

The Potential Role of the North-South Corridor for the Development of Trade between Middle-East and Caucasus



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What are the main characteristics of Caucasus and Middle East regions



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Interconnection Potential Benefits



Technical Benefits

*Reliability improvement
Reserve Sharing
Frequency Control*



Financial benefits

*Generation cost savings,
Non-supplied energy reductions,
Generation investment cost savings.*



Environmental benefits

*Possible reduction of GHGs
Increase the share of renewable energies*

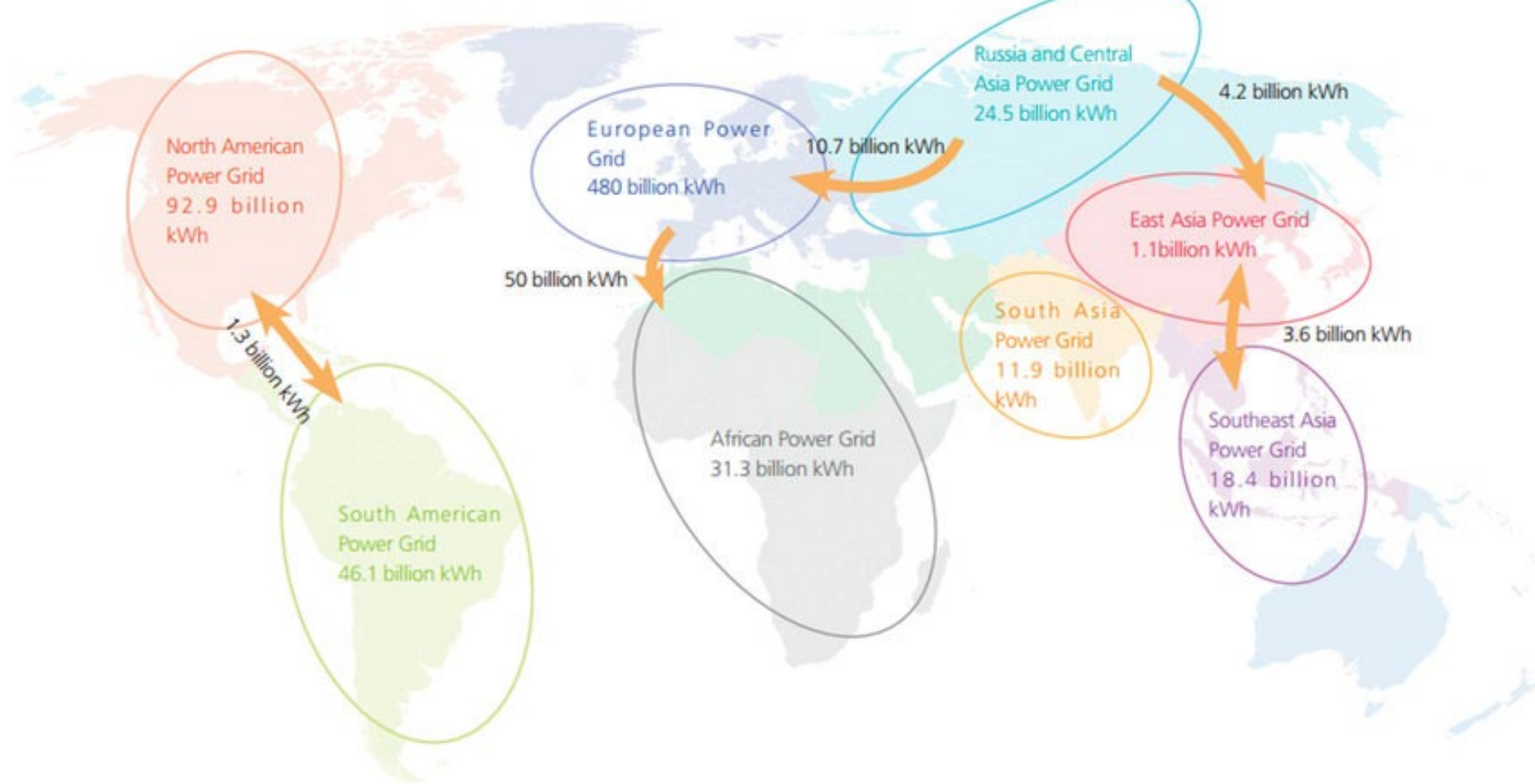


Strategic benefits

- *Increased security of supply and competition benefits.*
- *Regional Sustainable development*



