Transition Through Gas – a Smart Market

ECO-Caspian Energy Cooperation

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Flame

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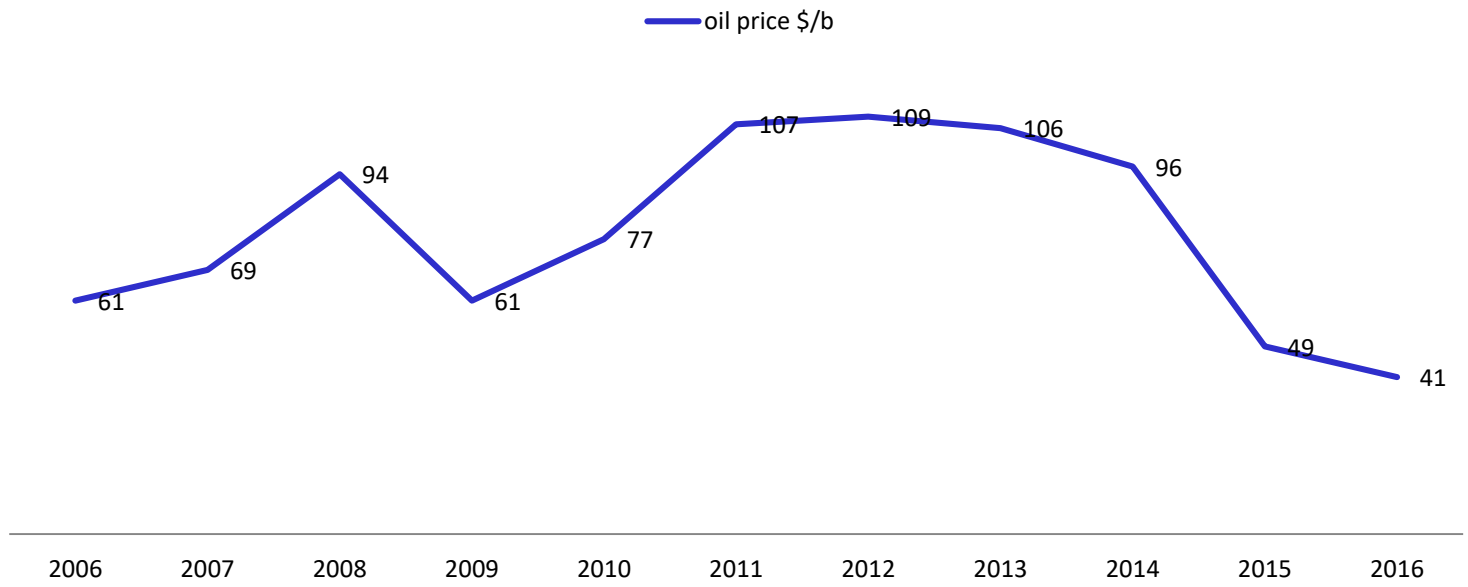
Setting the Scene

Average Oil Price
2006: $61
2007: $69
2008: $94
2009: $61
2010: $77
2011: $107
2012: $109
2013: $106
2014: $96
2015: $49
2016: $41



Peak Demand - '*Stone Age did not end for lack of stones & Oil Age will not end for lack of oil*'

Energy Intensity - Producers are caught between an Immovable Object of capped price & Irresistible Force of rising energy cost of production - Energy Return On Energy Invested (EROEI)

Transition through Gas - $Trillions are needed post-COP 21 to transition to a low carbon economy.

How is this achievable?

Iran's evolving Energy Policy

- 1997-2005 – Khatami Administration – Pragmatism “Whatever Works”
  - Substitution – Gas frees oil for export
  - Keep it Local - domestic value capture
  - CNG commercial transport & gas feedstock for petrochemicals
  - Energy Swaps – Caspian Oil Swap & Armenian Gas for Power
- 2005-2013 – Ahmadinejad Administration – Kleptocracy
  - Looting - 'justice shares', corrupt loans, 'Jobs for the Boys' (bureaucracy trebled in size)
  - Unintended Consequences - US financial sanctions actually prevented economic collapse
- 2013-2017 – Rouhani Administration – Economic Engagement
  - Dollar Economy – Trump administration has now rejected Iran
  - Euro Economy - EU lends Iran Euros to finance over-priced technology & create PetroEuro
  - Resource Sovereignty - conflict between Reform & Resistance
- 2017-2021 – Next Administration
  - Resource resilience
  - Smart – least resource cost
  - Keep it local

Keep it Local - Oman Gas Pipeline Project Operational by 2020

Following meeting between Iran's Petroleum Minister Bijan Zanganeh and Oman's Oil and Gas Minister Mohammed Bin Hamad Al Rumhy in Tehran regarding the gas pipeline project for exporting gas to Oman, Iran's SHANA news agency reported that the representatives from several global energy companies had also participated in the meeting to present their proposals for carrying out the project. The companies included France's Total, Royal/Dutch Shell, South Korea's Korea Gas Corporation (KOGAS), Germany's Uniper and Japan's Mitsui.

