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Impact of Russia-Ukraine war on petroleum and natural gas in Finland

Energy Security and Green Transition

Metropolia University of Applied Sciences
Bachelor of Business Administration
International Business and Logistics
Bachelor's Thesis
22 April 2023

Abstract

Author Number of Pages Date	Ajay Shah 41 pages 22 April 2023
Title	Impact of Russia-Ukraine war on petroleum and natural gas in Finland
Degree	Bachelor of Business Administration
Degree Programme	International Business and Logistic
Specialisation	Supply Chain Management and Logistics
Instructor(s)	Michael Keaney, Senior Lecturer

This report describes the impact of Russia-Ukraine war on petroleum and natural gas in Finland. Finland is heavily dependent on imports of energy from Russia, exposing it to potential supply disruptions, increased uncertainty, higher prices, and geopolitical risks. Energy security used to be about the supply and price of oil, but now it is about national security and the availability of natural resources for consumption. The dispute has highlighted the importance of diversifying energy supply and minimizing reliance on Russia. The Finnish government and EU have made initiatives to promote energy security by investing in renewable energy sources. Finland will continue to focus on increasing the use of renewable energy and reducing its dependence on fossil fuels, while diversifying its sources of energy. The completion of the OL3 nuclear power plant is a significant achievement for Finland's green transition.

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Glossary

ACER	Agency for the Cooperation of Energy Regulators.
EU	European Union.
LNG	Liquified Natural Gas.
LULUCF	Land Use, Land Use Change and Forestry
NATO	North Atlantic Treaty Organization
TEC	Total Energy Consumption.
TJ	Terajoule
TWh	Terawatt hour
US	United States.

Background:

The dispute between Russia and Ukraine is unresolved situation which has created significant problem for the region and the international community. The significant reason of the struggle between Russia and Ukraine became the political and financial consequences of the fall apart of the Soviet Union in 1991. In its aftermath. Since Ukraine’s independence from the Soviet Union, Russian-Ukrainian relations seem to be disturbed and Ukraine has shown more stronger relations with the West, particularly the European Union and the United States. Meanwhile Russia has always been seeking to put the influence in Ukraine and prevent it from moving closer to the West. The war between Russia-Ukraine began in 2014 and is ongoing. The war has resulted humanitarian crisis with several thousand deaths and over 1.5 million people are forced to leave their country.

Tensions escalated when pro-Russian Ukrainian President Viktor Yanukovych rejected a draft deal with the EU to show more positive relations with Russia which sparked widespread protests in Ukraine and Yanukovych's ouster and led to Yanukovych’s ousting in February 2014. Following his expulsion, a new government which was more prone to west was formed and this government was not accepted by Russia, so it started supporting separatist rebels in the eastern region of Donetsk and Luhansk provinces. Russia annexed Crimea in March 2014, placing off a broader geopolitical dispute among Russia and the West. In response to the war the western countries and European Union imposed economic sanctions to make the Russia economically weak (Patel, 2014).

Russia launched a full-scale invasion of Ukraine in February 2022 to oust Volodymyr Zelenskyy's Western-aligned administration. The tension between the country has a deep historical, cultural, and political root with many interests and agendas to play. Additionally, the takeover of Crimea was criticized which further increased the tension between the Russia and other countries. Russia has usually viewed Ukraine as buffer state among itself and the West and has attempted to keep affect in Ukraine to counterbalance the Western influence. The invasion has caused several casualties and displacement of people with the reports of human rights abuse and on the other hand many countries has imposed the sanctions and many international companies has end the operation in the Russia which has significantly affected the economy. Despite numerous ceasefires and agreements brokered by international organizations, the fighting continues and the situation remains tense and uncertain .(Masters, 2022).

The strategic importance of Ukraine:

With a population of more than 43 million, it is eighth the biggest nation according to population entirely in Europe (Statista, n.d.). The population size and its location make it important in terms of political and economic power. Due to its strategic location between Europe and Russia, Ukraine has historically been a major role in the area. It has an extended-shared border with Russia to the east, and for a long time, it has served as a buffer among Russia and Western Europe. Ukraine has emerged as a contested place as a result of its strategic area, with both Russia and the West attempting to impose influence. Black Sea ports in Ukraine are essential from a navy and commerce perspective. One of the most important ports in the Black Sea Region is the Port of Odessa which is located in Ukraine is a transport hub for trade and commerce exchange between Europe and Asia and various commodities like grain, oil, coals and others are shipped. Based in the Crimean Island port city of Seva Stopol, the Russian Black Sea Fleet is of military importance.

Another crucial component of Ukraine's strategic importance is its economy. The country is a huge producer of grains and different agricultural goods, making it a key player inside the global food markets. In addition, Ukraine has a broad industrial sector that includes significant sectors including steel manufacturing, energy, and aerospace. For example, Ukraine, one of the world’s largest steel producers, contributes significantly to global steel production.Significant natural gas reserves and production are part of Ukraine's energy industry, which has historically been a key cause of conflict between Ukraine and Russia. Ukraine produces airplanes and other aerospace equipment, making its aerospace sector important. For instance, the Antonov aircraft design bureau in Ukraine has a long history of building military and freight transport aircraft that are employed by other nations (Shehadi, 2022).

