



Islamic Republic of IRAN
Ministry of Petroleum

World Oil & Gas Outlook: Identifying the Key Factors and Driving Forces

Dr. Sajjad Khalili

(Deputy Minister for Supervision on Hydrocarbon Resources)

Dr. Soleyman Ghasemian

(Director General of Asia, Africa & Oceania)

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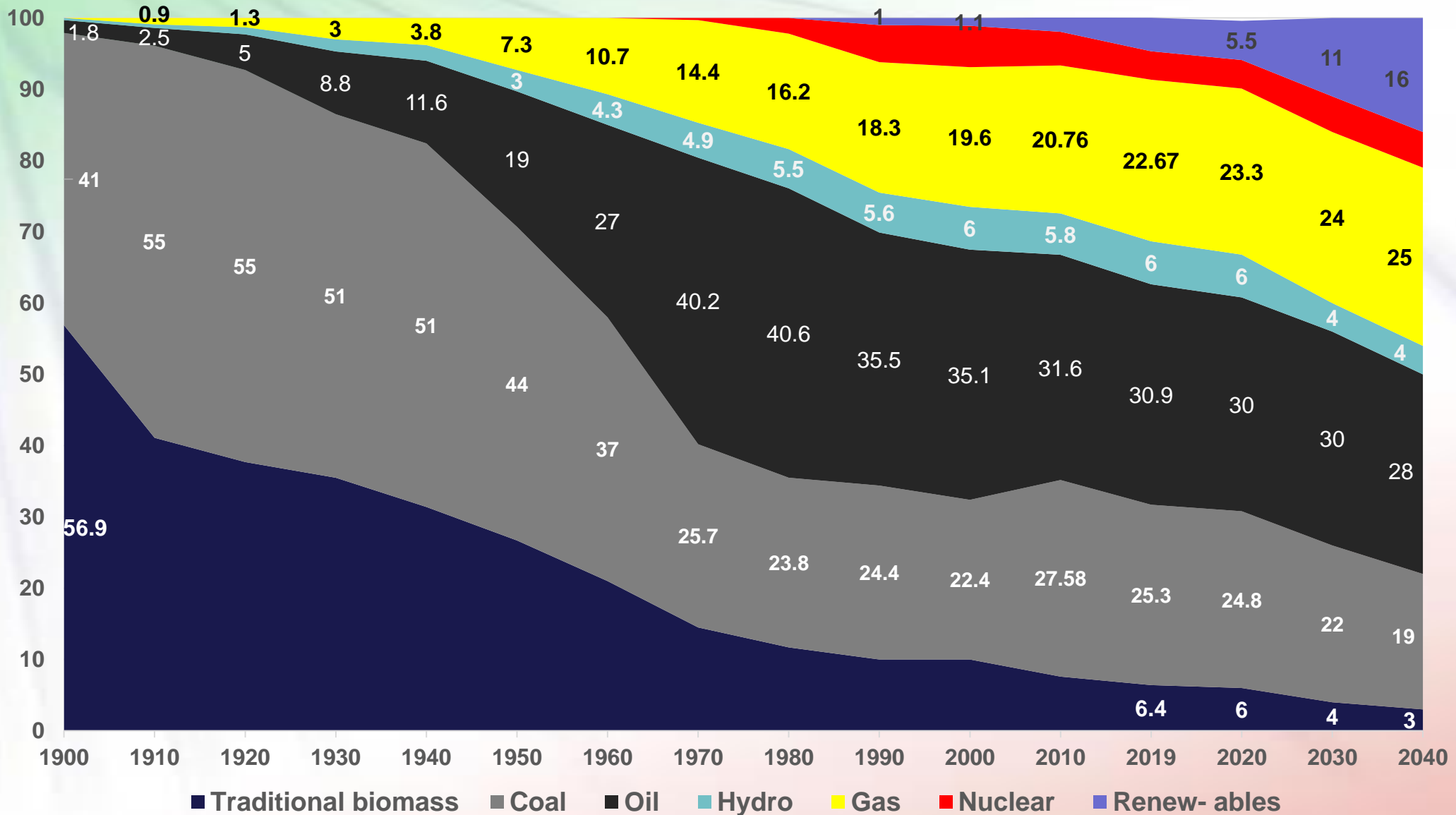
Introduction

- ❑ For decades, long-term changes in the production and consumption of energy resources have been the focus of attention of energy economists.
- ❑ Since the 1970s, the uncertainties existing in energy markets, especially in oil markets, have been of prime practical significance.
- ❑ Given the serious concerns such as security of energy supply, lack of investment in energy infrastructure, climate change, geopolitical tensions, pace of technological developments in renewables, inappropriate global governance and government intervention, limited decarbonization plans, the outlook of global energy markets in the long run is becoming much more sophisticated.

