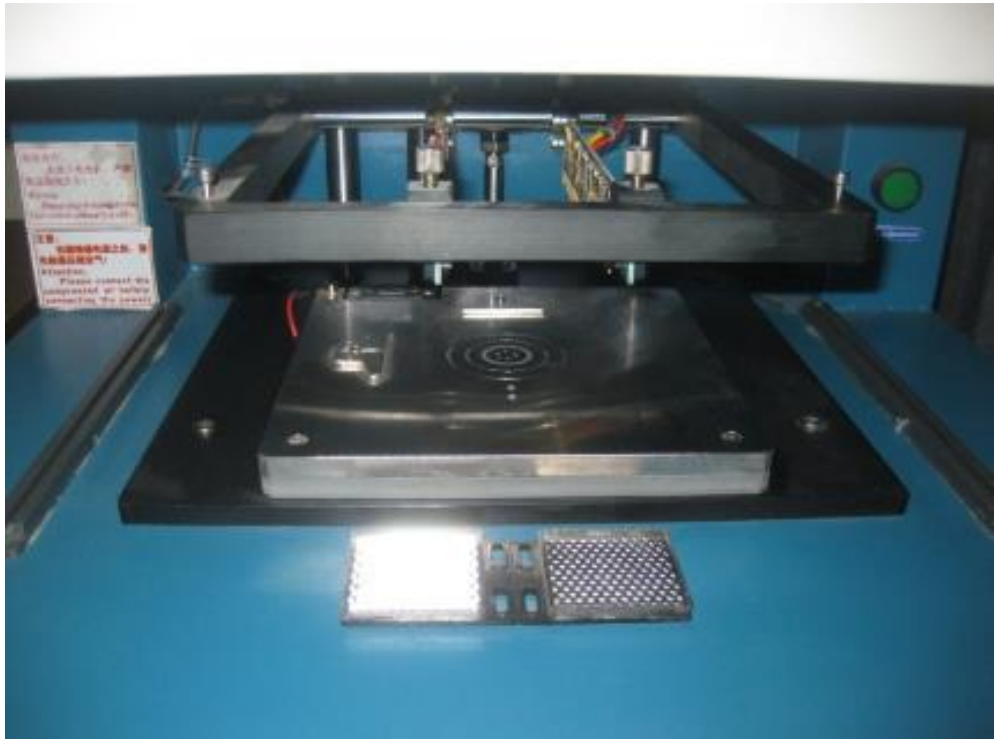
Design and Construction of two axis Tracking PV System

Single Axes Tracking (Polar) Fixed Dual Axes Tracking (Az-Alt)

Solar Energy

Plan of Solar Energy Systems Laboratory

Phase 1: Photovoltaic cells & modules)



Classification of Photovoltaic Module Tests

Based on Standard

- IEC 61215
- IEC 61646
- IEC 61730

Based on Tests:

- Diagnostic
- Electrical
- Performance
- Mechanical
- Thermal
- Environmental
- Safety
- Supplementary Tests (like Salt mist)

Solar Energy

Establishing Field Test center of Outdoor PV Systems

Wind Energy

Wind Turbine Technology Development Center

Main Projects

- **WENRI National Wind Turbine Platform**
- **Supporting of Series Production of Wind Turbines and Main Components in Iran**
- **National Wind Turbine Test Center**
- **Develop of a Novel 3.4MW Wind Turbine with a Hybrid Tower**
- **Design and Fabrication of Small Wind Turbine Prototypes**
- **Feasibility Study & Wind Resources Assessment Projects**
- **Iran Wind Energy Roadmap 2025**

5kW Wind Turbine (WENRI-5kW-2.4m)

1995 ~ 1998

25kW Wind Turbine (WENRI-25kW-13m)