Ukraine is an important geopolitical location for the Russia, Europe and Asia as its provide access for trade between the countries. It is a transit between the international locations for the power assets for Russian herbal gasoline to Europe passing thru its territory. The country's ability to sign up for alliances with the West and organizations like NATO and the European Union, however, has been visible by using Russia as a severe hazard to its dominance in the region. Russia has constantly taken into consideration Ukraine to be inside its sphere of have an effect on, and the country has long visible its strong ties to Ukraine as crucial to its own protection. The crisis in Ukraine can be regarded as a part of a larger trend wherein Russia has been greater decided in staking its authority inside the place. On the other hand, Ukraine has become a vital ally for the West in its efforts to counterbalance Russian influence in the area because to its strategic position and resources. The West has backed Ukraine's initiatives to deepen connections with Europe and has recently given the nation considerable economic and military help (Masters, 2022).

However, the scenario in Ukraine has a massive effect on the surrounding region and beyond. It has induced severe loss of existence, humanitarian disaster and the displacement of thousands of people. Also, it has harmed

Western and Russian ties and added to a general feeling of geopolitical uncertainty. All the parties who are concerned must work together to find a collective non-violent agreement to the situation in Ukraine. It will possibly include a mixture of diplomatic, financial, and military moves. The stability and security of the larger area and beyond would be significantly impacted by a peaceful end to the war.

Introduction

The war among Russia and Ukraine had a significant effect on the petroleum and natural gasoline industry in Finland. One of the major deal which has affected Finland in supply to natural gas to due to conflict whereas the conflict has also led to concerns about the reliability of this supply. Concerning this matter Finland has taken steps to expand its sources of natural gas and increase into energy security.The conflict has also had an impact on the price of petroleum and natural gas in Finland. These are the commodities that are determined to a great extent by global market forces, thus the Ukraine conflict is more likely to effect their price.In particular, the conflict has contributed to an overall increase in geopolitical tensions, which can lead to increased demand for energy commodities and higher prices. Meanwhile, the conflict between Russia and Ukraine has significantly impacted Finland's petroleum and natural gas and raised questions about price stability and energy security.

The invasion has significant consequences for Europe, both in terms of human suffering and economic impacts. The struggle has caused a great deal of human suffering among the people of Ukraine and continues to need extensive support. One of the main consequences has been that Russia has armed itself with force, putting pressure on Europe’s fragile energy resources. Despite this, Europe has been able to mitigate the impact of the Russian oil catastrophe through European co-options and national solutions, by sourcing

oil from other countries. The private sector has also adapted by finding new approaches to speed up the transition to green energy, which involves decoupling from fossil fuels. This has given an opportunity to diverse the investment in the field of renewable and make it energy efficient and make significance development in technologies and innovation in green energy. Cooperation between European countries on energy issues has also increased, that´s essential for ensuring the security of supply and lowering the dependence on Russian energy in the future. (Pankki, n.d.)

The conflict between Russia and Finland, especially Finland's decision to join NATO, have had a significant impact on energy supplies (South China Morning Post, 2022). Russia's decision to cut off natural gas and petroleum products to Finland has been largely symbolic as the energy imported accounted for 34% of Finland`s total energy consumption in 2021, resulting in the highest share of 92% of natural gas (www.stat.fi, n.d.). The high dependency on energy imports has led to threats to energy security and geopolitical risks, especially in times of conflict between Russia and Finland or the Russia-Ukraine war. However, the conflict has highlighted the fragility of Finland's energy supply and its dependence on Russian natural gas. The conflict has affected the cost of living and businesses. It has created supply chain disruptions resulting in the increased price of the fuels which had impacted the operation of manufacturing and agriculture sectors. The increase in prices of energy has led to increase the cost of production which has affected the profitability of the corporations. The uncertainty and volatility have also affected the transportation sector in Finland. Higher fuel prices have also increased the shipping cost.

In addition, the Nord Stream and TurkStream pipelines, built by Russia, create a direct path for Russian natural gas into Western Europe, which poses a threat to other European and American energy companies. This pipeline allows Russia to bypass transit routes and directly supply natural gas to western Europe. The dependence of Finland on Russian gas has been a great issue with the concern of energy security and political leverage. These pipelines have been a weapon to manipulate gas supplies and prices, and

have caused a reduction in the bargaining power of other gas suppliers, including the EU and Finland. The securitization of the energy supply and a shift in how people view energy sources is what is anticipated to be required in the emerging understanding of the current crisis. The crisis underscores the importance of having a diversified and resilient energy supply. It has also highlighted the importance of the integrated approach to energy security considering geopolitical, economic, environmental, and technological factors (Jirušek and Kuchyňková, 2018).

The integrated approach can be summarised as follows:

a) Impact on the global petroleum industry:

The conflict has had a significant effect on the international petroleum sector. The main areas of effect have been supply chain interruptions, pricing changes, and geopolitical unpredictability.