Overview and Key Findings

- ❑ This presentation is based on a study that applies mathematical principles to quantify the rational judgments of an expert panel in social, technological, economic, environmental and political framework.
- ❑ Based on an overview of selected scenarios including IEA, WEC, BP, OPEC, SHELL, ExxonMobil etc., and the academic literature on global energy systems, 40 Key factors are identified.
- ❑ Since the Driving Forces play significant roles in reshaping the world energy future, identifying these key factors of global energy system is the most important and crucial part of a energy scenarios analysis.
- ❑ In the final step, the application of cross-impact analysis identifies 10 driving forces of the global energy system using the MICMAC tool.

Share of Energy Resources in the World Primary Energy Supply 1900-2040



Source: IEA, World Energy Outlook 2021

The Current Situation and Future of World's Primary Energy Consumption

- ❑ Over the past four decades, the world's rapid growth in energy demand has mainly been satisfied by fossil fuels.
- ❑ fossil fuels accounted for 82/1% of world primary energy consumption in 2021 that will reduce to 72% in 2040.
- ❑ The combined market share of oil and gas in the global primary energy mix is expected to remain above 50% till 2045.
- ❑ The forecasts shows that renewable energies will not be able to meet the growing need for global energy neither in the current condition nor in the coming decades.

Outlook for World Oil Demand Up to 2050

Selected Scenarios		2021	2030	2035	2040	2045	2050
opec		95/2	108/4	109/5	109/8	109/8	
IEA	STEPS	92/6	102/4				102/1
	APS		93				57/2
	NZE		75/4				22/8
BP	Accelerated	89/88	95/6	85/4	72/1	59	46/5
	Net Zero		89/7	75/4	55/1	37/2	24/1
	New Momentum		101/1	97/9	91/9	85/9	80/5

Million barrel per day (MB/D)

- ❑ Oil is set to retain the highest share in the global energy mix up to 2050

Outlook for World Gas Demand Up to 2050

Selected Scenarios		2021	2030	2035	2040	2045	2050
IEA	STEPS	4149	4372				4355
	APS	4149	3874				2660
BP	Accelerated	4037	4230/1	3950/4	3606/7	3067/8	2614/3
	Net Zero		3707/4	3042/2	2587/7	2047/4	1681/1
	New Momentum		4433/5	4679/5	4888/1	4992/8	5020/4

Billion Cubic Meter per Year
(BCM/Y)

- ❑ Natural Gas is one of the most important players in the reliable transition period of energy.

Megatrends of the Global Energy System by 2050

- ❑ Concentration of oil and gas demand growth in three regions of Asia (China, India, Indonesia, etc.), Africa and the Middle East
- ❑ Increasing the share of gas and renewable energy in the world's primary energy basket.
- ❑ The leading role of petrochemical industry in the global gas demand growth
- ❑ The leading role of petro refineries in the global oil demand in coming decades.
- ❑ The significant increase in the share of LNG in the global gas trade
- ❑ The continuation of the economic and geopolitical importance of oil and gas in the world in the coming decades.
- ❑ The rapid growth of investment in technologies to improve energy efficiency, carbon emission management, new clean fuels (hydrogen), etc.

