



IRAN Efforts for ECO Regional Electricity Market

Establishment of ECO Regional Electricity Market (ECO-REM)
2nd Experts Meeting

Mohammad Hossein Zendeudel, Managing Director of Electricity Exchange Office,
Iran Grid Management Co. (IGMC) zendeudel@igmc.ir

Dushanbe, Tajikistan – November 27-28, 2024

Outlines

- Overview on Power Sector in Iran
- Electricity Trade and Interconnections in Iran
- Terms of Reference (ToR) for establishment of ECO

Regional Electricity Market

- Training course

Overview on Power Sector in Iran

Supply Side Statistics in Brief

Installed Production Capacity

Type	Capacity* (MW)	Share (%)
Thermal	77104	81.8
Hydro	12156	12.9
DG @ CHP	2665	2.8
Nuclear	1020	1.1
Renewable	1338	1.4
Total	94283	100

Installed Renewable Capacity & Share

Type (Renewable)	Capacity (MW)
Solar (PV)	744
Wind	462
Small Hydropower	120
Biomass	12
Total	1338

* End of November 2024

Overview on Power Sector in Iran

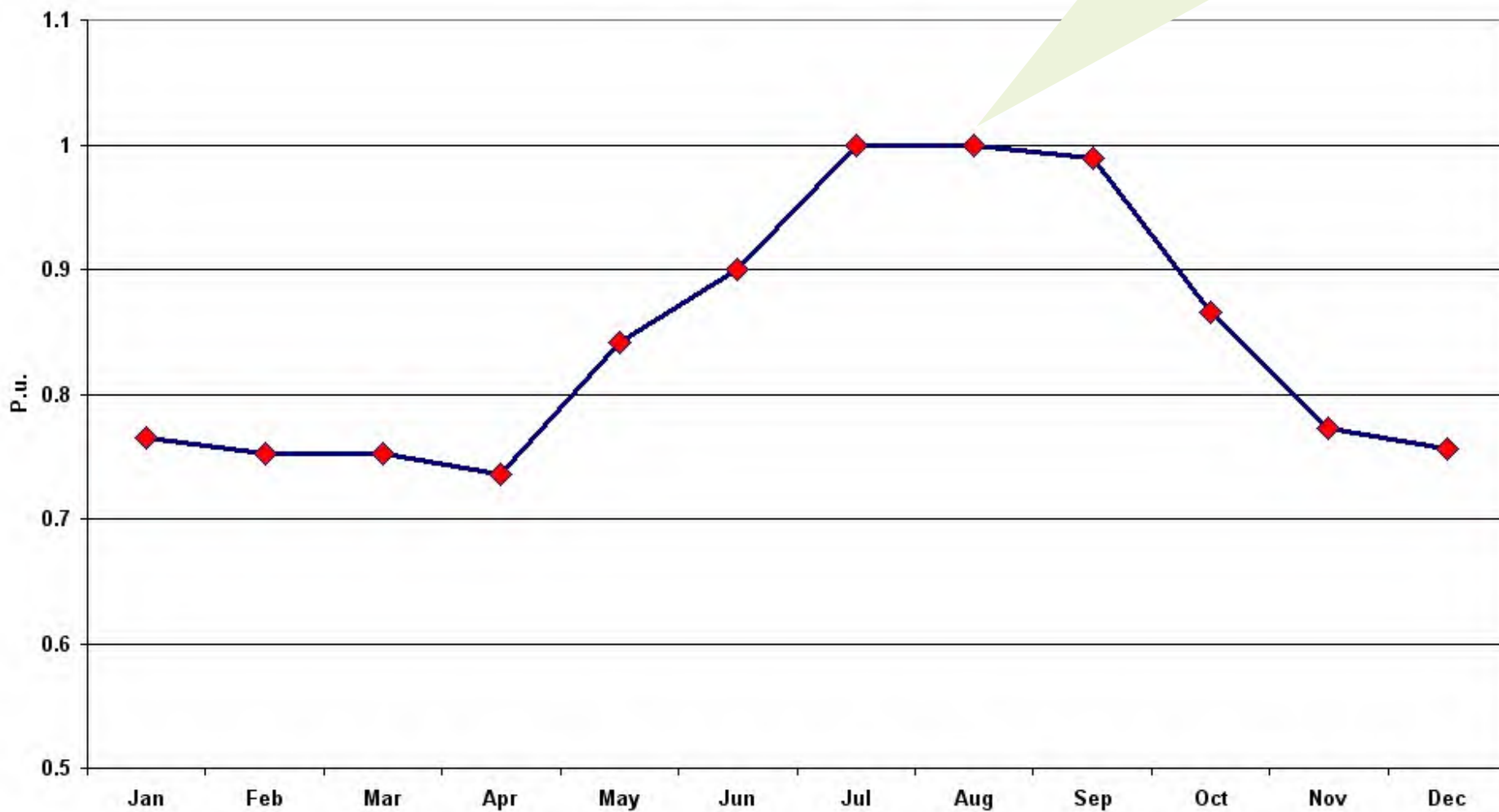
Demand Side Statistics in Brief

Description	March-24	March-22	unit
Installed Capacity per Capita	1083	1072	W
Generation per Capita	4523	4338	KWh
Consumption per Capita	3900	3738	
Ave. Con. Of each Household	3191	3106	