I. Supply chain interruptions, and price changes: Oil is supplied through a pipeline in Ukraine, and the conflict there has a big influence on the world's petroleum business. The violence has disrupted the flow of gas and physically damaged the pipelines, reduced gas flow, and suspended gas through Ukraine. The breakdown in the supply of gas has created scarcity which has led to hike the price of gas in Europe. The tensions have led the disruptions in the supply of gas to Europe as the Russia provides large amount of energy.The uncertainty of the availability of oil has affected the LNG market and it has also created volatility in the market. This situation will probably have greater impact in the winter season as the Europe is heavily dependent on Russian gas for heating and electricity. After the invasion, the price of the European benchmark brent crude hiked to $105 per barrel which is 47% up since July 2014 compared to December 20, 2022. (Klebnikov, n.d.)

II. Geopolitical Risk and Uncertainty: The war has resulted in geopolitical risk and uncertainty in the world petroleum industry. It has impacted lives and livelihoods with disturbances in the supply chains, industries, and economies. The energy sector is facing numerous uncertainty and challenges. Fluctuations in the global economy such as a change in the rates, currency exchange rates, and commodity prices have affected the industry. The conflict has resulted in sanctions and limitations, which have had an impact on several foreign oil firms' operations and revenues. The sanctions have led to uncertainty and volatility in the industry. For instance, international companies have been forced to withdraw from the projects due to the sanctions. The geopolitical uncertainty by the conflict between Russia-Ukraine war has affected the global oil market and this has impacted demand and supply dynamics creating high volatility in the market (GEP, 2022).

b) Finland´s role in the Global Energy Market:

Finland's role in the global energy market is significant. The need for energy in Finland is high due to the energy-intensive industry, weather, and standard of living. Finland has highly developed manufacturing industries that rely on energy. The industries like steel, paper, pulp, and chemical production use a significant amount of energy. As the weather condition is cold and it has long winter, Finland needs more heating and energy-intensive machinery for snow removal operations. The demand is always high for heating, transportation, and other services during the winter.

Finland is heavily dependent on fossil fuels as it doesn´t have its own resources. However, it has various renewable energy sources such as wood fuel, peat, and biomass. Finland has extensive forests, and the forestry industry contributes significantly to the economy. Wood-based fuels are the primary source of heating as well as for electricity generation. Finland is also investing in new technologies to generate energy sources in the future. Finland is actively involved to combat climate change and

transitioning to a sustainable energy future. Finland has signed the Paris Agreement which states to reduce greenhouse emissions and increase the share of renewable energy in its energy mix. Finland has set a goal of growing the share of renewable electricity to 50% by 2030 and has additionally set a bold objective of carbon neutrality by 2035.The Climate Change Act is a key pillar of this policy, and the government is committed to meeting its target (International Trade Administration, 2022).

c) Impact of the Conflict on the Petroleum Industry in Finland:

In Finland, the petroleum industry is one of the massive sectors of the economic system, which provides essential energy resources for the industries and consumers. This industry produces, refines, distributes, and markets petroleum merchandise and it is a crucial source of employment and tax revenue in Finland. The war has created disruptions in the supply chain, price fluctuations and geopolitical risk and uncertainty.

The Russia-Ukraine battle has had a extensive effect on the petroleum industry in Finland as it's far heavily dependent on the import of energy. The conflict has disrupted the supply chain and has caused hike in the price of oil and gas in Finland, which ultimately has affected the standard of living and businesses. The supply of oil and gas passes through Ukraine from Russia and the disruption in the route has affected the supply of the energy for Europe as a whole. As the price of fuel has hiked up the goods and services prices has increased directly or indirectly. This has tendency to affect a company's profitability, while also lowering the consumer's purchasing power. Energy-intensive industries, consisting of production and agriculture, are most affected with rising manufacturing costs, which has reduced the profitability and competitiveness of those industries. Higher manufacturing costs have resulted in the higher pricing for these industries making them less competitive in the global market. In addition,

customers would focus buying products that are cheaper from other countries.

The Russia-Ukraine conflict has created uncertainty and volatility in the petroleum industries, and it has made difficult for the Finnish companies to plan and invest for the future. The economic sanctions by European Union have created the uncertainty about the supplies of the oil and has created uncertainties for the long-term investment plans of states and companies. It has also made it hard to secure financing from the banks and financial institutions, investors, and lenders as the markets are very risky due to the current situation. There is delay or cancellation of the investments due to increased risk caused by the war. The cancellation of the investments has also led to reduction in the job opportunities in the petroleum and related industries.

There are many challenges currently for the petroleum industry to navigate these uncertainties the companies need to adapt changing conditions, make necessary innovation, and maintain a flexible and resilient approach to their operations. The industry needs to require several strategies to make the business competitive and sustainable:

1) Strategic planning: The industry must need to reallocate the long-term plans and make the adjustments according to the impacts of the conflict on the global market. They need to consider alternative sources of oil or make contingency plans to ensure petroleum products can remain in production.