Methodology

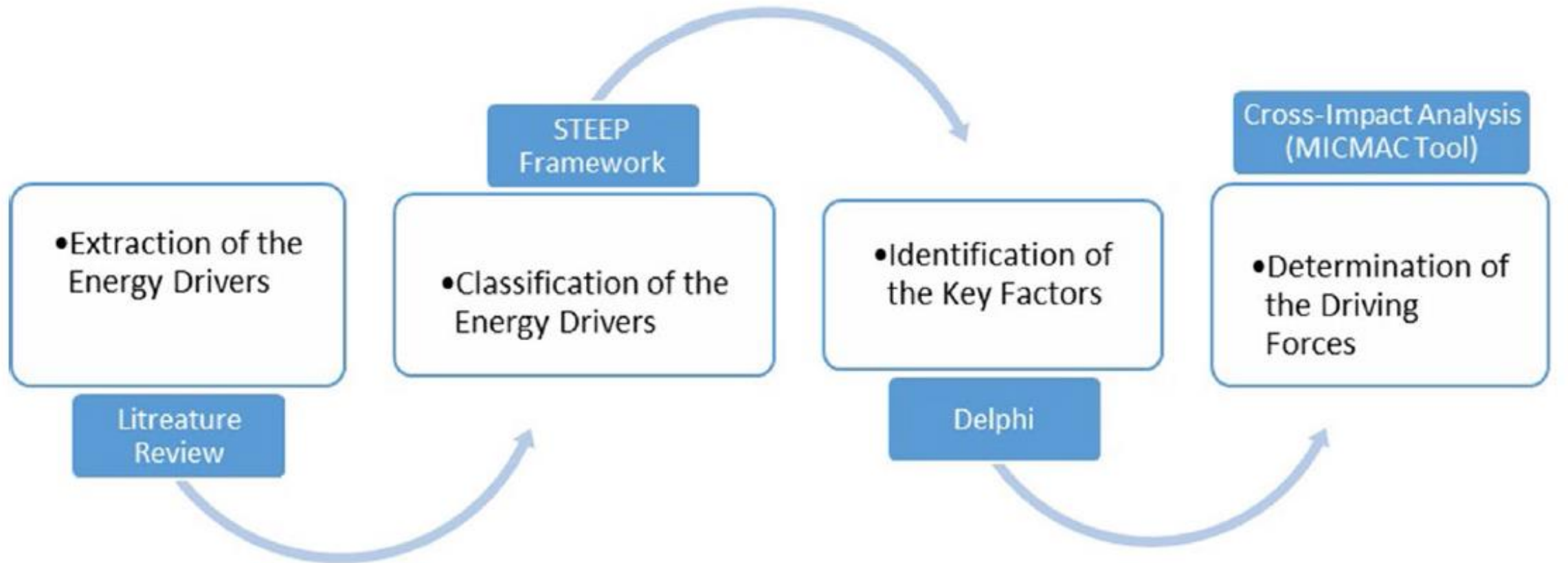


Illustration of our four step method to reach global energy driving forces

The 40 Key factors of Global Energy System

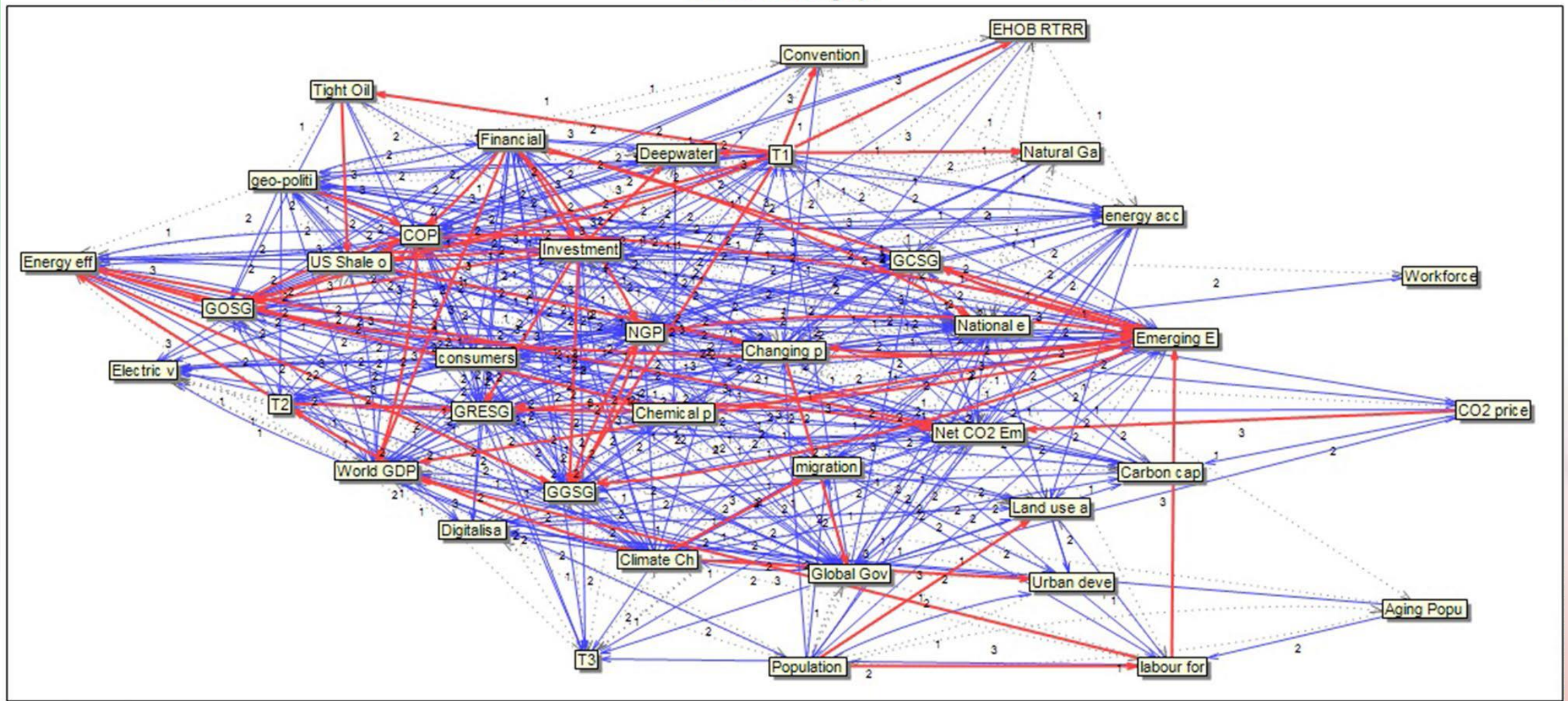
Social	Technological	Economic	Environmental	Political
Population growth	Remaining technically recoverable natural gas resource	World GDP growth	Climate change	Global governance
Aging population	Remaining technically recoverable tight oil resource	Energy efficiency	Net CO ₂ emissions change	National energy policies
Urban development	Remaining technically recoverable extra heavy and bitumen resource (EHOB RTRR)	Investment in infrastructure	Land use and access	Geo-political relationships and tensions
Migration	Remaining technically recoverable conventional crude oil	Financial shocks	Chemical pollution	Changing power blocs (changing <i>P</i>)
Labor force growth	Technology developments in petroleum upstream (<i>T1</i>)	Emerging economies GDP growth (Emerging E)	Carbon capture and storage	
Workforce productivity	Technology developments in renewables (<i>T2</i>)	Consumers behavior		
	Technology developments in nuclear (<i>T3</i>)	Global oil supply growth (COP)		
	Electric vehicles (EV)	Global gas supply growth (GGSG)		
		Global coal supply growth (GCSG)		
		Global renewable energy supply growth (GRESG)		
		Energy access and poverty		
		GDP per capita change		
		Crude oil price		
		Natural gas price (NGP)		
		US shale oil production		
		Deep water shelf production		
		CO ₂ prices		

□ These Key factors has been determined of global energy scenarios in selected international studies.