2001 ~ 2004

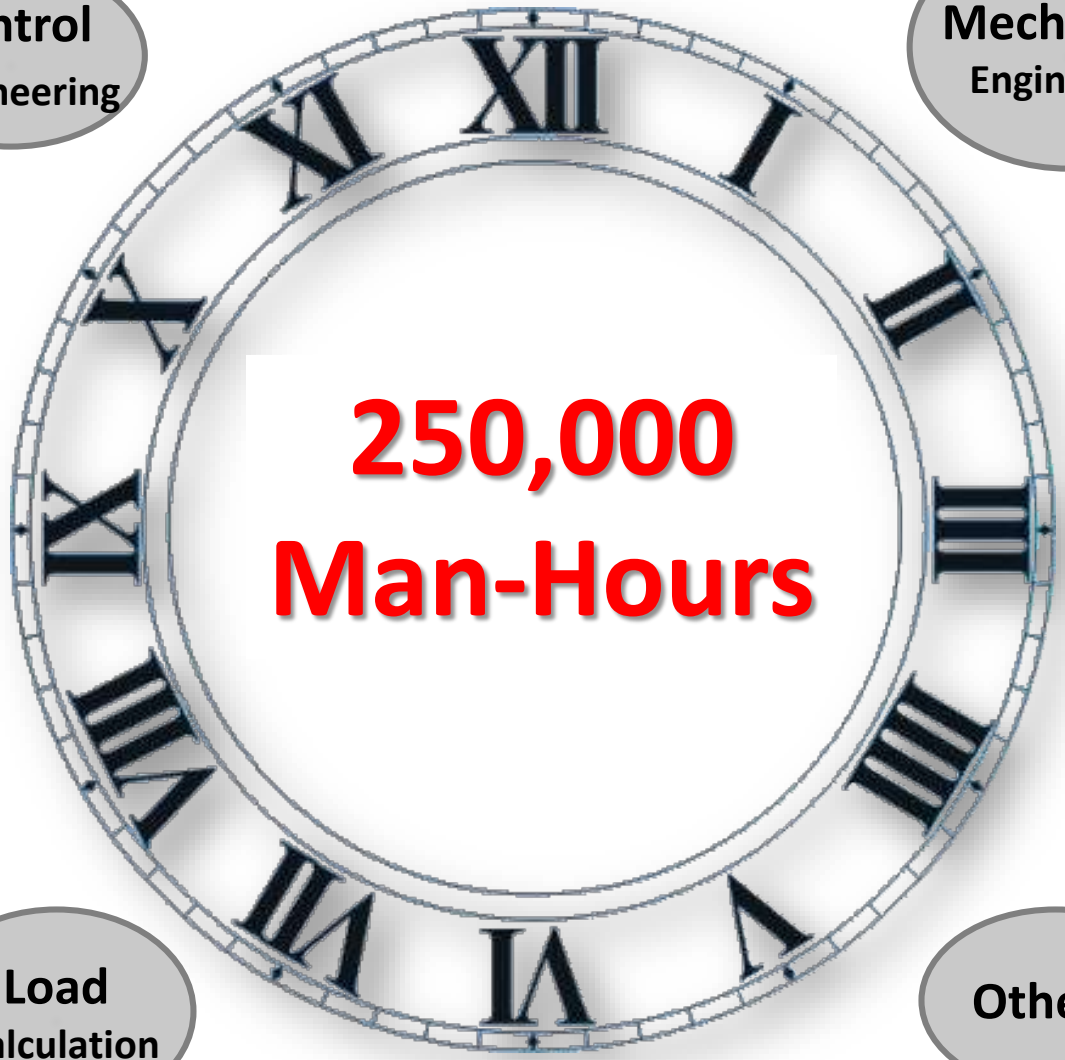
Design and Development of a 2MW Wind Turbine Prototype

WENRI- 2.0 -87

- **Capacity:** 2MW
- **Concept:** HAWT- Geared- DFIG
- **Wind Profile Class:** IEC II-A
- **Certification Guideline:** GL-2010 & 2015