Share of Consumption in Various Sectors (%)

Description	Sep-2024	Sep-2023
Industrial	34.0	35.3
Residential	33.6	32.7
Agricultural	14.1	14.9
Public	8.9	8.4
Other (Commercial)	8.3	7.7
Street Lighting	1.1	1.0

Monthly Peak Pattern



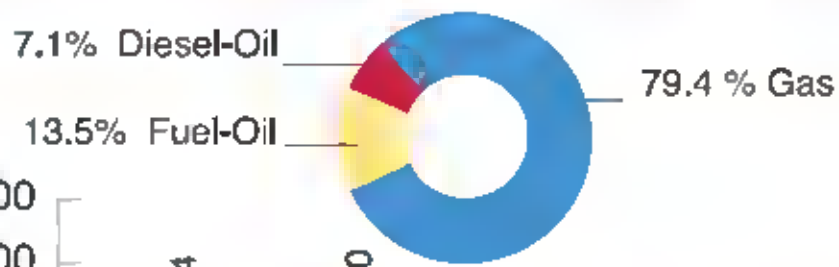
Peak Demand in the summer 2024 reached 80000 MW

Fuel Consumption

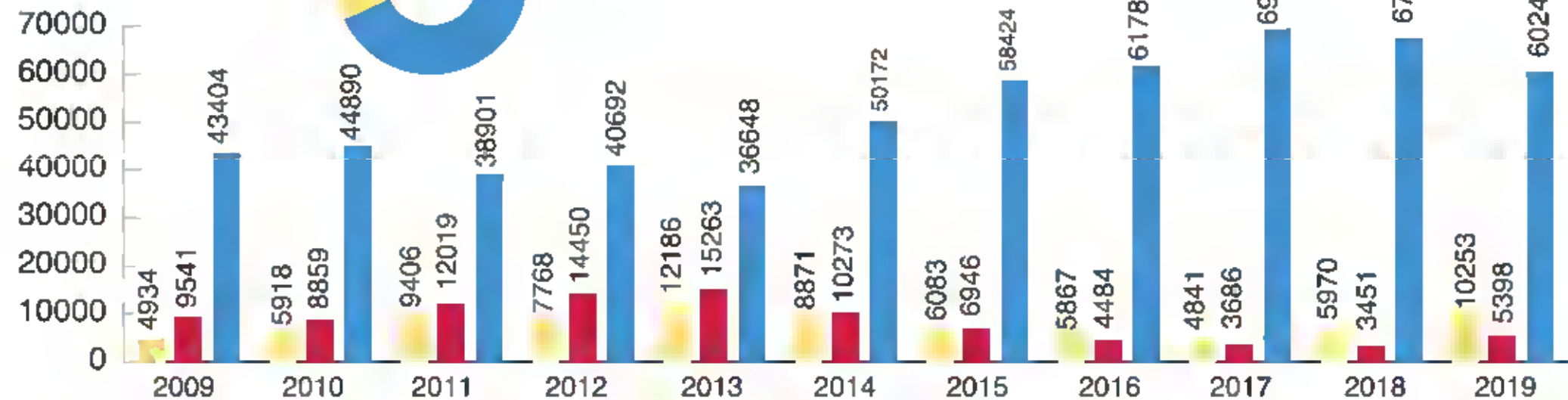
Fig. (11): Diagram of Fuel Consumption of MOE Power Plants

(10^6 m^3 or 10^6 Liter)