Global interconnection View in Recent Years



Reference: IET-Wiley Virtual Symposium on Renewable Energy, 2022

Allocation of Clean Energy Resources



Ref: Global Energy Interconnection, IEC White Paper

Among other advantages, interconnections help the power system to take advantage of load profiles diversity among:

- time zones,
- different seasons, and
- different load patterns,

The study of CIGRE working group (C1.44) considers 22 regions to use more precise values for the potential capacity factors of wind and solar, and also the implementation of additional links between the considered regions.

Potential Interconnection Corridors



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- time zones,
- different seasons, and
- different load patterns,

The two most important regions in this classification are:

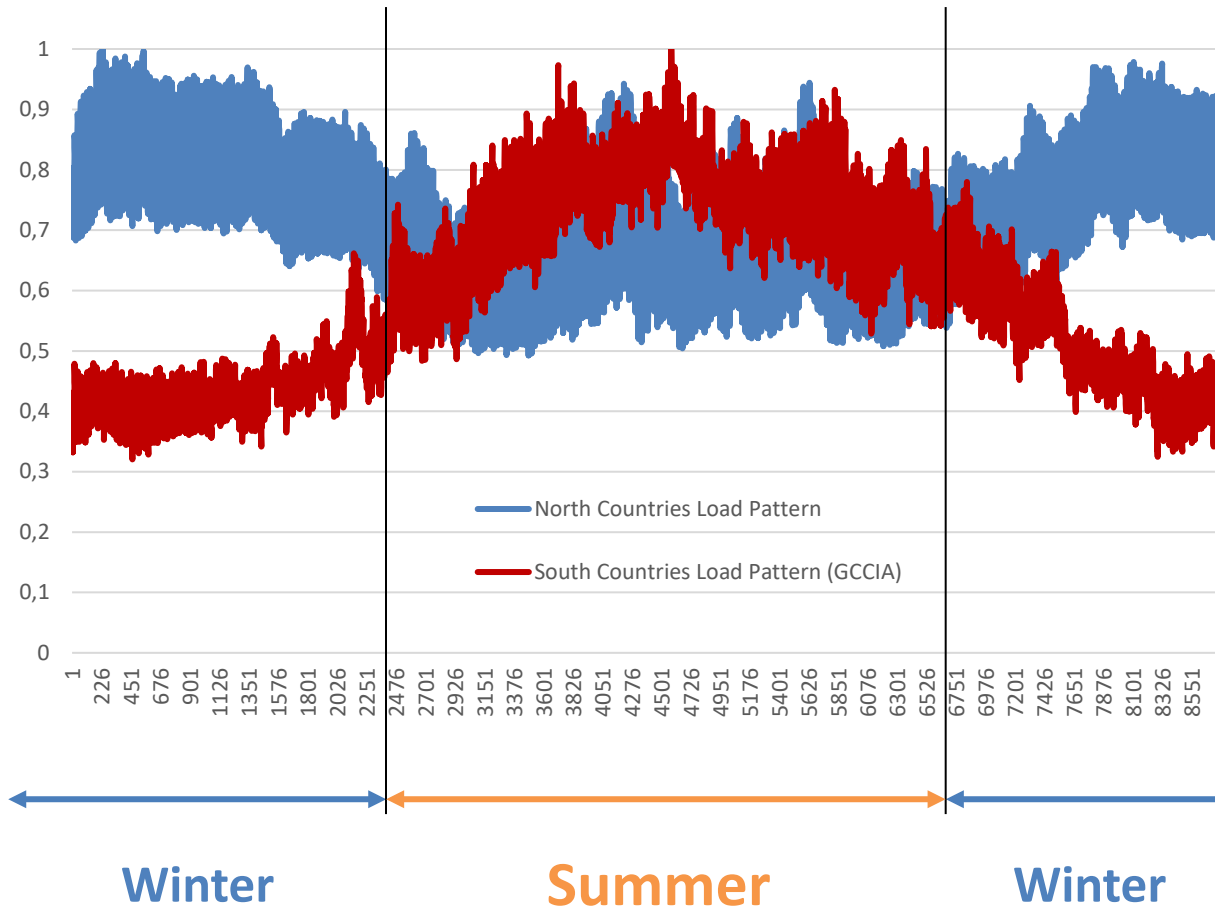
- Middle East (12)
- Western UPS (13)