Design & Engineering

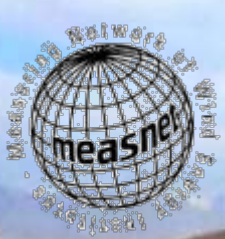
Network Shaping



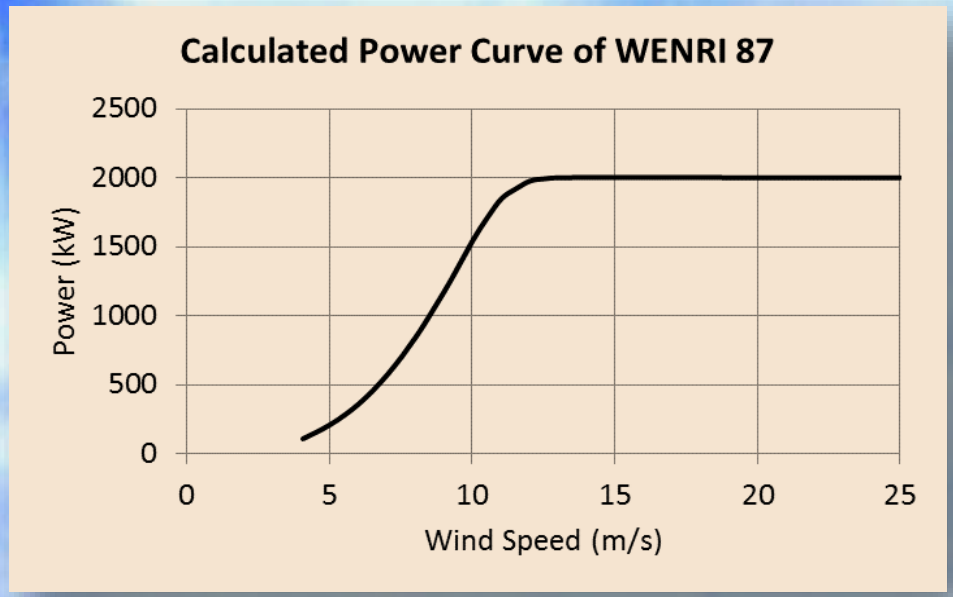
- Control Engineering
- Mechanical Engineering
- Civil Engineering
- Power Engineering
- Aerodynamic Engineering
- Site Assessment
- Load Calculation
- Other…

Wind Turbines Power Performance Test Center

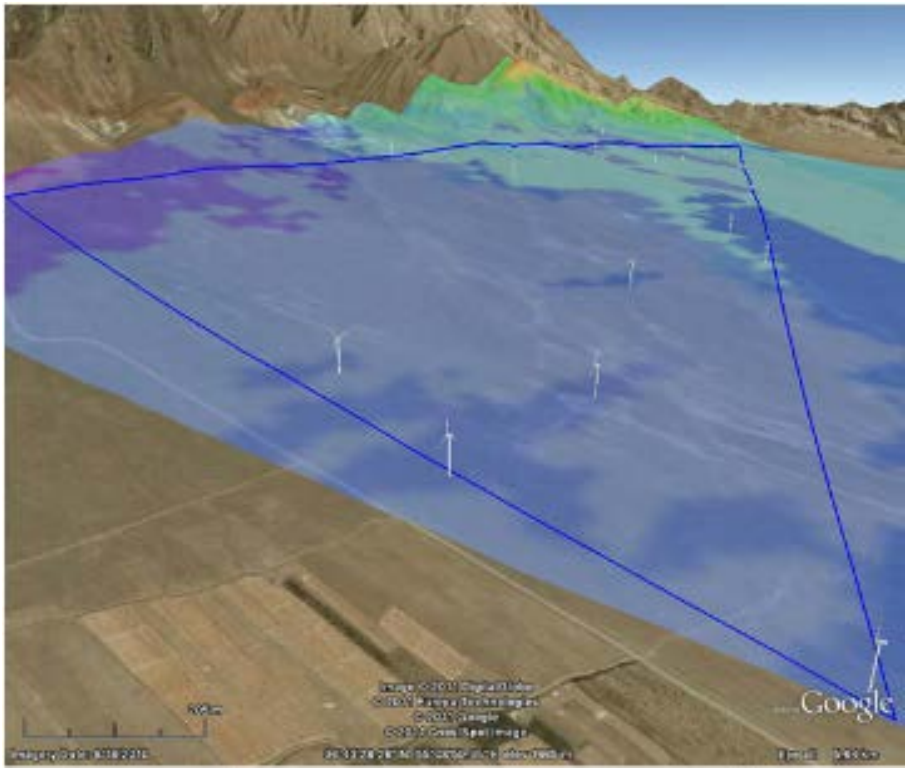
- 80m Standard wind mast
- Grid and Road Infrastructures
- Feasible Wind speed
- Site Class: IEC-II A
- MEASNET, TUV NORD

