Energy Crisis and Energy Security

Prof. Hong Chong Cho Department of Economics Dankook University

Dec 1st, 2022

1. Introduction



1. Inflation expansion+Low Unemployment+Recession

Giant Step of Fed

- Highest inflation rate for 41 years = 9.1%
- Energy inflation expansion → food, labor, service, housing cost etc.
- But US's unemployment rate still= 3.7%
- CPI-Effective FFR>0
- Giant Step tackles → demand-driven inflation only
 - \rightarrow No way to restrain supply-driven inflation





Giant Step → Recession

in order to restrain inflation without adjustment of Net-Zero speed

1. King Dollar is back

• US's two advantages of king dollar

- National issue: to control inflation
 - ➢ Back to Philips Curve
- International issue: to drag down oil price
 - > Dragging down oil price \rightarrow to disable Russia's warfare
- Keeping king dollar even though US economy is a little bit impaired
 - > Already mortgage interest rate rises to 7%
 - > Until the unemployment rate reaches 5%







1. Fiscal crisis in EU

• UK's U-turn

- Truss's energy support bill (£200 Bil)
 - \rightarrow support energy bill with fiscal policy
 - \rightarrow reduce incorporate tax
 - \rightarrow contradictory policy
- Concern of fiscal debt → crush in bond market
- Margin call for Pension funds → U-turn
- New prime minister Rishi Sunak has a creative solution?

• German's fiscal support for energy bill

- Too much rise of energy bill
- Energy support fiscal policy = €200 bil
- Defensive shield including a gas price brake and a cut in sales tax for the fuel to protect companies and households from the impact of soaring energy prices
- Same route to UK's fiscal crisis
- No agreement of who will pay the bill?

Stress Scenarios

Government debt is on an upward path without tax rises and spending cuts

- \checkmark UK public debt baseline \checkmark Baseline with historical shocks \checkmark Geopolitical stress test
- 🖊 Higher energy prices: persistent 🦯 Higher energy prices: temporary



Source: Office for Budget Responsibility

Market Verdict UK assets have had a rough ride since Liz Truss took over as prime minister



1. New Cold War

• New paradigm in Energy market

Supply, Demand, and a \$10 Rise in the Oil Price

- demand effect>supply effect → The oil price rised more when US job data released than when OPEC+ declared reduction of oil production
- US no longer depends on OPEC+'s oil supply=> Pursuing strong IRA
- New Cold War surrounding energy: US+Western vs China+Russia+India(?)+Saudi(?)=> EU approaching to China?



US Crude Oil Imports by Country of Origin, 1973-2020

Most US crude comes from Canada

Saudi Arabia
 Venezuela
 Iraq
 Other OPEC Countries
 Canada
 Mexico
 Russia
 Other Non-OPEC Countries



Source: Department of Energy, thousand barrels per day

The world may be careening toward a 1970s-style energy crisis -or worse

"Now we have an oil crisis, a gas crisis and an electricity crisis at the same time," Fatih Birol, head of the International Energy Agency watchdog group, told Der Spiegel in an interview published this week. "<u>This energy crisis is much bigger than the oil crises of the 1970s and 1980s. And it will probably last longer."</u>

INTERVIEW: IEA boss Birol warns of Europe rationing natural gas and oil price surges



2. Dependency of EU on Russian Energy

2. EU's Import goods from Russia



Most traded goods between EU and Russia, 2021

(€ billion)



Note: While the trade balance provides information on the absolute value of trading positions, the cover ratio provides a relative measure that is based on the ratio (expressed in percentage terms) between the value of exports and the value of imports; if exports are higher than imports then the cover ratio will be above 100.

Source: Eurostat (online data code: DS-018995)

The following HS codes were used: 27, 72, 71, 44, 74, 76, 75, 26, 31 Source: Eurostat (online data code: DS-045409)



eurostat O

10

2. EU's trend of energy import

• Rising trends of importing energy

- Decreasing trend in petroleum oil
- <u>Natural gas is increasing</u>
- Coal is decreasing
- Electricity is relatively decreasing

Imports of energy products from Russia, 2011 - 2021

E million											
Product	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Petroleum oils	125 514	134 557	131 446	111 140	70 163	62 255	76 201	86 071	79 115	46 850	70 838
Natural gas	16 545	16 988	17 790	13 424	11 994	7 848	9 465	14 145	12 581	7 780	21 707
Coal	3 585	3 538	3 200	3 116	3 147	3 047	5 170	5 890	4 451	2 782	5 225
Electricity	714	357	311	292	263	281	279	543	614	196	803

Petroleum oils are CN codes 2709 and 2710; natural gas: 27111100 and 27112100; coal: 2701 and electricity: 2716

Source: Eurostat (online data code: DS-045409)

......