2) Risk management: The disruption in the supply chain, security concerns, and price fluctuations have created significant risk in the industry. To minimize the risk the industry needs to develop effective strategies like identifying alternative sources of oil or focusing on increased domestic production, enhancing security measures, and implementing risk-minimizing measures. The industry also needs to be

updated about the potential regularity changes and develop a continency plan to mitigate the risk.

3) Adoption of new technology: The industry should adopt new technology to remain competitive in the global market. Investment in the renewable energy sources along with wind and solar power can assist in lowering the consumption of fossil fuels and the carbon footprint. The industry can also focus on energy storage systems to optimize its energy usage, reduced wastage, and improved overall efficiency. They can also adopt smart grid technologies to monitor real-time data to optimize energy consumption and improve the reliability of the operation. The adoption will also help in improving in the environmental performance, reduce the operation cost and maintain its competitiveness in the global market.

4) Develop partnerships: Collaborating with companies, governments, and stakeholders will help to develop the solution to these complex problems as well as enabling navigation of complex regulatory environments and market conditions. The collaboration will help to reduce the cost by sharing resources and expertise and it can also lead to expanding its market access helping in gaining growth and increased revenue.

Historical energy supplies to Finland, evolution, and growth.

Finland has a long history of utilizing a variety of energy sources to in shape its energy requirements.The country's energy supply has developed and grown over the years as new technologies and resources have emerged. Finland is a country with a plenty of forests with more than 75% land covered by the forest. So, it is the one of the main reasons that wood is the primary source for

centuries. Historically, wood has been used for cooking and heating purpose and it also played big role in the development of forest industries.

In the late nineteenth and early twentieth century, the usage of coal and peat in Finland shifted. People in the country's south and west utilized peat for cooking and coal for industrial uses. However, these resources were limited and insufficient to fulfill the country's expanding energy demands as it industrialized. Finland commenced to import oil and natural fuel in the mid-twentieth century to fulfill its local energy supplies, permitting it to broaden its business base and enhance its energy production. The import of natural gases helped the Finnish manufacturing and service to increase the economy of the country and had a significant improvement in the living standard of the people. These fossil fuels continue to play a vital part in Finland's energy system, but their proportion has declined in recent decades (www.stat.fi, n.d.)

Finland commenced to increase and modernize its hydroelectric power infrastructure capacity in the 1970s and 1980s. The contribution of the hydroelectricity is 10% of the total electricity production consumption in Finland. Finland is diversifying its energy sources to renewable energy such as wind and solar to become independent and move closer to its aim green transition. (75, n.d.).

However, the Finnish energy system has evolved and grown over time, becoming more diverse and sustainable. Finland energy mix which includes domestic and imported energy resources, hydroelectric power and renewable energy sources has fulfilled the demand of the energy. Hydroelectric and renewable energy has assisted to reduce its carbon footprint and led towards more cleaner and sustainable energy system.

The current Finnish energy system

The Finnish energy system is undergoing transition towards higher shares of renewable energy, this transition has driven by several goals that have remained consistent over time. Reliability, affordability, stability of consumer prices, ability to maintain industrial competitiveness, and responsibility towards international and European efforts to mitigate climate change are the main drivers of future. They reflect a desire to balance the competing demands if economic growth, environmental sustainability, and social equity. The transition towards renewable energy sources presents an opportunity for Finland to achieve its energy goals, there are differing views on the best way to achieve these goals. There is debate on issues along with the precise mix of renewable and traditional power, the role of nuclear energy, the need for energy storage and the appropriate level of government intervention in the energy sector. It's important to note that the overarching desire to achieve the same goals remains ubiquitous.

Total energy consumption (TEC) in Finland was approximately 355 TWh (1.26 million TJ) in 2020. This included a record high share of renewable energy, at 40%, dominated by wood fuels (28% of TEC) .Among the renewable energy sources production in hydro power grew by 28% and the production of wind energy by 30%.However, final consumption of energy went down by 6% down from previous year 2019.