Based on an agreement signed in 2013, Iran will export 28 million cubic meters of gas to Oman per day for a period of 15 years through a pipeline that will go to the sultanate through the Persian Gulf.

Almost a third of the gas exported by Iran to Oman will be turned into liquefied natural gas (LNG) in the sultanate's Qalhat plant, and the rest will be consumed domestically. (Saturday, Feb 11, 2017:Iran)

Keep it Local - Iran/Iraq Co-operation

Minister of Petroleum Bijan Zangeneh and his Iraqi counterpart Jabbar al-Luaibi signed Memorandum of Understanding (MOU) on cooperation in different fields of oil and gas on Monday at the end of their negotiation.

Issues such as development of oil and gas fields in common borders, exporting engineering and technical services, exporting goods and cooperation in the field of petroleum and derivatives were mentioned in the MOU, Iran's SHANA news agency reported.

Rendering help to rebuild infrastructures of Iraq oil and gas refineries by Iran were also mentioned in the MOU.

The two petroleum ministers also reached agreement on exporting Kirkuk oil through a pipeline, which passes from Iran's territory and it is due that an international consultant to be introduced for its technical and economic justification.

Granting university scholarships to Iraqi students to study in upstream oil and gas courses were also among other issues in the MOU.

The two sides agreed to establish a joint committee to follow up taken decisions and agreements.

Zangeneh, heading a high-ranking delegation, arrived in Baghdad on Monday 20th Feb. morning and held talks with Iraqi oil and energy ministers concerning bilateral cooperation.

Wednesday, Feb 22, 2017

Smart Trade – Iran provides oil, EU provides energy technology & services

Eurostat February figures show 2016 Iran exports to EU at €5.494 billion compared to €1.235 billion in 2015 as Iran resumed oil exports to EU following the nuclear deal.

More than 50 European companies and business associations and some 40 Iranian energy companies participated at the Tehran forum.

(Canete) Following the nuclear deal, "we established a dynamic energy partnership. Now we want to take this success story one step further. The energy sector will feature prominently in our future relations and we are committed to fully tap into its economic and social potential while contributing to achieving our climate commitments"

Miguel Arias Canete
European Climate Action & Energy Commissioner
Iran-EU Business Forum on Sustainable Energy – Tehran, April 29, 2017

Question: how can the Smart Trade be financed?

Smart Market – Resource Resilience

Resilience – the ability to adapt to change

Resource Resilience

Organising Principle (least resource cost) for a given amount of energy as a service (heat/cooling, mobility, power) minimise consumption of energy as a commodity

Economic Rationale – the more expensive finite resources (water, fossil fuels) become the more profitable it is to save them

Caspian Energy Grid – market model developed to achieve resource resilience by

Petro Scotland (UK company)

Iran Chamber of Commerce Industries, Mines & Agriculture (ICCIMA) Education & Research Institute

Research Institute for Energy Management & Planning (RIEMP) - University of Tehran.

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ICCIM Education and Research Institute

Research Institute for Energy Management and Planning (RIEMP)

Smart Market – Resource Resilience

ECO-Caspian regional electricity market requires *both* a resilient physical energy network *and* a resilient financial market network.

Transition to low carbon economy requires $ or € trillions worth of investment which existing financial market cannot deliver.

This proposal is for 'Smart Market' energy institutions/frameworks, instruments and grid which are *complementary* to existing infrastructure

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Smart Market – financing & funding Caspian Energy Grid

Production & Cost Sharing – *Energy Swaps*
Producers & Consumers (i.e. Iran & Turkey) allocate an agreed % age of Grid energy flow to:

Technology (IP) Costs - Technology/Energy Swap

Operating (People) Costs

Risk Sharing – *Energy Credits*
Grid Investment through producer-issued energy credits/promises - "Energy Loans"

Energy Credits issued by one producer are accepted in payment by another

Producers, Consumers, Investors share risk by mutual guarantee (P & I Club)

Administration, Accounting & Risk Management by Service Provider/Grid Operator

Smart Market - Energy Swaps

Energy Swap
An Energy Swap is an exchange of an energy flow for another flow

Location Swap
A flow of energy into one location is exchanged for a flow of energy out of another. eg the Caspian Oil Swap

Category Swap
A flow of energy of one type is exchanged for a flow of energy or value of another type eg Iran gas for Armenian power

Hybrid Swap
A combination of Location & Category Swap eg international Oil for Product Swap Iranian oil exchanged for Turkish oil products, and other goods and services.