EU imports of natural gas from Russia, 2011 - 2021



EU imports of coal from Russia, 2011 - 2021





EU imports of electricity from Russia, 2011 - 2021



2. EU's oil import

• EU's 24% of oil comes from Russia

- Oil exporting to EU(`21): Russia, Norway, US
- High importing from Russia: Lithuania, Finland and so on

Where do EU oil imports come from?

Percentage of European Union's total oil imports, 2021



European countries importing Russian oil

Percentage of country's total oil imports coming from Russia



2. EU's dependency of Russian PNG

• Russia: 40% of EU's natural gas imports

- Top exporting countries: Russia, Norway, Algeria
- Germany is top importing in EU: 43bcm(`20), 52bcm(`21), 50% of German usage
- Italy: 30bcm(`20), 27bcm(`21), 30% of it
- 100% dependency: Hungary, Moldova, Latvia, Bulgaria and so on

Extra-EU imports of natural gas by partner, 2020 and 2021

share (%) of trade in value



Source: Eurostat database (Cornext) and Eurostat estimates

Russia's gas exports

Countries by billion of cubic metres imported from Russia



Source: IEA, Data for 2020

ВВС

Russian roulette

Gas imports, 2021, bn cubic metres



eurostat I

3. The Effect of Russia-Ukraine War

3. EU's structure of natural gas import

• EU's natural gas import=PNG+LNG

- PNG 289bcm+LNG 53bcm
- Russian PNG: 153bcm a year



EU Gas Impor	t Capacity and S	upply by Sou	rce (bcm), 20	21	
Dillion cubic motors	Annual	2021	Spare	Utilization	
Billion cubic meters	Capacity	Flow	Capacity	Rate	
		Pipeline	e Flows		
Russia	276	153	123	55%	
Norway	109	88	21	81%	
North Africa	79	40	38	51%	
Azerbaijan	13	8	5	62%	
Total pipelines	477	289	188	61%	
		LNG Import Terminals			
Spain	69	19	50	27%	
France	43	18	26	41%	
Italy	20	10	10	50%	
Belgium	17	4	13	24%	
Netherlands	14	8	6	57%	
Greece	7	2	5	29%	
Portugal	7	6	1	86%	
Poland	6	4	2	67%	
Lithuania	4	2	2	50%	
Croatia	3	-	-	-	
(as of Dec. 2021)					
Total LNG	187	72	115	39%	
excluding Spain	117	53	64	45%	
Total	663	361	302	54%	
Russia	276	153	123	55%	
Non-Russia	387	208	179	54%	

Source: Bruegel (2022) based on ENTSOG, GIIGNL, GIE, NPD

(as of Dec. 2021) Total LNG <u>excluding Spain</u> Total

GLOBAL LNG HUB

15

3. Russia cut off PNG to EU

- Russia cut off PNG by 7%
 - Russia's resource weaponization
 - Gradually cut off PNG
 - Nord Stream 1 shut down
 - Yamal shut down

The Gas Pipelines Linking Russia and Europe

Major Russian-European natural gas pipelines and theoretical capacities (in billion cubic meters per annum)



Ukraine: actual 2021 flow Source: JPMorgan via The Economist







3. TTF, JKM: historical price jump

• TTF jump as well as JKM

- TTF jumps up historically by end of August
- JKM jumps up too
- Two are synchronized
- 8/30 TTF(\$99/mmbtu), JKM(\$71/mmbtu)
- After then, two prices plunged but higher than average level in the previous years

• US is the last resort

 US takes the last resort for EU's gas supply in charge

Figure 5: Winter Exports and Imports of Natural Gas in the U.S.