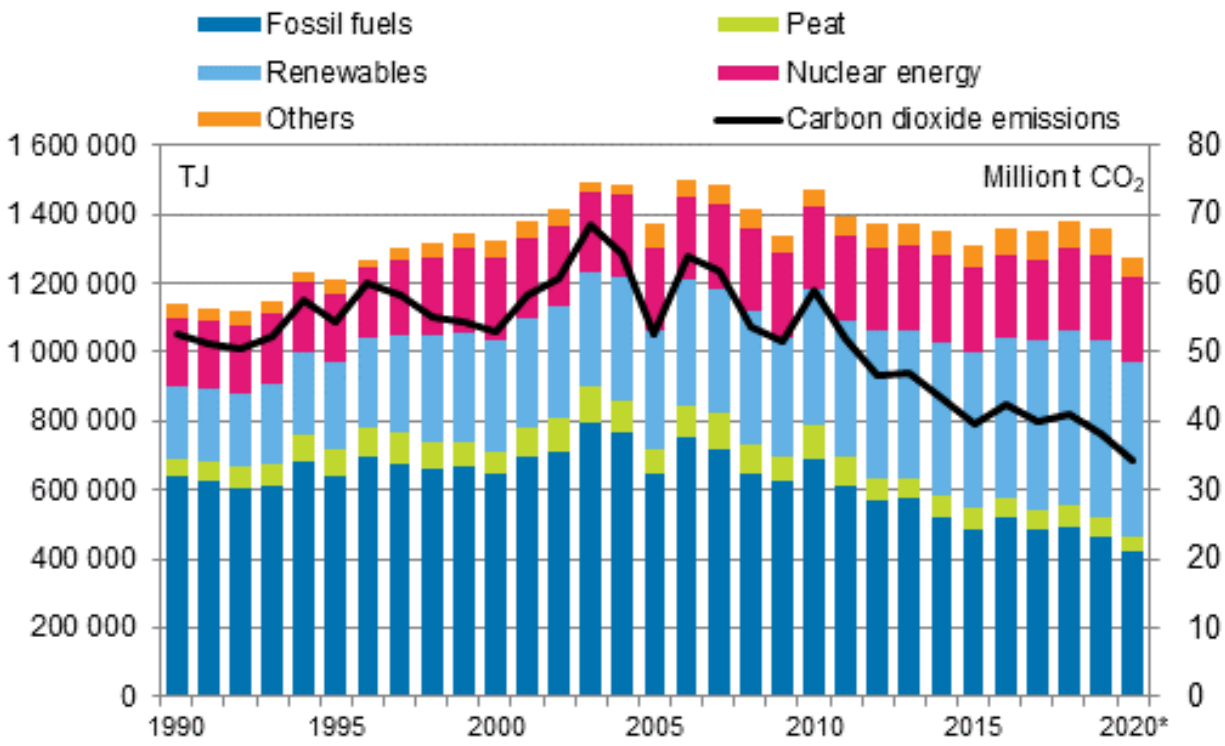

Figure 1,Total energy consumption by source (TJ), 1990-2020.
Sourcee(Statistics Finland 2020)

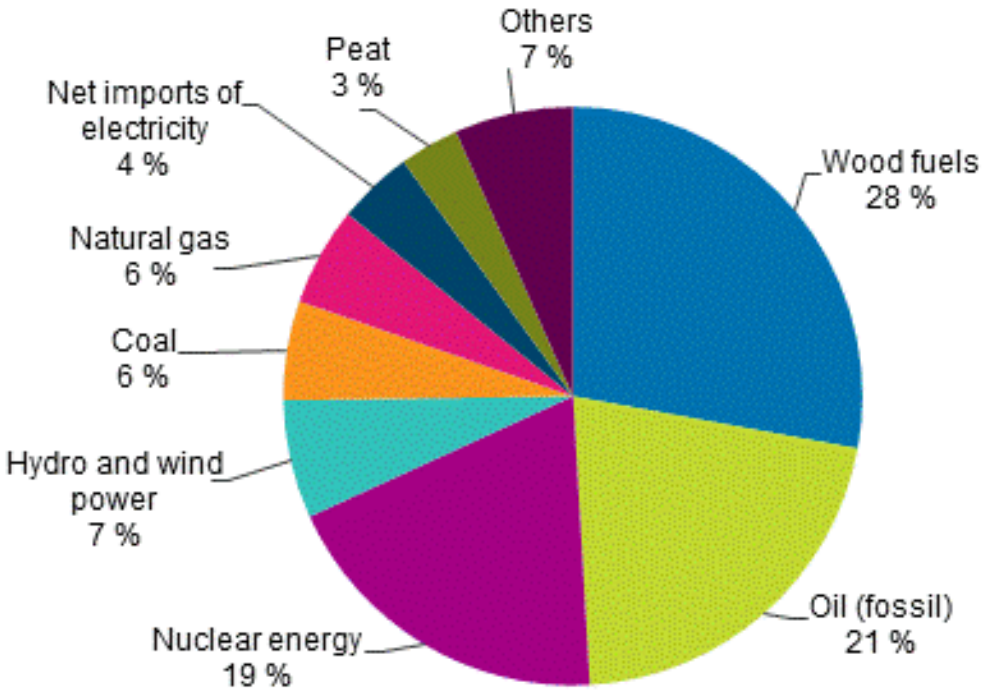

Figure 2,Source: Statistics Finland, Energy supply and consumption 2020, %

Electricity consumption totalled 81 TWh in 2020. Finland's own electricity production covered 82% of its consumption. Other 18% were imported from Nordic countries, Russia, and Estonia. Nordic electricity market enables Finland to import electricity from its neighboring countries. The largest consumer of electricity was the industry and construction sector accounting for 46% of total electricity consumption. The household and agriculture sector followed 28%, the service and public sector accounts 23% which includes government offices, hospitals, schools, and various service industries. (Statistics Finland 2020).