Share of Various Fuel in MOE Power Plants in 2019



Gas
Diesel-Oil
Fuel- Oil

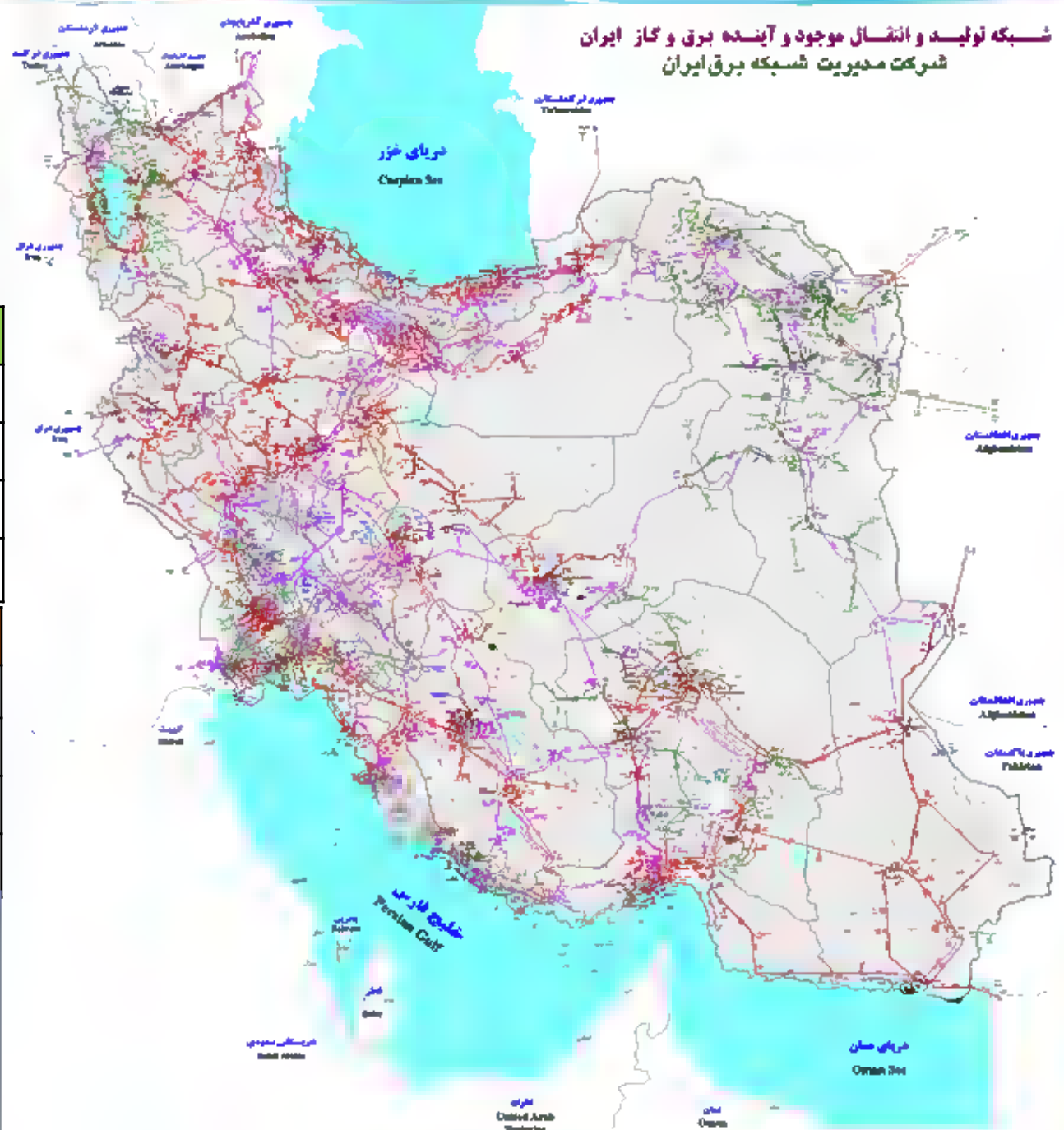


Iran Electricity Grid Operation

- Iran has a highly **developed and integrated power grid**, consisting of generating plants, bulk power transmission network and sub-transmission networks.
- The **back-bone transmission network** consists of 400 and 230 KV transmission lines.
- **HVDC links** (B-to-B link with Turkiye, under study with the Russian network), and **submarine links** (Oman & Qatar).
- **Restructuring and Unbundling in Electric Power Sector** (generation, transmission and distribution)
- **As result of unbundling:**
 - ➔ **Iran Grid Management Company (IGMC)** as an Independent System Operator (ISO) has been formed,
 - ➔ **39 DISCOs and retail electricity market** have been formed,
 - ➔ **Private sector has become involved in construction and operation of new power plants**, and existing plant are gradually sold out to private investors through stock exchange
 - ➔ **Transmission network remains in public sector** owned and operated by 16 Regional Companies.

Overview of Iran Power Network

Transmission Lines (Nov 2024)	
Voltage level	Length (Km)
400 KV	22470
230 KV	33759
Sum	56229
Sub-Transmission Lines (Nov 2024)	
Voltage level	Length (Km)
132 KV	25862
63&66KV	52391
Sum	78253
Power Transformers (Nov 2024)	
Primary Voltage level	Rated Capacity (MVA)
400 KV	92549
230 KV	102620
Sum	195169
Power Transformers (Nov 2024)	
Primary Voltage level	Rated Capacity (MVA)
132 KV	41416
63&66KV	88173
Sum	129590