The study of CIGRE working group (C1.44) considers 22 regions to use more precise values for the potential capacity factors of wind and solar, and also the implementation of additional links between the considered regions.

Load Pattern of Persian Gulf Countries Vs. Caucasian Countries

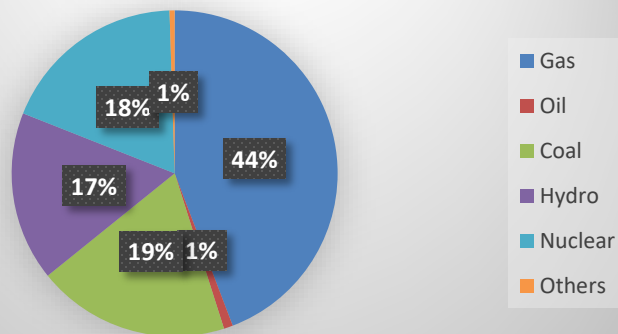
Firstly: The difference between the load patterns of Middle Eastern countries Vs. Caucasian and Central Asian countries provide a trade potential for transfer of power from:

- South to North in winter
- North to South at summer

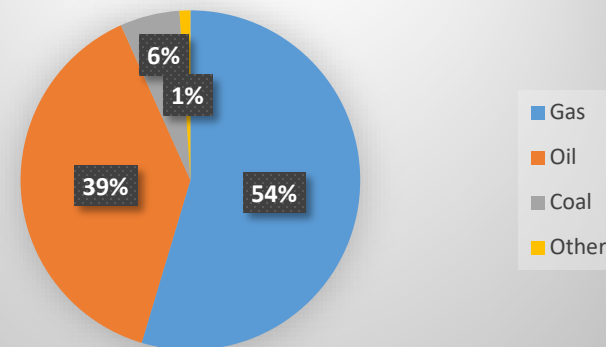


Energy Source diversity in Electricity Generation

Caucasus and Central Asia



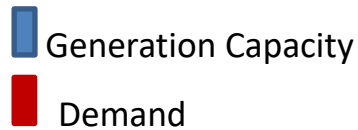
Middle East



Source: International Renewable Energy Agency

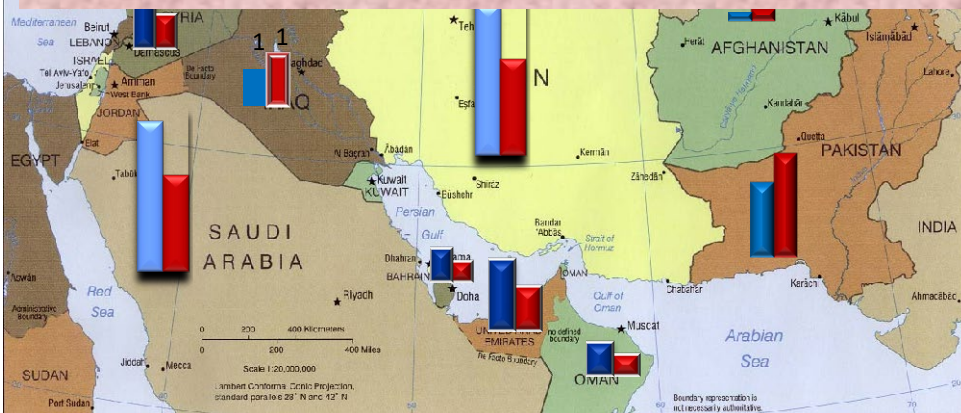
Secondly: Electricity Generation Mix in Caucasus and Central Asian countries is different with the Middle Eastern Countries which can be an incentive for these regions for seasonal trades of electricity.