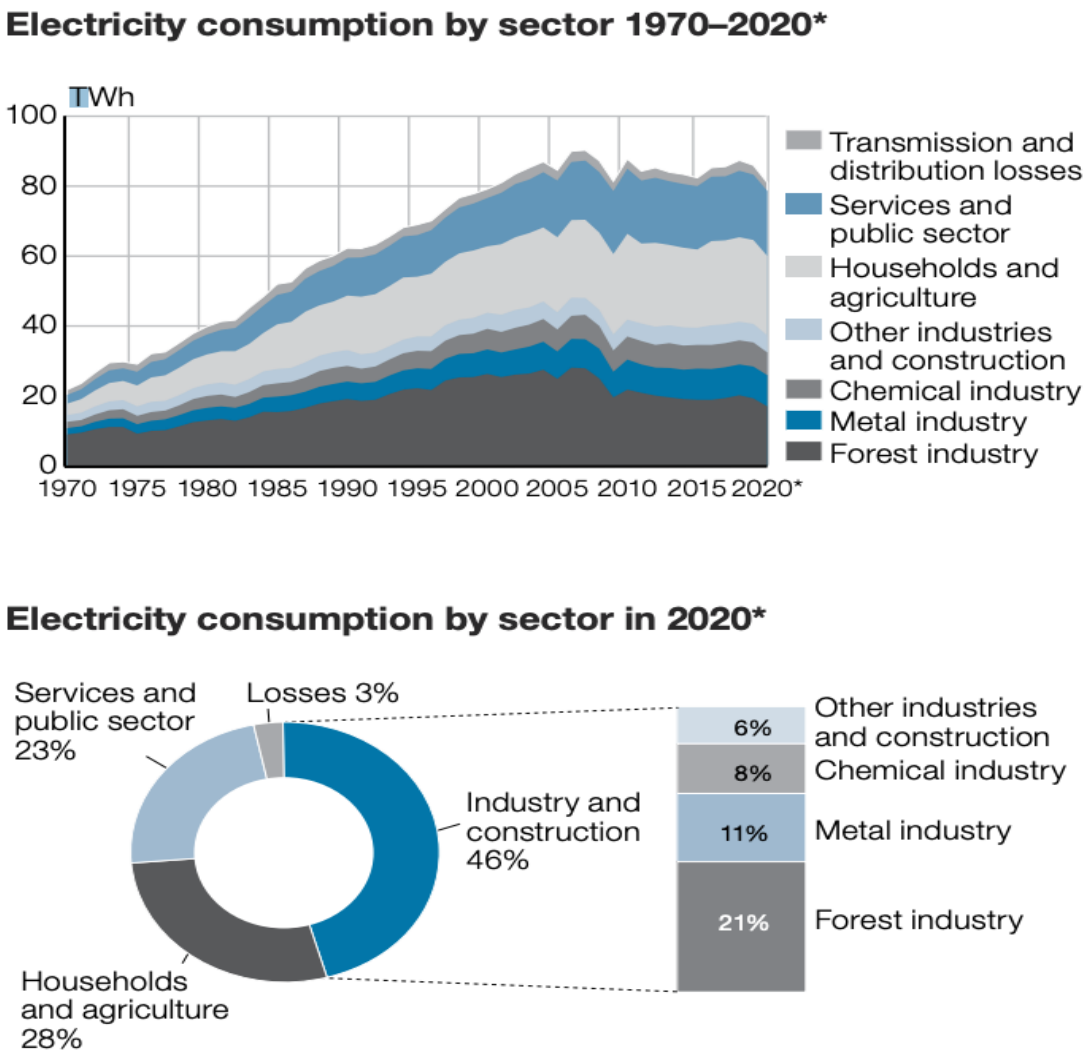

Figure 3,Electricity consumption by sector Sources: (Energy in Finland, n.d.)

Greenhouse gas emissions in 2020 were expected 48.1 million tonnes of CO2 equivalent (Mt CO2E). Emissions decreased by 9% compared to 2019

emissions. The fall in emissions is due to production structure of electricity and the decrease in transport performance. The energy sector was the largest source of GHG emissions in Finland that is 34.6 million tonnes of C02 equivalent, which is 50% less than 2003.Emission from waste and industrial processes and product decreased by 3% and 5% from the year before. The net sink of the land use, land-use change, and forestry sector was -17.2 million tonnes of CO2 equivalent. Negative figures indicates that the growth of carbon pools exceeded greenhouse gas emissions, meaning that the sector acted as a carbon sink. The LULUCF sector is not included in the scope of the EU Emissions Trading System or the reduction targets of the EU's Effort Sharing Decision. Finland has met its target of reduction of emissions set by EU Effort Sharing Decision and the Kyoto Protocol. It has set a goal of achieving net-zero emission by 2035 and eradicating all the emissions of greenhouse gases by 2050. Finland has also introduced measures to increase the energy efficiency of buildings, improve public transport, and promote low-carbon transport solutions. (Forsell, n.d.)