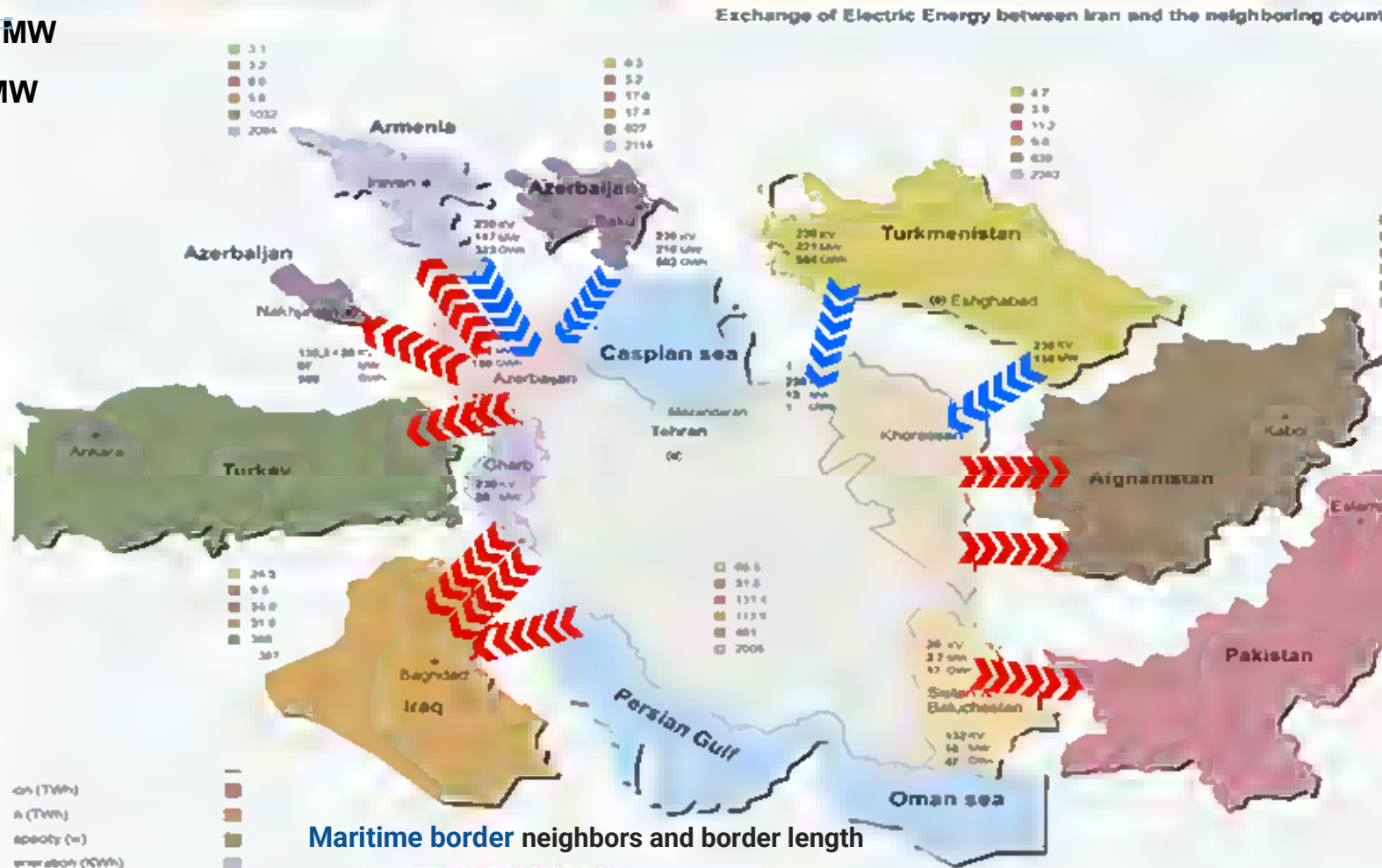


Interconnections and Trade with Neighboring Countries

Maximum Export (2020): 1854 MW

Maximum Import (2020): 737 MW

Export
Iraq
Afghanistan
Pakistan
Import/Exchange
Turkmenistan (Synchronous)
Armenia (Synchronous)
Nakhichevan Autonomous Region (Synchronous)
Idle
Turkey
Azerbaijan



Land border neighbors and border length

Afghanistan: 936 km (582 mi)
Armenia: 35 km (22 mi)
Azerbaijan (2): ^[9] 432 km (268 mi)
Iraq: 1,458 km (906 mi)
Pakistan: 909 km (565 mi)
Turkey: 499 km (310 mi)
Turkmenistan: 992 km (616 mi)

7 Land & 8 Maritime border

Iran ranks 10th in terms of the number of borders in the World


Existing Interconnections:

Country	Number of Tie lines	Interconnection voltage level (kV)	Type of trade	Capacity (MW)
Azerbaijan	1 & 1 & 2 & 1 & 2	330 & 230 & 132 & 110 & 11	Exchange	800
Turkey	1 & 1	400 & 154	-----	640
Turkmenistan	2	230	Import	400
Afghanistan	2 & 4	132 & 20	Export	180
Pakistan	3 & 2	132 & 20	Export	200
Armenia	2	230	Barter-Exchange	350
Iraq	3 & 2 & 2 & 4	400 & 132 & 63 & 20	Export	1500