Energy Balance in the Region



Thirdly: Considering generation capacity and

North- South Corridor can bring a brilliant potential for electricity trade between Caucasus and Middle East regions! er ones which have generation surplus.



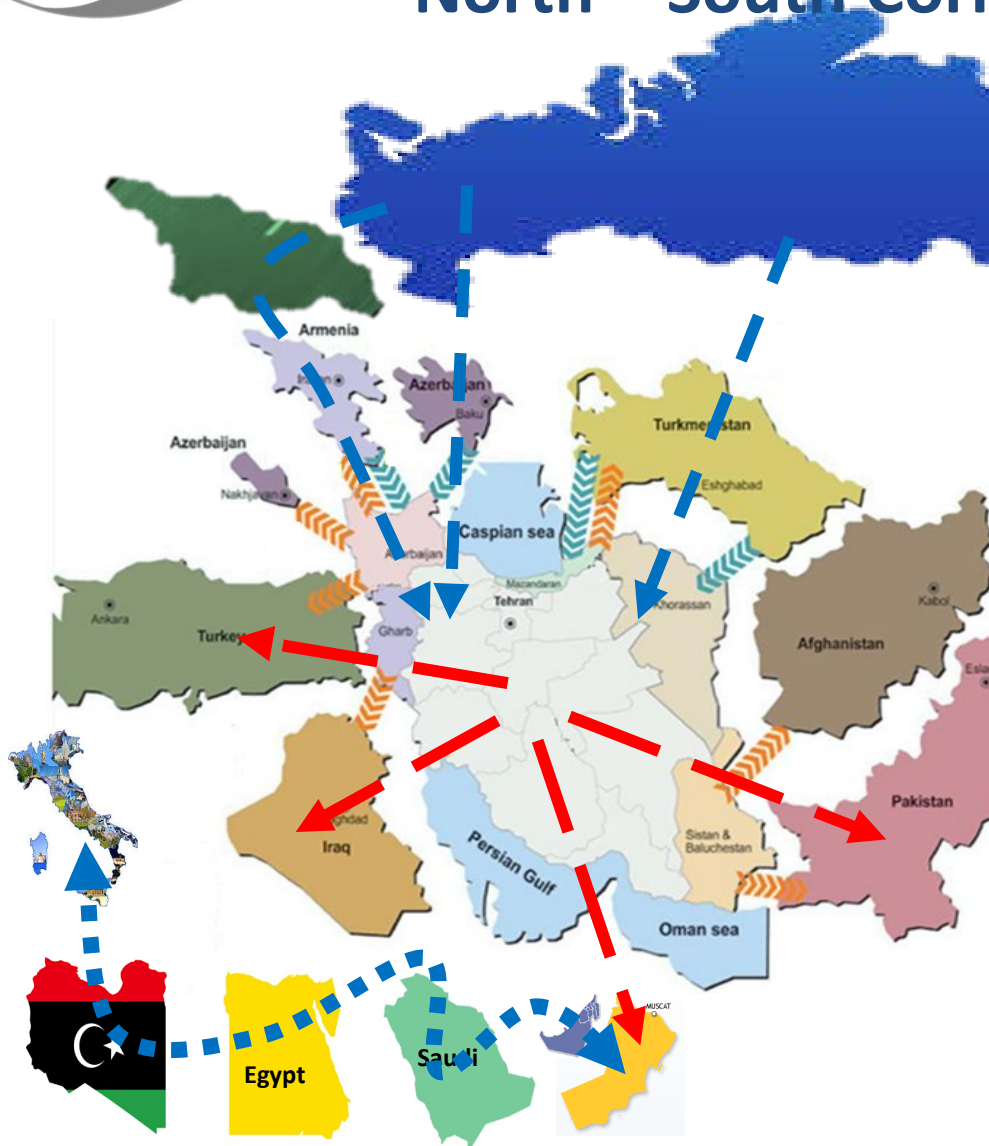
Russia Trades of Electricity

On the other side, Western UPS as a part of Russian power grid has numerous