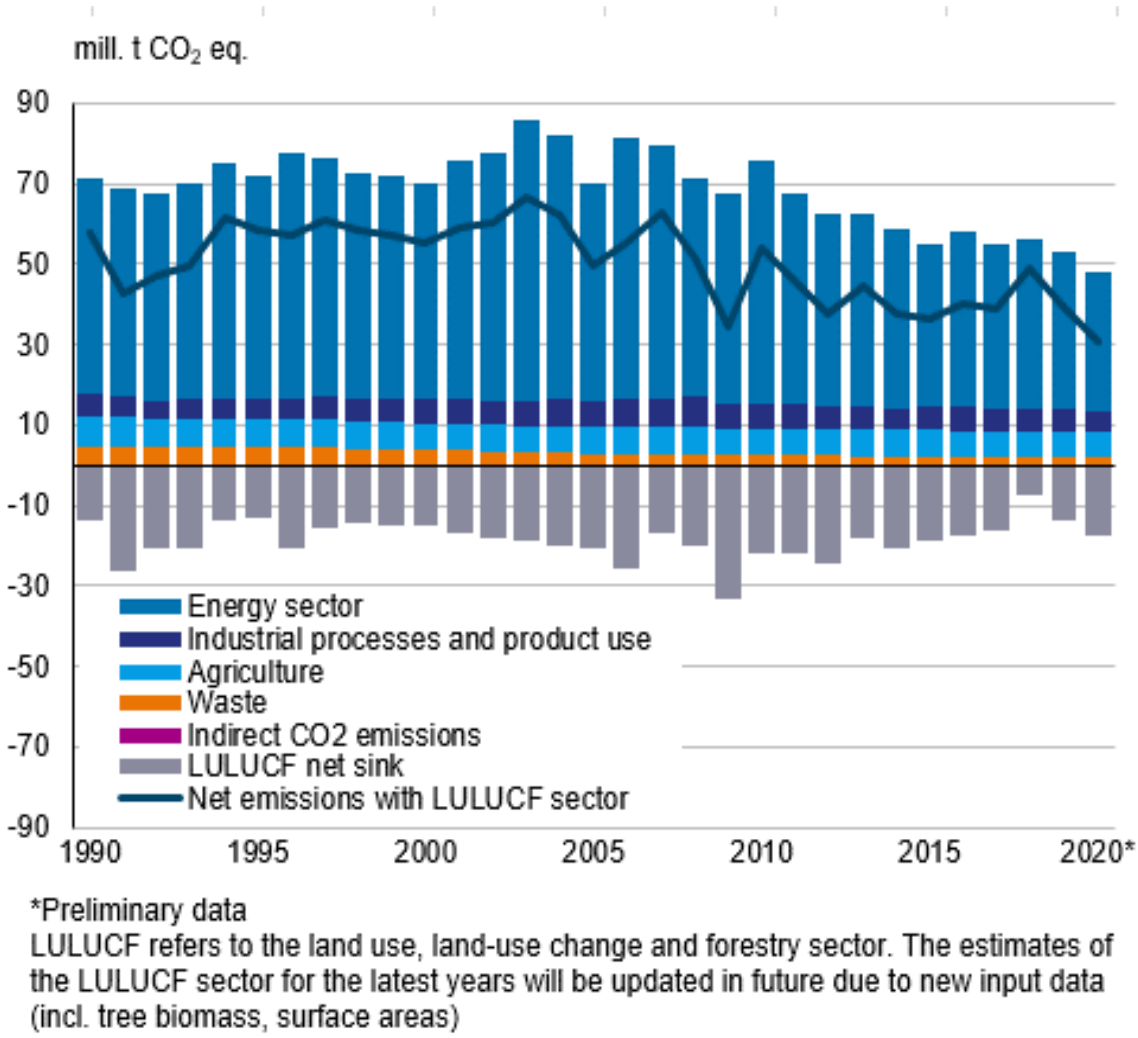

Figure 4,Greenhouse gas emissions (Mt of CO2 equivalent), 1990-2020, Source:(Statistics Finland 2020)

Energy security, both in Finland and the EU

Energy security refers to stable access to the energy sources to fulfill the demand of the economy and society at an affordable price. Energy security as a concept and measuring its drivers can be approached from a wide range of perspectives with a different focus. Also, there is more attention given to an increasing number of perspectives to the alternative factors such as giving more emphasis to the environment (Jääskeläinen et al., 2018). Energy security

used to be about fuel supply and prices, but now it is about national security and the availability of natural resources. It has always been about security of supply, but until recently that was taken for granted. The conflict has highlighted the importance of diversifying energy supplies and reducing dependencies on Russia. The Finnish authorities and the European Union have taken steps to enhance energy protection by making an investment in renewable resources by generating the energy from wind nuclear and solar to increase electricity performance.