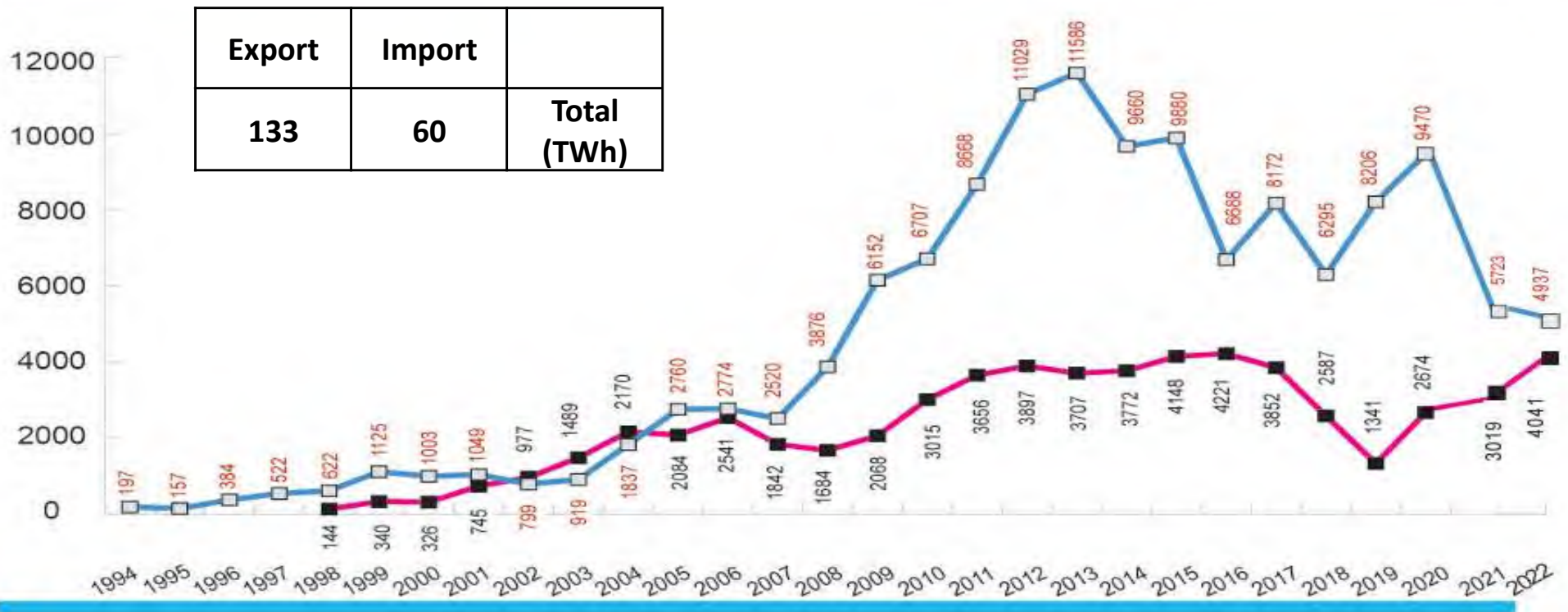
Total Existing Capacity : 4070MW

Exchanged Electricity with Neighboring Countries

(GWh)