Identification of the global energy Driving Forces

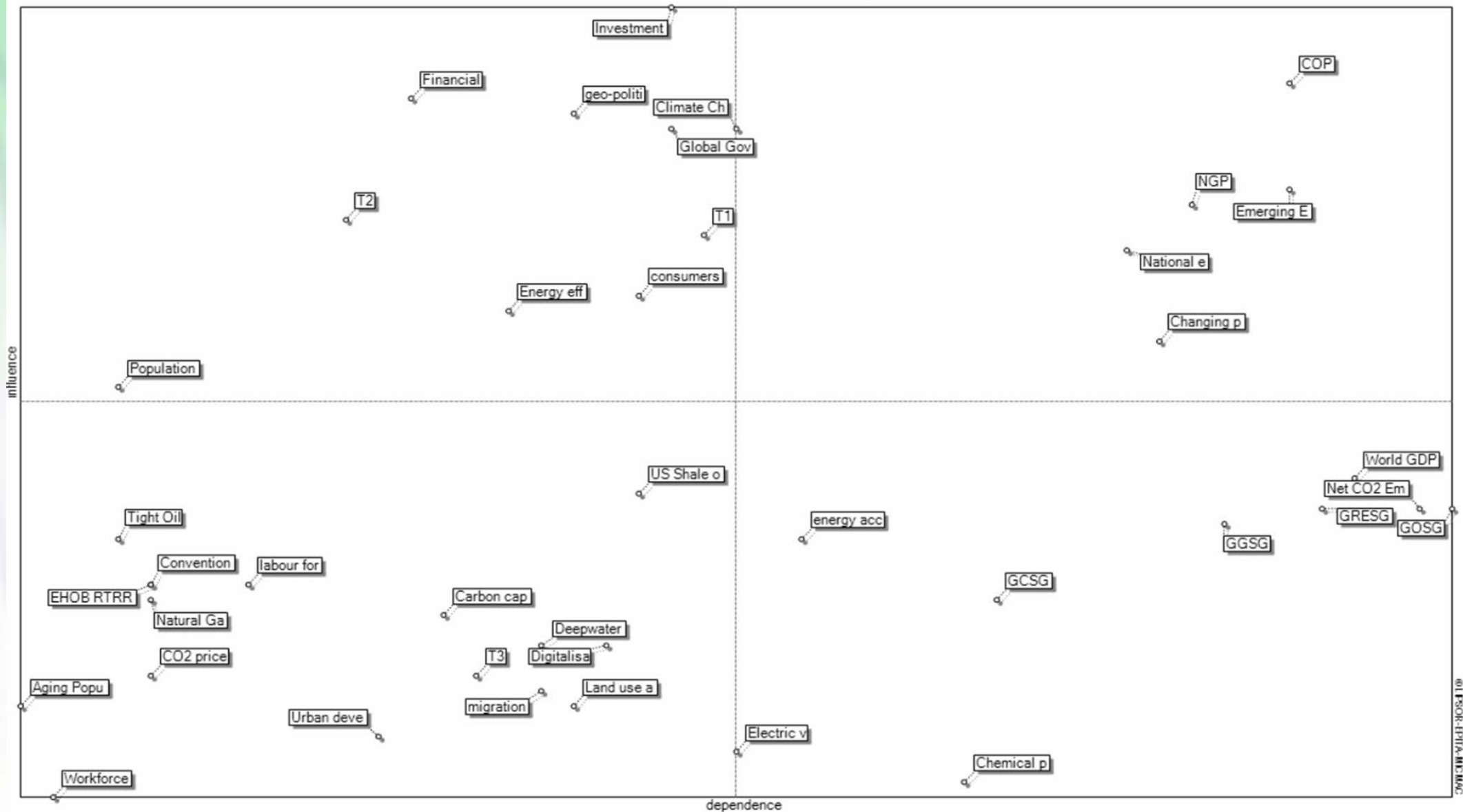
- **Driving forces are the key factors which have strong impacts on other key factors but are weakly affected by the others.**
- **Driving forces represent all variables that can form future energy players individually or through interaction with other factors.**
- **Cross-impact analysis is a method which contains a process of scanning possible futures.**
- **Cross-impact analysis is a scenario design methodological approach in which mutual connection of a set of variables (descriptors) has been assessed by expert judgment.**

The Direct Influences Graph of Key factors



- Weakest influences
- Weak influences
- Moderate influences
- Relatively strong influences
- Strongest influences

The Direct Influence – Dependence Map of Key factors



The 10 Driving Forces of Global Energy System

1. **Consumer behavior, (S)**
2. **Technology developments in renewable, (T)**
3. **Technology developments in petroleum upstream, (T)**
4. **Investment in infrastructure, (E)**
5. **Energy efficiency, (E)**
6. **Financial shocks, (E)**
7. **Emerging economies GDP growth, (E)**
8. **Climate change, (E)**
9. **Geo-political relationships and tensions, (P)**
10. **Global governance, (P)**

Thanks For Your Kind Attention