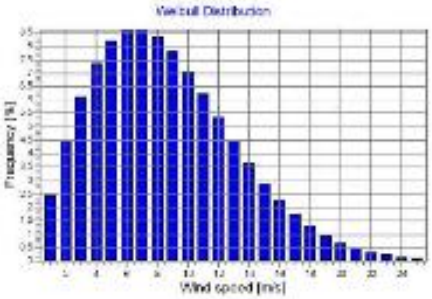


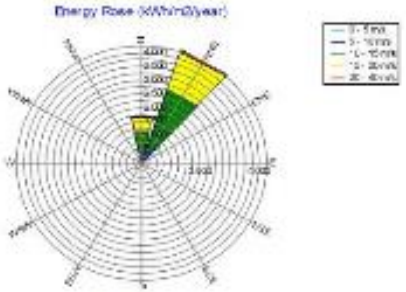
IEC 61400-12

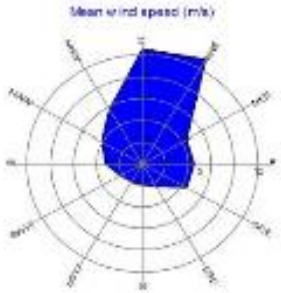


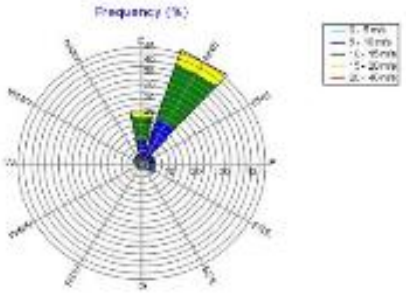
Wind Resources Assessment Projects











Biomass Energy

- Agro-residues
- Municipal solid wastes
- Municipal wastewater
- Food industrial wastes
- Animal wastes

Biogas (Landfill & digesters) projects:

- Design and fabricating a pilot plant with 17m3 capacity for OFMSW
- Feasibility study and conceptual design of landfill gas-to-energy systems in Mashhad and Shiraz
- Super intention on construction of landfill gas power projects in Mashhad and Shiraz
- Basic design of large-scale anaerobic digesters