Export 

Import 

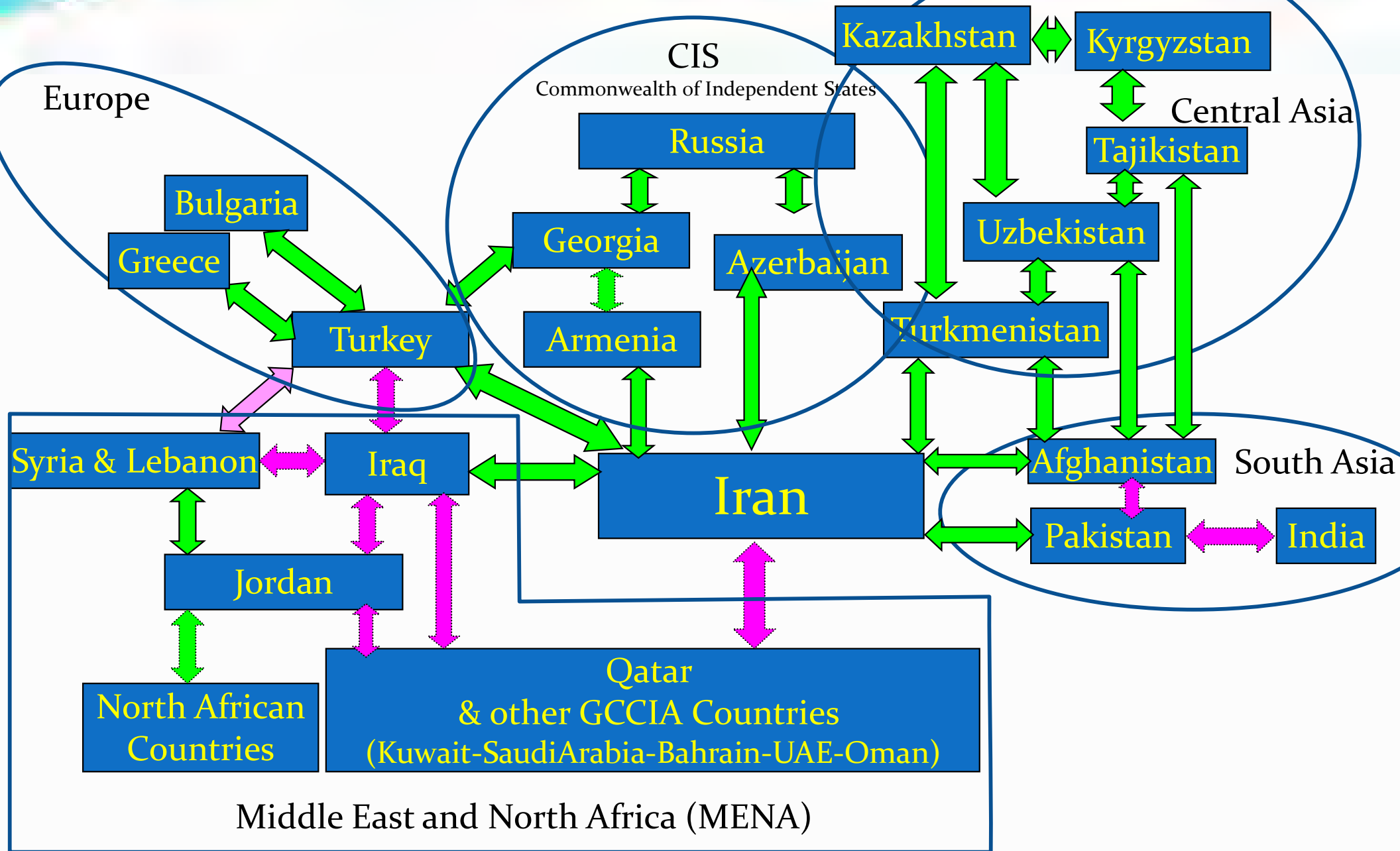


Turkey	Iraq	Pakistan	Afghanistan	Turkmenistan	Armenia		Azerbaijan		
Export	Export	Export	Export	Import	Export	Import	Export	Import	
15	90	7	10	35	4	20	7	5	Total (TWh)

Conclusion: Iran's Advantages as Energy Hub

- **Stable power system with 2 decades without major blackout**
- **Major Oil and Gas reservoirs, i.e. 20% of total reservoirs**
 - **(1th in the World)**
- **Integrated synchronous and extensive power network**
 - **(10th in the World)**
- **Extensive Land and Maritime borders**
 - **(10th in the World)**
- **Huge Installed power generation capacity**
 - **(14th in the World)**

ECO Regional Electricity Market



ECO Regional Electricity Market

Mission

- ✓ Integrating supply and demand of different Zones
- ✓ Minimize barriers to trade within the region
- ✓ Increase the security of supply
- ✓ Promote the competition level of market
- ✓ Postpone the unnecessary investment
- ✓ Improve the market efficiency
- ✓ Sharing of reserve
- ✓ Soften the inter and intra zonal congestion problem
- ✓ Ensure that all countries share benefits and responsibilities
- ✓ Improve the economic and political relation between the members



ECO Regional Electricity Market

The initial idea of this market was formed after the proposal of Iran and the meeting with the Secretary General of the Organization of Economic Cooperation (ECO) in 2011.

The first meeting of the regional economic power market of ECO member countries was hosted by Tavanir on November 14-15, 2013.

The most important agreements of the meeting were:

- Considering the experience of the countries of Iran and Turkey in setting up the electricity market, conducting coordination and feasibility studies to set up a common electricity market between the two countries as the first step in implementing the regional electricity market.
- It was proposed that the Islamic Development Bank should finance the studies required to establish a regional electricity market between ECO countries

ECO Regional Electricity Market

In October of 2014, the first bilateral meeting of Iran and Turkey was held in the presence of the ECO Secretariat on the ECO-REM Regional Electricity Market (ECO-REM) in Ankara.