interconnection networks with its neighboring countries such as:

- Finland
- Estonia
- Latvia
- Belarus
- Ukraine
- Georgia
- Azerbaijan
- Etc.



North – South Corridor Options



❖ North- South Corridor can be completed via the following links:

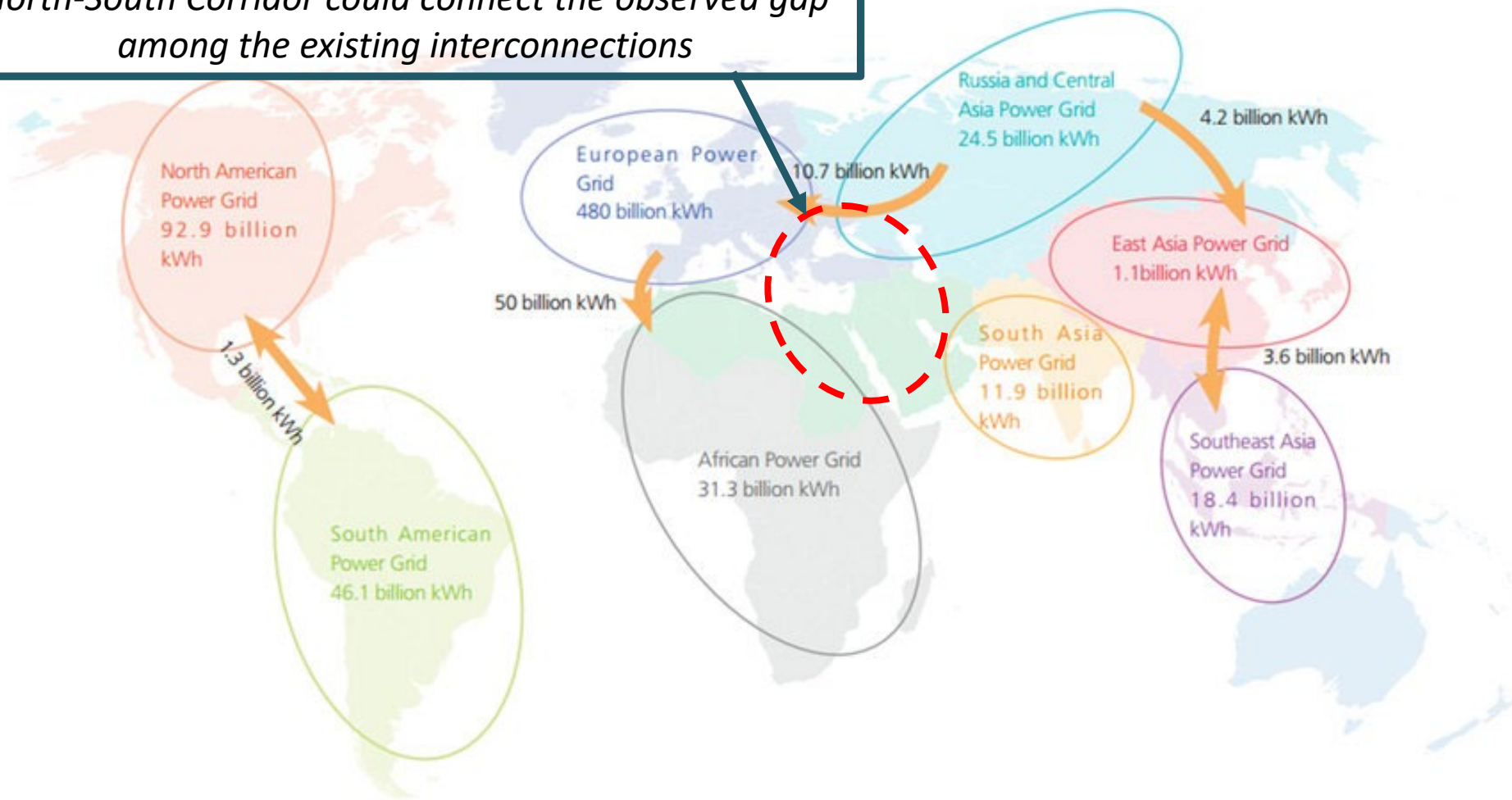
- Russia- Turkmenistan- Iran
- Russia- Georgia- Armenia- Iran
- Russia- Azerbaijan- Iran