3. EU's energy bill skyrocketing

• Surge in energy bill due to gas price

- 10 times more than in early this year
- Future price consistently high up to spring in 2023
- France €1,130/mwh, Germany €995/mwh by August in 2022, UK's planning cap £2,500
- Electricity demand 30% decreases

Energy price cap forecast to rise to £4,650

Annual bill for a typical household on a price capped dual-fuel tariff paying by direct debit



Power Soars



3. Industry shut down

Industry shutdown

- steel makers including Arcelormittal
- aluminium, ammonia, fertilizer and pulp
- Energy consuming industry

Soaring gas prices hit Europe chemicals, fertilizers

Capacities in '000 tonnes/vear put next to product impacted in green, plants colour coded by country, updated on 31 October 2022



Idled steel plants in EU, as of 06.09.2022

SALZGITTERAG **DELAYED START OF THE BLAST FURNACE**

3. EU's energy crisis index

• Energy support and Crisis index

- Energy cost is endurable
- Fiscal spending goes up high portion of GDP
- Energy crisis happen in different way
- Overall very dangerous

Energy Crisis Index | Updated: November 4, 12:00 PM GMT

Performance relative to historical seasonal average:

Worse Better 🛈



Spiraling Costs

European countries are spending billions on energy support

•	1 5	0, 11
Country	Funding allocated (€ billion)	As % of GDP
Malta	1.1	7.7
Germany	264.2	7.4
Lithuania	3.6	6.6
Greece	10.5	5.7
Netherlands	45.3	5.3
Croatia	2.4	4.2
United Kingdom	97.0	3.5
Italy	62.6	3.5
Portugal	7.0	3.3
Luxembourg	2.4	3.3
Latvia	1.1	3.2
Spain	38.5	3.2
Czechia	6.9	2.9
France	71.6	2.9
Romania	6.9	2.9
Bulgaria	1.8	2.6
Austria	9.3	2.3
Poland	12.4	2.2
Denmark	6.8	2.0
Slovakia	1.9	2.0
Norway	4.6	1.1
Slovenia	0.5	1.0
Belgium	4.3	0.8
Cyprus	0.2	0.7
Ireland	2.1	0.5
Estonia	0.2	0.5
Finland	1.1	0.4
Sweden	1.6	0.3

Source: Bruegel, Bloomberg

20

3. REPowerEU

Key Elements of REPowerEU Proposal to Reduce Dependence on Russian Gas

By end-2022, billion cubic metres



*Including wind and solar in the power sector (replacing 20bcm of gas) and solar rooftops (2.5bcm) Source: Fitch Ratings, European Commission

FitchRatings

REPowerEU

- Oxford's assessment of REPowerEU
- Importing large volume of LNG in stead of Russian PNG
- Temperature in winter is critical

Detailed REPowerEU Proposals for 2022

1. Increase imports of liquefied natural gas (LNG) by 50 bcm: up to 35 bcm looks possible, more will be difficult 2. Increase pipeline gas imports by 10 bcm: realistic 3. Increase biomethane production by 3.5 bcm: very difficult although current price levels are helpful 4. EU-wide energy saving to cut gas demand by 14 bcm: very much depends on winter temperatures

5. Rooftop solar to reduce gas demand by 2.5 bcm: possible but marginal

6. Heat pumps to reduce gas demand by 1.5 bcm: possible but marginal

7. Reduce gas demand in the power sector by 20 bcm by deployment of wind and solar: difficult, will depend on weather patterns and conditions in individual countries



3. EU's Storage of gas and LNG Project

• Storage level seems enough for winter

- Storage level: 94.7%(30th in October)
- Spending €106 bil at €140/mwh
- New 21 LNG project
- Launching FSRU
- Approximately 128bcm in a year
- Suck up LNG from all over the world

100%

90

80

70

60

Oct

• Fail cap Russian gas price

The \$100 Billion Sprint

Gas storage (as % of capacity) in Europe has risen at high speed and high cost

EU

Jul

2022



22

Source: Bruegel

Jul

2022

Germany

3. Energy savings

- EU's best strategy in energy crisis
 - Demand reduction
 - Energy efficiency up

ENVIRONMENT 18 October 2022

By Carissa Wong



German cities like Berlin will turn lights off early on public monuments Christian Ender/Getty Images



Playing my part:

How to save money, reduce reliance on Russian energy, support Ukraine and help the planet lea.org



3. Europe's energy crisis is very far from over

- Enough Storage and Price down but still energy crisis lasts next year
 - Supply cut must meet 84bcm
 - Equivalent 17% of normal annual consumption
 - EU sets a price cap on Russian gas but cooperation of EU member countries depend on each country's situation.

Europe's energy crisis is very far from over

We war game what will happen next





A price cap on Russian oil or any type of embargo don't make much difference => other countries such as china or india suck up the extra supply of oil and some of natural gas

The more Russian fuel cannot get to market, the more Europe has to pay to replace it.