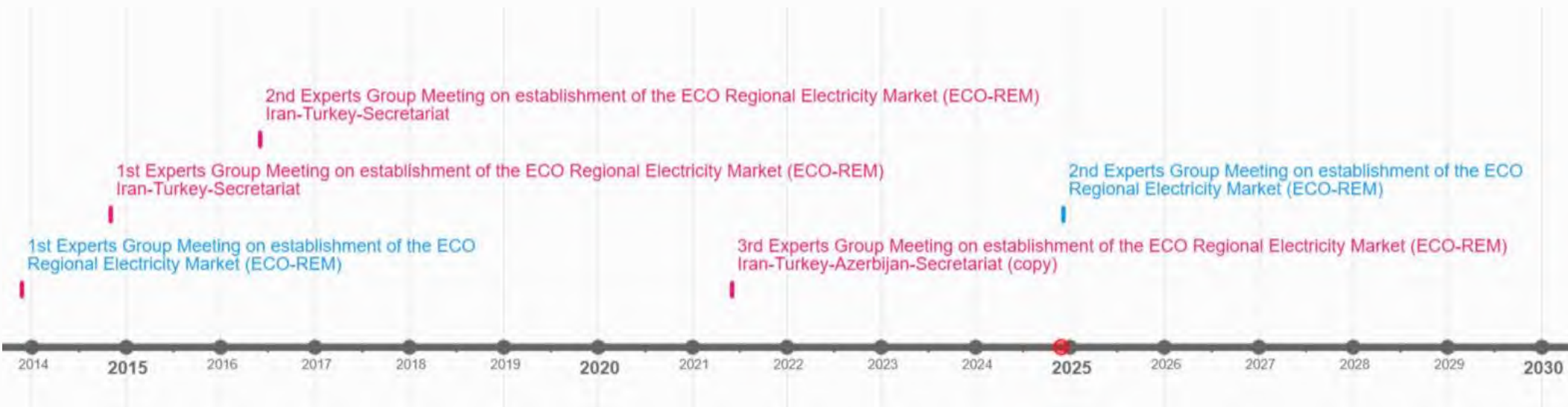
The issue of the establishment of the ECO Regional Electricity Market was addressed by representatives of Iran at the 3rd ECO Summit of Energy Experts held in Tehran in June 2015.

In May 2016, the second bilateral meeting between Iran and Turkey was held in the presence of the ECO Secretariat in Shiraz. At the end of the meeting, it was agreed that the ECO Secretariat would coordinate the views of both countries on the criteria, specifications, and method of selecting three advisers (one Iranian consultant, a Turkish advisor and an international consultant) to conduct feasibility studies for the launch of the ECO regional electricity market by the end of June 2016. Based on the views expressed by Iran and Turkey, the ECO Secretary-General accepted the approval of \$ 50,000 to finance part of the study.

The ECO Secretariat has been seeking international partnerships and international agreements to provide technical and financial support to the ECO REM Project, and has agreed on an agreement on this issue. ECO, in partnership with Energy Charter, on the sidelines of the Twenty-third World Energy Congress in Istanbul (2016), hosted a panel discussion about ECO Electricity Market.

3rd Experts Group Meeting on establishment of the ECO Regional Electricity Market (ECO-REM) Iran-Turkey-Azerbaijan-Secretariat In this meeting, it is requested that the updated ToR of the ECO Regional Electricity Market project be finalized and approved by the representatives of Iran and Turkey in a virtual expert meeting.

ECO Regional Electricity Market (Meetings)



OPERATIONAL AGREEMENT

IRAN GRID MANAGEMENT COMPANY (IGMC) and
TURKISH ELECTRICITY TRANSMISSION CORPORATION (TEIAS)



Operational Agreement

- 1. General
- 2. Technical Equipment
- 3. Ownership and Operational Boundaries
- 4. Operation
- 5. Operational Control
- 6. Equipment Maintenance
- 7. Protection and Automation Devices
- 8. Metering Equipment for Accounting
- 9. Telecommunication
- 10. Telemetry
- 11. Real time data exchange
- 12. Cross-border Capacities and Allocation
- 13. Scheduling
- 14. Accounting and Settlement
- 15. Limitation and Suspension of Electricity Transfer
- 16. Disturbances During Operation 86
- 17. Emergency Supply in case of Severe Disturbance for Power System Restoration

1. NTC allocation procedures on the 400 kV OHL Van BtB (TR) - Khoy SS (IR) shall be decided after the signature of this Agreement.

Terms of Reference (ToR) for establishment of ECO Regional Electricity Market

The Secretariat of the Economic Cooperation Organization (ECO) with reference to Paragraph 10 of 'Sector C: Energy, Minerals and Environment of the Work Program 2017' of the 27'h Meeting of ECO Regional Planning Council(Tehran, 5-8 December 2016) and the feedbacks of the concerned authorities of Iran and Turkey in line with Paragraph 16 of the Report of the 2nd Iran & Turkey Bilateral Meeting, on establishment of ECO Regional Electricity Market (Shiraz, 10-11 May 2016) enclose Terms of Reference (ToR) for hiring international and local consultants for preparation of a Feasibility Study on establishment of ECO Regional Electricity Market.

Terms of Reference (ToR) for establishment of ECO Regional Electricity Market

Objectives

The objectives of this feasibility study are to:

- Study prerequisites and existing conditions in the ECO region for the establishment of ECO Regional Electricity Market through harmonizing and merging the electricity markets of Iran and Turkey with the possibility of further expansion to the other Member States, assessment of risks involved, consideration of legal arrangements and supportive documents;
- Advise the ECO Member States on the optimal approaches to increase electricity trading via forming relevant trading arrangements, possibilities for capacity building and enabling framework, institutional enhancements, improving policy and regulatory environment;
- Determine of line routing, control scheme, project cost, implementation plan, functional specifications, operations and maintenance plan and associated risks.
- The information and recommendations of the feasibility study should be useful to the policymakers at the regional level as well as at the level of member states, both in pursuing region-wide initiatives and in negotiating specific trading and investment deals.