❖ This corridor can be completed via interconnection to central and south Asian countries like Afghanistan and Pakistan, Persian Gulf countries such as Oman and Qatar and other middle east countries like Iran and Turkey.

Concluding Remarks & Recommendation

Global interconnection View

North-South Corridor could connect the observed gap among the existing interconnections



Trade between Middle-East and Caucasus via North-South Corridor



Countries with Studied Interconnections with Iran

- Oman is connected to the Persian Gulf countries already creating an opportunity to connect to these countries. The feasibility study for a submarine HVDC interconnection has already been completed between Iran and Oman.

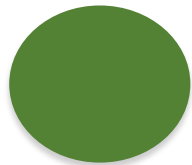


Potential Future Countries to be Interconnected

- Through the Persian Gulf connection, potential exists for connecting to Africa where some of the fastest developing countries reside and also an alternate route to the south of Europe through Libya and Italy.
- The interconnection with Turkmenistan and Afghanistan can provide access to Tajikistan, Uzbekistan, ... while can also ultimately lead to a connecting to China as



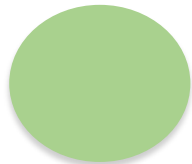
Potential Access to New Markets via North-South Corridor



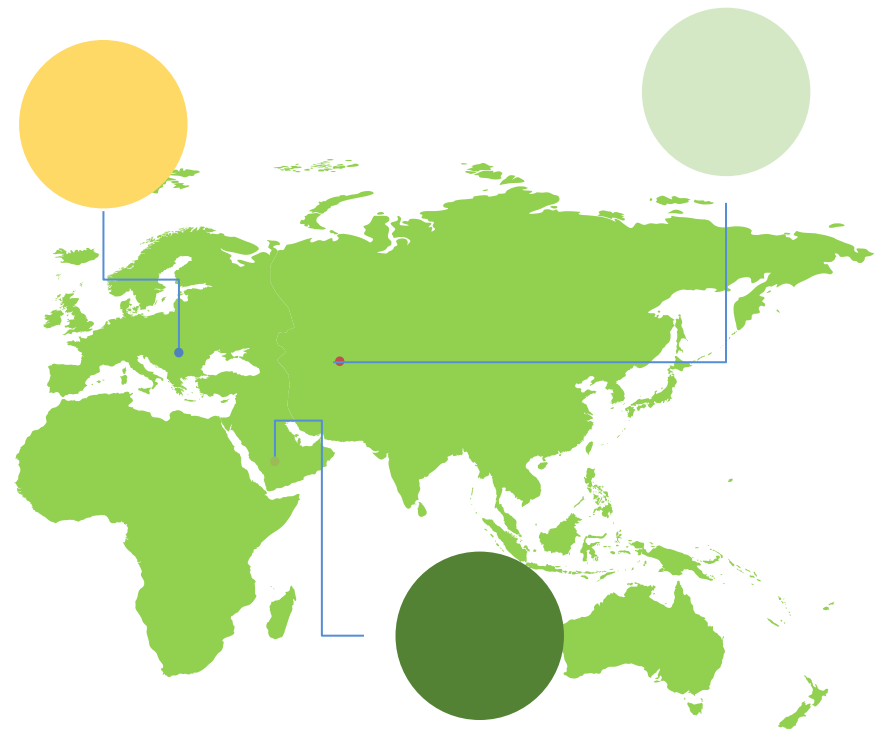
Connect to Persian Gulf Countries and developing countries such as Iraq.