EU's pain still remains although Russia also endures a tremendous economic hardship.

3. Economic impact

• This winter and so on

- Recession is expected
- GDP Growth rate: EU Council(-1.5%), IMF(0 to -6.5%)
- 90% of Storage is not enough for next early spring
- Russian complete cut off=> 22% need to be stored again in next year

Germany can make it through the winter but only by continuing to cut natural gas demand by 15%

TWh, natural gas supply-demand balance



Next Year's Fear

Still-high Dutch TTF gas futures for Feb 2023 reflect supply concerns Feb 23 futures price Day ahead price



Source: Bloomberg, ING

How a Russian Gas Freeze Would Curtail European GDPs

GDP output losses twelve months after a theoretical Russian gas supply shut-off, by European country (in %)



* low adjustement frictions, integration into global LNG market ** High adjustment frictions, households protected from shortages Source: IMF



• Concept and Scope of Energy Security

 Energy Security incorporate economics security, ecological security, technological security, defense security, political security, and cyber security=> comprehensive concept



 Political dangers
 Dangers resulting from disasters, breakdowns, service errors
 Dangers connected with a military or a terrorist attack

- World Energy Trilemma
 - Affordable, Accessible, Reliable
 - Concept extension=>Energy+Environmental Security
 Sustainability+Energy Equity





Source: World Energy Council



World Energy Trilemma Index

Reflects a nation's capacity to meet current and future energy demand reliably, withstand and bounce back swiftly from system shocks with minimal disruption to supplies.

Assesses a country's ability to provide universal access to affordable, fairly priced and abundant energy for domestic and commercial use.

Represents the transition of a country's energy system towards mitigating and avoiding potential environmental harm and climate change impacts.

• UK Energy Security Strategy(22.04.07)

- Energy Efficiency, security of Oil and Gas=> North Sea+CCS
- Renewable such as offshore wind & 30 year expansion of Nuclear power plant & Hydrogen(Blue, Green, Pink)

We are delivering on the 10 Point Plan, having already generated 68,000 green jobs and £22 billion in private investment, so now we are raising our ambition.

10 Point Plan	Delivery highlights so far				
Advancing offshore wind	 Over £1.6 billion invested, securing 3,600 jobs 11GW already generated, and another 12GW in the pipeline Up to £320 million in government support for fixed bottom and floating wind ports and infrastructure Additional government support for other low-cost renewables technologies 				
Driving the growth of low carbon hydrogen	 £7.5 million awarded to ITM's Gigastack Project, an early mover in the market, with potential to support up to 2,000 jobs over time Preparing to allocate up to £100 million of revenue support to initial electrolytic projects Launching £240 million Net Zero Hydrogen Fund later in April Developed indicative Heads of Terms for hydrogen business model contract 				
Delivering new and advanced nuclear power	 Committed to provide up to £1.7 billion of direct government funding to enable one nuclear project to FID this Parliament Investing £100 million into Sizewell C to help develop this project Investing £210 million to develop Small Modular Reactors with Rolls Royce Announced a £120 million Future Nuclear Enabling Fund to progress new nuclear 				
Accelerating the shift to Zero Emission Vehicles	 £4 billion of investment has flowed into the UK zero emission vehicle sector Building two new gigafactories, in Sunderland and Blyth 30,425 public charge-points in the UK with 100 new rapid chargers were added to the UK network every month during 2021 				
Green public transport, cycling and walking	 1,678 zero emission buses funded Launched Active Travel England, increased cycling by 75% 				
Jet zero and green ships	 Consulted on introduction of a UK Sustainable Aviation Fuel (SAF) mandate, requiring jet fuel suppliers to blend an increasing proportion of SAF into aviation fuel from 2025 Allocated £23 million as part of the Clean Maritime Demonstration Competition 				

British Energy Security Strategy

10 Point Plan	Delivery highlights so far
Greener buildings	 Cut VAT for insulation and heat pumps 46% of English homes at EPC C or above, up from 9% in 2008, and 2,300 social housing homes in the process of being improved Over 60,000 heat pumps installations estimated by industry, now offering households grants of £5,000 towards an air source heat pump so they are cost competitive compared to a gas boiler
Investing in CCUS	 Committed £1 billion in public investment to decarbonise our industrial clusters Announced the first 2 clusters in Teesside, the Humber and Merseyside Launched phase 2 of the Industrial Energy Transformation Fund, allocating £60 million to decarbonisation technologies, with a further £100 million delivered in May and October this year
Protecting our natural environment	 Additional £124 million provided at Spending Review 2021 to the Nature for Climate Fund to support tree planting and peat restoration, going beyond 2019 Manifesto Commitment of £640 million 13,290 hectares of trees planted across the UK in 2020/21 Launched three new Community Forests, in Cumbria, Devon and the North-East £5.2 billion invested in six year programme of flood defences
Green finance and innovation	 £615 million allocated from Net Zero Innovation Portfolio allocated Set the JET world record, with 59 megajoules of heat energy in a single fusion 'shot' that lasted 5 seconds