Smart Market - ECO-Caspian Energy Swaps

Oil for Products – optimising Kashagan flows

Gas for Power – Turkmen power generation & regional HVDC power supplies

Hydro for Gas – Inter-seasonal swaps between upstream and downstream ECO – Caspian nations

Virtual Transmission - CASS 1000 project

- electricity delivery as local as possible
- geographic swaps replace inefficient, costly & vulnerable long distance transmission

Many more

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Smart Market - Energy Credits

Energy credit

Energy Credit is a promise issued by an energy producer in exchange for value received from an acceptor & returnable in payment for energy supply

Energy credit is not

Debt – holder cannot demand payment of currency (eg $)

Derivative – holder cannot demand delivery of energy

Equity – holder has no ownership of energy flow

Energy credit is

Accepted by promissor in payment for energy supply instead of currency

Prepayment for energy

Smart Markets - Least Energy Cost economic decisions

Energy as a commodity is not the same as energy delivered as a service to users

- People cannot consume raw oil, gas or electricity but they do use and pay for heat/cooling, transport/mobility, light/communications and so on as delivered to their location

- Producer promises (credit instruments) returnable in payment for useful energy are (within a suitable mutual trust agreement) generally acceptable in exchange – which is the definition of a currency.

- Value in exchange of any energy currency varies subjectively by reference to $, € and other central bank currencies – economic decisions in the $ economy are 'least $ cost'

- But in the material world the most energy efficient solution requires an objective 'least energy cost' economic decision

Gas Clearing Union (GCU) & Gas Currency

Currency

Currency - generally acceptable credit instrument (promise)

Bancor – centrally issued currency & International Clearing Union proposed 1944 by Keynes at Bretton Woods

Terra - (Trade Reference Currency) proposed by Bernard Lietaer based on a basket of commodities

Gas Clearing Union

Promises/credits issued by natural gas producers in exchange for value from an acceptor are returnable in payment for gas supplied in the future

Gas credits issued by any GCU member is accepted by all GCU members (Gas Currency)

Risk of non-performance is mutually assured by GCU Guarantee Society

Clearing & settlement, administration, dispute resolution, market standards managed by a service provider

Gas Loans

Investment by prepayment of gas credits refinances $ & € debt to give an energy return

Energy Standard

Unit of Account

Standard unit of measure for value in same way a metre is a standard unit of measure for length

We keep score of costs and exchange transaction prices using a unit of account

We cannot run out of metres and we cannot run out of units of account

However, we can run out of credit & currency priced in a unit of account

Energy Standard

standard unit of energy of generally understood scale which is independent of the type of energy – eg energy equivalent of 10 kWh or energy equivalent of 1 mmBtu or energy equivalent of 1 litre of gasoline

Enables accounting in energy and therefore 'least energy cost' economic decisions

Any conventional 'fiat' unit of account eg $ or € may be set to represent a standard unit of energy in the same way that participating European currencies fixed their unit to the € unit at Euro launch date.

ECO-Caspian Natural Gas energy benchmark

- **ECO-Caspian Balancing Point physical natural gas price in $ applied to all gas entering or leaving the ECO-Caspian gas network**

- **ECO-Caspian Energy Clearing Union guarantees all natural gas and other energy credits**

Smart Market - Outcome

ECO –Caspian Energy Grid – Physical Network

- 'Smart' Grid optimising energy production and use

ECO-Caspian Energy Clearing Union – Financial Network

- ECO-Caspian Energy Clearing Union connects producers directly to consumers through Energy Swaps and Energy Credits

Smart Market

- Most efficiently produced power is always despatched first – ***Smart Market***
- ***Least resource cost – not least $ cost***

ECO- Caspian Energy Grid – Super grid

Gas/ Power Hub

Gas/ Power Hub

Gas/ Power Hub

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Next Steps – Road Map

Step 1/ Foundation
Turkey & Iran in cooperation with ECT/ECO Agreement to create ECO-Caspian Energy Grid/Market

Initiate ECO-Caspian campus of International Institute for Resource Resilience

Step 2/ Concept Research & Development
Create Outline ECO –Caspian Energy Grid/Market Proposal

Step 3/ Pre-Planning
Themed Proof of Concept projects with diverse Public/Private participation

Milestone: Turkey & Iran to Launch Formally the ECO –Caspian Energy Grid/Market

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Shah Deniz Gases Phase 2

Baku

KTIOP

Caspian Sea, Persian Gulf, Sea of Oman, Black Sea, Mediterranean Sea.

Energy for Peace

Neka

Iran is key to 5 Seas Energy Cooperation.

Persian Gas to EU

Tabriz

Caspian Refinery

Tehran

Turkmenistan Gas Pipeline to P.G.

Iran Gas Pipeline via Iraq, Syria, Mediterranean Sea to EU

Western & Eastern Economies requires security of oil & gas supply; Iran & other producers and exporters require security of demand.

Can Energy Cooperation & Diplomacy be Win/Win?

Persian Gulf

Peace Pipeline-

IPI

JASK

Thank you

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Mahmood Khaghani, now retired, had more than 33 years of service in senior international positions in Iran's petroleum industry. He held the position of the Director for Energy, Minerals and Environment at the Secretariat of the Economic Cooperation Organization (ECO) during 1996-2000. He is a graduate in energy engineering at Britain's Surrey University and is a Petroleum- development Strategy advisor (International). Mr Khaghani has participated and presented papers in many international conferences and seminars. He is Advisor to the ICCIMA Education & Research Institute and RIEMP . Mr. Khaghani is Initial Member of IRAEE , http://www.iraee.org/eng/

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