Connect to African Countries through Egypt and an alternate route to South Europe through Libya.



Connect to Central Asian countries and developing countries such as Afghanistan and Pakistan.

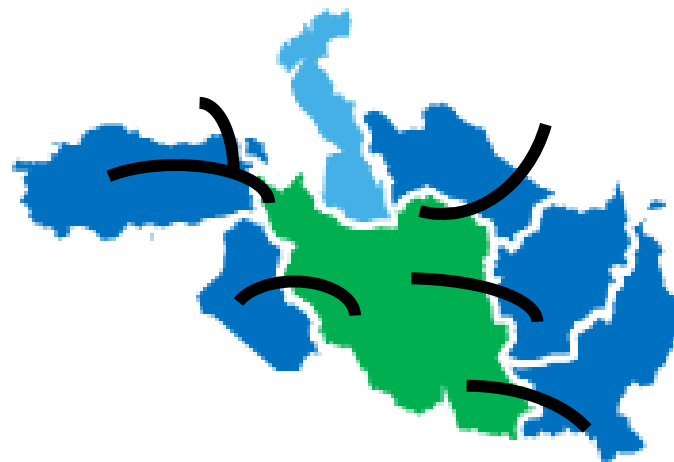


Potential Access to New Markets by North-South Corridor

Countries with Existing Interconnections with Iran

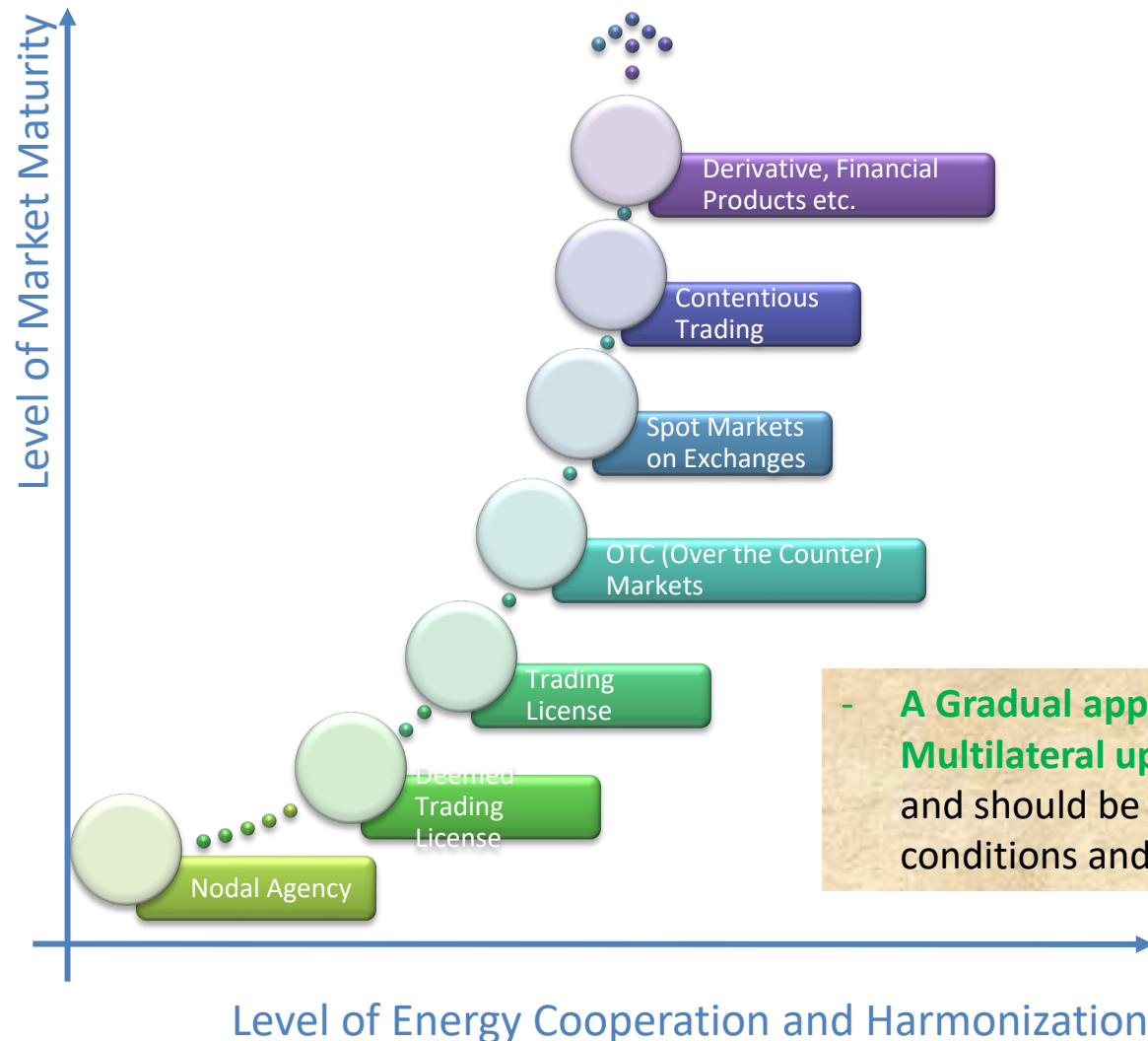
- Through existing interconnection, Iran can provide connection to the electricity markets of Iraq, Turkey, Turkmenistan, Afghanistan, Armenia, and Pakistan.
- Most of the countries are developing countries with huge potential for GDP growth in the coming years that would require fast demand growth creating the opportunity for export.
- Iraq, Afghanistan, and Pakistan have a peak demand that occurs in summer when additional generation capacity exists in countries such as Russia.
- The northern-southern corridor could connect countries in the south in warmer climates with the northern countries in colder climates also has the potential to significantly allow trade due to the difference in peak demand times.

Iran as a gateway towards lucrative markets



Interconnecting the countries with different seasonal load shapes. This will create an opportunity for electricity swap.

Gradual Development of a Common Electricity Trade Framework



- **A Gradual approach- from Bilateral to Multilateral up to regional trading** is necessary and should be followed given different conditions and local constraints

Gradual Development of a Common Electricity Trade Framework



- **A continuous recursive procedure should be conducted** to enhance market maturity and develop electricity trade cooperation.

Other Key Recommendations

- **A Gradual approach- from Bilateral to Multilateral up to regional trading** is necessary and should be followed given different conditions and local constraints
- **Political Support is needed** for realization of interconnectors
- **Bilateral energy trading – the market model** for energy trading and using transmission capacity **should be as simple as possible**, especially in early stages of interconnection operations. Therefore, the starting point could be based on the use of **bilateral contracts in the form of PPA** between countries , plus relevant arrangement for transfer capacity
- **Regional market model-** the regional market model **in a mature restructured power system** would see the **coexistence of bilateral energy trading and short term energy transactions on a spot market** where the various market agents (seller, purchaser, traders) operate
- **Regional Institutions should be promoted and created**, in the form of regional Energy Committee, with tight operational links with the involved TSOs and utilities
- **Regulatory harmonization-** While some national reforms will be needed, regional rules should minimize interference with domestic policies.



Questions & Discussion