Biomass Energy

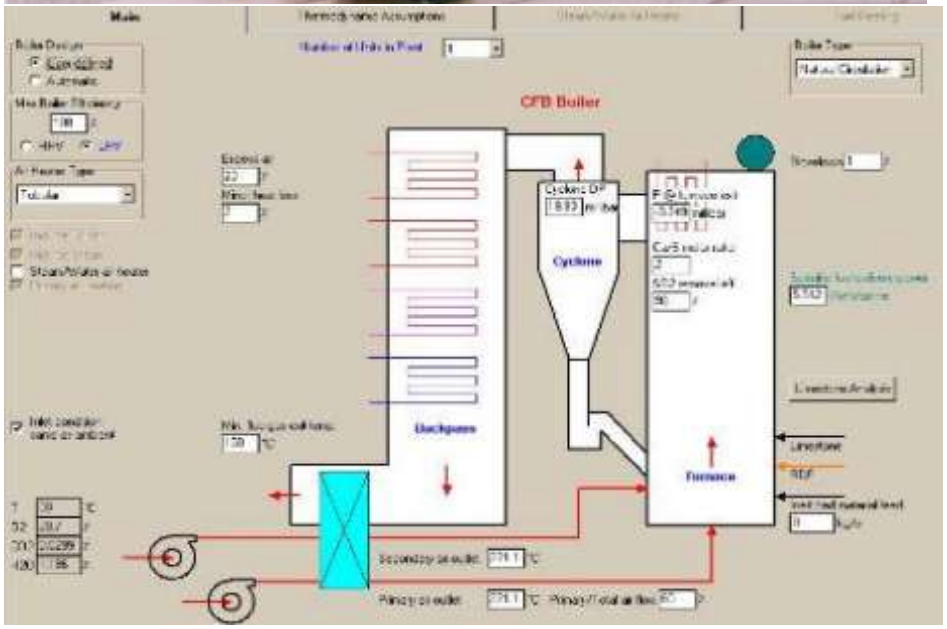
Mashhad LFG power plant

Anaerobic digestion pilot

Shiraz LFG extraction system

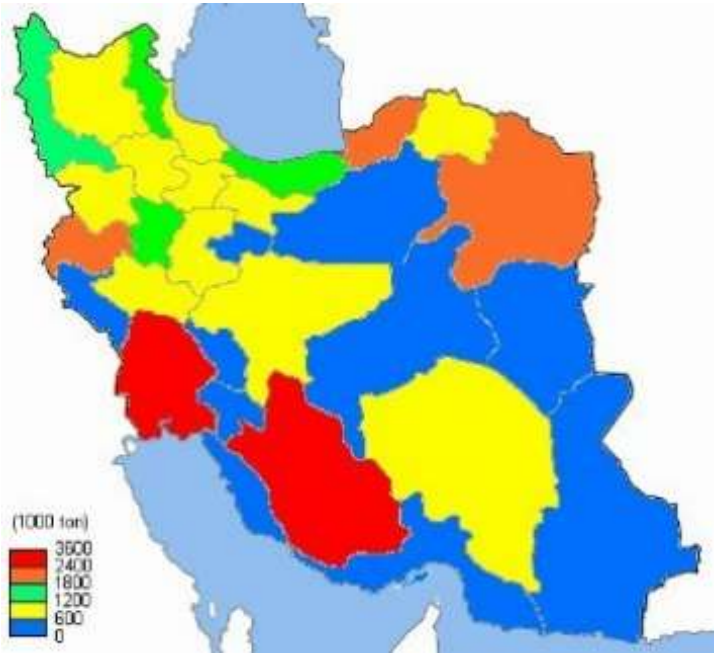
Incineration projects

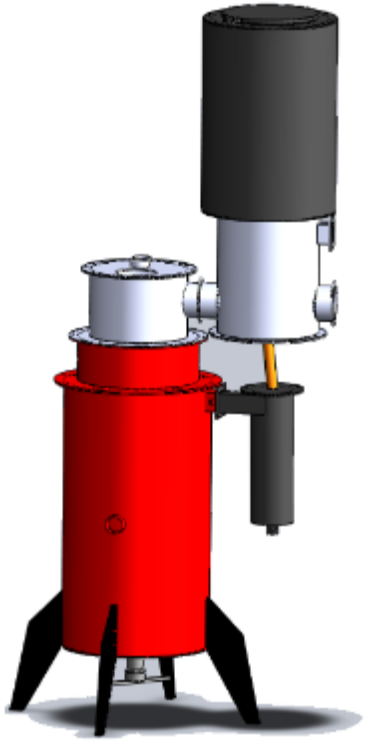
- Conceptual Design of a Waste-to- Energy Power plant for Tehran
- Design and Providing Basic Technical Specification of 1200TPD Solid Waste-to-Energy (Incineration) Power plant
- Design and Fabrication of an incinerator (50kg/hr)