Terms of Reference (ToR) for establishment of ECO Regional Electricity Market

The Scope of Work

- ✓ The study will entail a descriptive part depicting the current state of affairs and a definitive roadmap on the establishment of ECO REM, to be prepared through the necessary technical and economic input data for achieving objectives.
- ✓ The Consultants will thoroughly explore/ weigh up the alternative ECO regional electricity markets and their attendant features (technical, commercial, organizational, institutional, regulatory, etc.). The study should contain in-depth Survey Of the possible evolution of the electricity markets from the simpler ones (bilateral cross-border trade between Iran and Turkey) toward integrated multi-country markets. Based On this Survey, the Consultants will suggest the most appropriate arrangements for the current energy trade picture of the ECO Region and its possible evolution.
- ✓ The economic component of the study will envisage the analysis of investments needed for implementation of the establishment of ECO-REM. The study will also identify the costs of reinforcements in the interconnection lines and internal systems in order to ensure reliable energy exchanges and transits in all involved power systems. The study will further estimate the feasibility of power exchanges and transits through the ECO Member States power systems.
- ✓ The study shall cover technical as well as economic evaluation of alternative electricity markets with different exchange capacities, voltage levels and Alternative Current/Direct Current (AC/DC). Alternatives shall be ranked on techno-economic merits.

Terms of Reference (ToR) for establishment of ECO Regional Electricity Market

The Scope of Work

- ✓ Risks and risk mitigation in the electricity market and investments. International electricity trading projects include a number of stakeholders like sellers and buyers, donors/investors, governments, national utility providers and regulators, power off-takers, lenders and insurers, construction contractors, non-governmental organizations, the general public, etc.
- ✓ The study will take into account the fact that risk mitigation arrangements depend on the legal, policy, regulatory, institutional, and commercial environment, and vice versa – the latter could be designed so as to facilitate risk mitigation.
- ✓ The study will describe how risks are managed -- identified, assessed, allocated, and mitigated -- in international electricity trade projects; how the associated contractual and institutional framework documents are designed as a function of the trading arrangements *between* and *within* the electricity markets; and how the projects are structured to mitigate the risks. The study will describe the main elements of project arrangements and associated contractual and framework documents. The study will address all important risks, with a particular focus on those specific to international electricity investment and trade projects, bilateral and multilateral. The study will recommend future options for structuring international electricity projects in the ECO region.

Terms of Reference (ToR) for establishment of ECO Regional Electricity Market

The Scope of Work

- ✓ The study will outline typical set of legal documents for an international investment project in the electricity sector, including their coverage (concession agreements between the government(s) and developer(s); transit agreement; shareholder agreements between the shareholders; power purchase agreements; operating agreements; guarantee agreements; construction contracts; etc. – this list is not exhaustive and depends on the overall framework for trade – bilateral or multilateral, or in a more integrated regional market, with or without an intergovernmental framework agreement).
- ✓ Role of the public and private sectors and options for financing/funding. The study will examine the role of the public and private sectors and options for public-private partnerships (PPPs) promoting regional electricity trade and investment, from creating an appropriate enabling environment to undertaking specific projects, and how PPPs could stimulate trade through sharing of benefits and risks. Elements of such partnership could include intergovernmental framework agreements with appropriate institutional arrangements which would enable private sectors to finance investment projects and enter into commercial contracts. The governments could also play a significant role at the project level, especially in such aspects as mitigating the environmental and social impact, guaranteeing the performance of national utilities or national regulation, providing concession for the development of a resource, etc.
- ✓ Options for financing electricity market projects. The task of establishment of ECO REM is quite challenging and is not limited with only following policy recommendations and roadmaps. Financial support from international financial institutions is essential to undertake complex and ambitious multinational projects. The study will describe options for financing electricity market projects, in the context of risks mitigation strategies (including financial risk mitigation instruments), and the role of the private sector in this context. The study will focus on the options which could be of particular interest in the ECO Region context

Training course

IREMA and IGMC experts are experienced in holding tutorial courses. A well contented curriculum has been defined, covering all subjects relevant topics. Each level will takes (7-10) day workshops including some social & recreational events. Experts and elites lecture the topics that are related to their professional field.

- Restructuring in Electricity Industry
- Market Structures Including Roles, Responsibilities, and Interconnections
- Reduction of energy losses
- Energy saving and efficiency
- Power distribution planning and load management forecasting for periods of surplus and shortfall
- Power system Planning, design and development
- Power system stability study (Including Dynamic, Transient, Frequency and Voltage stability)
- Power system operation and maintenance

Training course (2)

- Supervising of the Power system operation and maintenance
- Installation, testing and commissioning of high voltage lines and stations
- Special Protection Schemes
- Frequency Control
- Reactive Power Control
- SCADA(Telemetry, Communication, Engineering)
- EMS(Energy Management system)/WAMS
- Power system Analysis
- Maintenance Planning (Day and Year ahead)
- Load Forecasting
- Energy metering system
- Energy Efficiency

Thanks for your kind attention