- Conventional Energy Resource Security
 - Still importance of conventional energy resource such as oil, natural gas and coal
 - Management of storage, inventory, production and supply chain
 - Efficiency and demand reduction
 - Government, industry, and international coorperation



Source: Jinsoo Kim(2022)

4. Electricity Security

• Concept and Scope of electricity security

- Multi-dimensional security approach
- Timely appropriate infrastructure, regulation, market, geopolitical security



In the **infrastructure** dimension, electricity security is assessed in terms of the power system (i.e. the electricity value chain) capability to supply end users with minimum service standards/criteria.

In the **source** dimension, electricity security is assessed in terms of the energy system capability to ensure the accessibility, in the various timeframes, to primary sources to be converted in the power plants to meet the required total demand of electricity.

In the **regulation and market** dimension, electricity security is assessed in terms of the power system and market capability to adequately fulfil their electricity delivery mission with a set of laws, rules, market arrangements and price schemes.

In the **geopolitical** dimension, electricity security is assessed in terms of the energy/power system capability to assure the availability of primary sources and/or cross-border electricity exchanges in case of economic or geopolitical constraints/stresses (e.g. unilateral primary energy cut by international players outside the considered region).

Source: EU Commission, Electricity Security

4. Reasonable Electricity Mix

- The 10th basic plan of electricity supply and demand modifies electricity mix up to 2036
 - Korea is lack of energy and single and closed electricity system => to make use of nuclear power
 - Adjustment of renewable energy

Ratio of power generation by energy source in 2030

Comparison between basic plan for electricity supply and demand and S. Korea's nationally determined contribution



Source: Ministry of Trade, Industry and Energy

4. Supply Chain of Raw Materials

• Critical raw material security

- Battery-related raw materials
- China's monopoly of supply chain of processing and mines

100%

80%

Preemtive preparation for the future demand





4. Energy Security is top policy priority

- Top priority of government policies
 - DOE, DOD and DOS in US take care of energy security all together
 - Defense power depends on clean energy technology and domestic production ability of raw materials
 - Resource Nationalism, Friendly-shoring: solar PV, Battery production

U.S. Departments of Energy, State and Defense to Launch Effort to Enhance National Defense Stockpile with Critical Minerals for Clean Energy Technologies

4. K-taxonomy revision if nuclear power plant

- K-taxonomy: include nuclear power plant given condition
- Various nuclear technologies and projects, including small module rectors, next-generation nuclear plants that can minimize radioactive waste, accident tolerant fuels, radioactive waste management, and research for improving nuclear safety and facility reliability, will be included in the green segment.
- Construction of new nuclear power plants and improving aging reactors for extended operation will be added to the transitional category, the ministry said.
- But to qualify for the label, the construction and the lifespan extension of nuclear plants must be approved by 2045, and they have to meet a range of criteria regarding treatment of nuclear waste, greenhouse gas emissions, and the use of advanced technologies and fuels.
- The inclusion of nuclear as green resources has been widely expected since President Yoon Suk-yeol's inauguration in May. He has pledged to revitalize the atomic industry to ensure energy security and reduce carbon emissions, reversing his predecessor's policy to phase out nuclear power.

CLIMATE CHANGE AND WEAPONISATION OF NATURAL RESOURCES



4. Special Law of Energy Security

Resource special law in process

- Top decision making governance under Prime minister's office
 - Comprehensive structure of energy security
 - > Planning, monitoring and alarm system in order
- Infrastructure, market system, governance
 - Efficient system of energy usage
 - Market restructuring of new energy business
- Ordinary and emergency management
 - Ordinary management: life-cycle supply chain management, international development of resources, advanced contract, trading
 - Emergency management: friendly-shoring, international network
 - Construction of effective acquiring methods of raw materials, conventional resources and renewable energy epc.



ENERGY SECURITY BILL

Building a clean, affordable, home-grown energy system



Thank you.