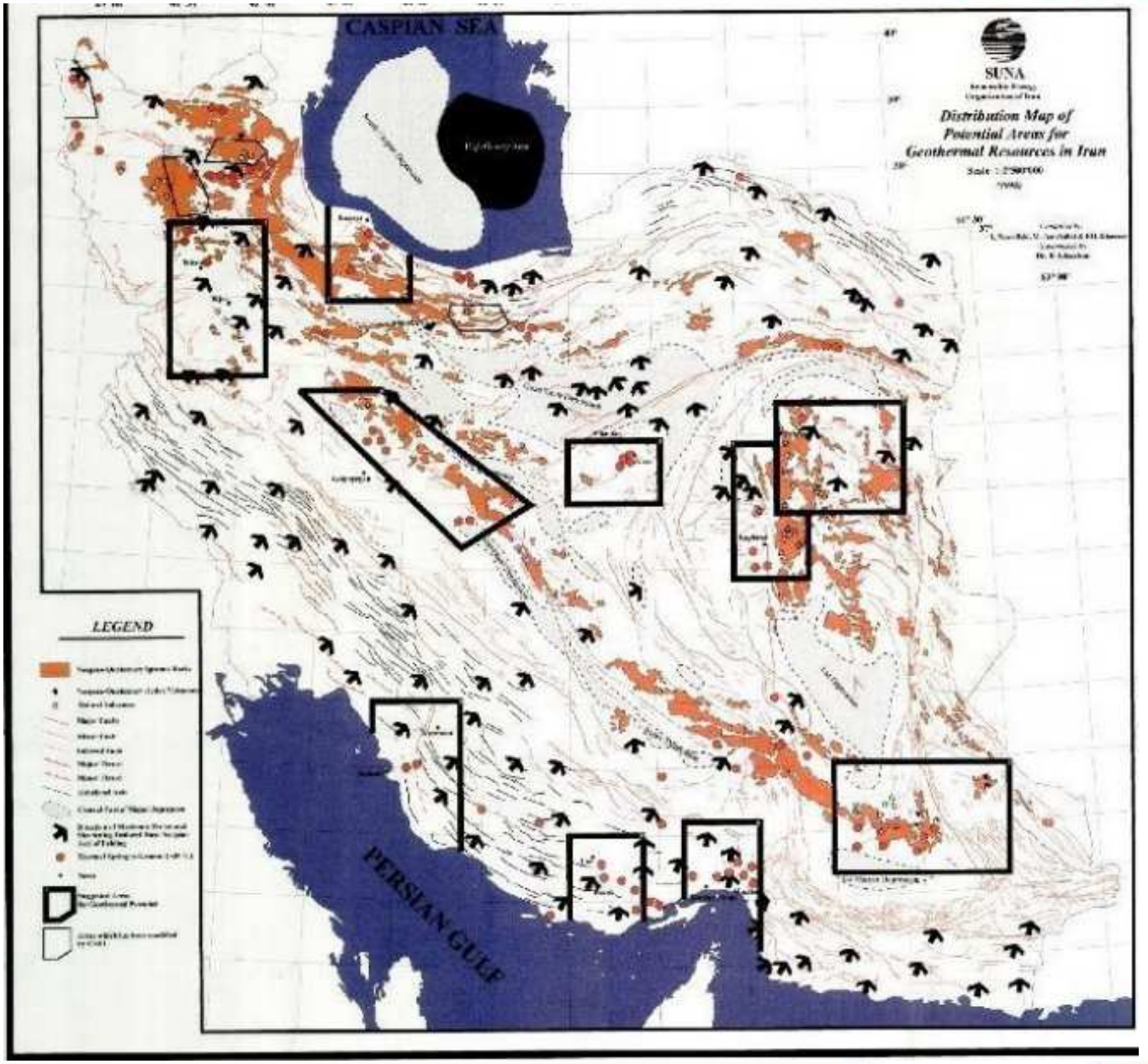
Gasification projects:

- 1- Assessment of the biomass gasification potentials in Iran
- 2- Experimental study on various biomass fuels
- 3- Engineering, procurement and construction of 10 & 25kWe gasification-generator units for SUNA





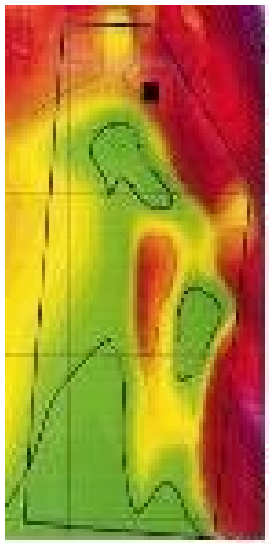
Geothermal Energy

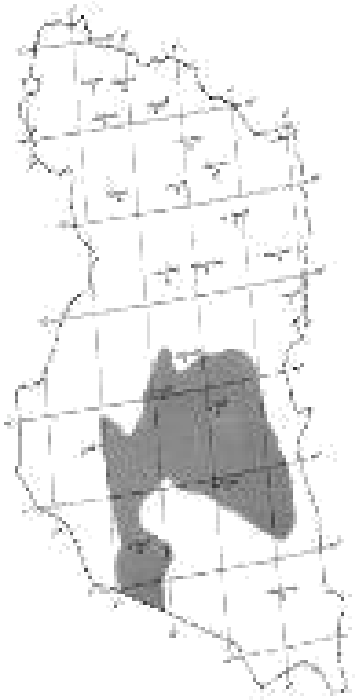


Geothermal Energy

Projects

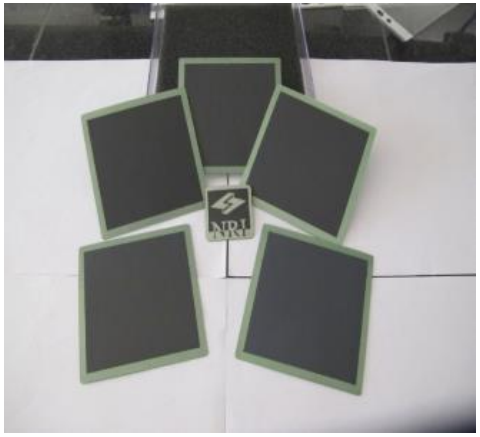
- Identification of Geothermal Prospects in Khorasan, Mahalat & Damavand Provinces
- Assessment of Geothermal Potential
- At West Azerbaijan Province
- Semi-Detailed Studies of Geothermal Potential at Mahalat Region





Solid Oxide Fuel Cells (SOFCs)

- Policy Requirements: electricity and renewable energy development sector and national strategic plan of fuel cell technology in IRAN in relation to general policies of forth economic, cultural and social development plan of vision for IRAN
- Now the SOFC Projects have been carried out by NRI and the works are conducting to produce a 100W SOFC stack.
- Outlook & Target: Design & Fabrication of 5 kw SOFC Fuel cell



SOFC projects at NRI

1- Design and Fabrication of a Solid Oxide Fuel Cell with purpose of Technical know-how achievement

2- Design and fabrication of a 100W short SOFC stack

3- Design and Fabrication of a Solid Oxide Fuel Cell which working with Natural

4- Design and Fabrication of a 50Watts SOFC stack by using Natural Gas

SOFC project at NRI

SOFC Fabrication Lab

SOFC Testing Lab

Thank You

for your Attention !

Niroo Research Institute
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