Finland's gas Gasgrid Finland Oy who is responsible for the transmission of natural gas and biogas in Finland has suspended gas imports from Russia and has agreed to lease a floating LNG-terminal vessel to improve the security of supply. The vessel is planned to be available for the winter of 2022-2023 and will be located in Inkoo or Paldiski depending on the speed of construction works. The final location will be in Inkoo (National Report on the state electricity and gas markets in Finland to the Agency for the Cooperation of Energy Regulators and the European Commission, 2021). Finland has a high level of energy security due to its good and diversified energy supply. Finland energy security focus on using the combination of both domestic and import gases to meet the demand. As Finland is rich in natural resources like forest and water it uses those resources to generate electricity. Finland's energy policy strongly focuses on energy security, self-sufficiency and use of domestic resources. It focuses on promoting energy security, sustainability, and competitiveness. The government is also involved in the energy sector, with state owned companies playing a significant role in the energy production and transmission. Finland has made significant efforts to increase the share of renewable sources focusing on bioenergy and wind energy. Due to its success in decarbonization and renewable energy adoption, Finland is frequently featured in the list of European nations in the forefront of the energy revolution. Finland has also set target to attain carbon neutrality by 2035 and objectives to increase its share of renewable energy by 50% by 2030. It is diversifying its energy sources and modes of supply and it has invested heavily in energy infrastructure such as gas pipelines and power grids. Overall,

Finland is focused on transitioning to a low carbon and sustainable energy system (Haukkala, 2018).

The hydroelectricity in Finland produces significant amount of electricity. About 10% of total consumed electricity is fulfilled by the hydropower. Additionally, Finland has large forests, which are a major source of biomass for energy production. The country also possesses substantial coal deposits, which are utilized to create energy in some power plants.Finland has been focusing to increase the share of renewable energy to improve its energy efficiency and increase the energy security. Finland has set to reach carbon neutral by 2035 and focusing on nuclear program for the generation of electricity. And it also exports electricity to the neighboring country Estonia. Finland has huge hydropower resources, allowing excess electricity to be exported to a neighboring country.The electricity trade between Finland and Estonia is governed by the Nord Pool Spot market. Most of the oil and natural gases is imported from Russia and Norway and Russia is the main exporter of natural gasoline for Finland. The country also has some domestic production of oil, primarily from the Gulf of Finland. Finland also connected with a pipeline to import liquified natural gas (LNG) from the Baltic and Poland. Finland's diverse energy mix and focus on renewable energy sources, in addition to its connections to other energy markets through imports and exports, help to make ensure energy security in the country.

Energy security inside the European Union (EU) is a key interest because of its heavy dependency of natural gas from Russia. EU is implementing policies to improve energy efficiency, reduce greenhouse and increase its energy independence. To deal with those concerns, the EU has established several guidelines and initiatives to promote electricity efficiency and the development of renewable electricity. The European Union has addressed the energy security issue of its member states' import dependence on major foreign energy suppliers in several ways. Iran may be seen as an alternative source of energy in the European market but the dispute between Iran and the west over the economic sanctions is longstanding. Iran has the world´s largest natural

gas reserves and the fourth largest oil reserves but it is a geopolitically sensitive area (Heshmati and Abolhosseini, 2017).

The EU has set a goal to increase the percentage of renewable power in its usual energy mix to as at least 50% by 2030 (energy. etc. Europa. EU, n.d.). EU has followed policies to increase the share of renewable energy and taken measures for the Energy Efficiency Directive to reach its target of energy saving. The EU also has plenty of mechanisms in place to encourage Member State collaboration on energy security. The Internal Energy Market is intended to encourage competition and cross-border energy commerce, and the formation of the Agency for Cooperation of Energy Regulators (ACER) aids in ensuring the Internal Energy Market's correct operation. Furthermore, to be able to diversify gasoline supply channels and promote energy independence, the EU has invested in the construction of new pipelines, LNG terminals, and interconnections across nations' transmission networks. Additionally, EU countries are encouraged to increase energy efficiency, by implementing Energy Efficiency Directives as well as Energy Performance of Buildings Directive, also to ensure that energy is used more efficiently and decrease the need for energy imports. However, the EU is focusing to become independent on energy and increase the use of renewable energy.

“Subject to economic sanctions that prevent European access to Iran’s supplies of natural gas and oil”.

Iran has been subjected to economic sanctions for decades due to its nuclear program being suspected as for military purpose by certain countries. The sanctions have had significant impact on the economy of the Iran which is prohibited from much international trade and commerce. One of the most significant effects is the limitation of EU access to Iran´s supplies of natural gas. Iran has major reserves of oil and natural gas, but sanctions have prevented Europe from investing in Iran’s energy sector. The purpose of the

sanctions is to put pressure on Iran´s financial system by lowering off its access to key sources of revenue by limiting its oil and gas exports. Since the sanction imposed by EU Iran has struggled to find buyers for its oil and gas, particularly in Europe (HFW, n.d.).
The economic sanctions have prevented Europe access to Iran´s supplies of natural gas and oil which have a significant impact on both Iran and Europe. The sanction on energy resources has limited their to Iranian energy resources which has created disruption of supply of oil as an alternative of Russian energy.

Green transition, both in Finland and the EU

The green transition is the move to a more sustainable and environmentally friendly economy, by declining the use fossil fuels and make higher use of renewable energy sources. It mainly focuses on reducing the carbon footprint and move towards the step of green planet. This includes land use and transport changes, and the adoption of sustainable practices in industries such as agriculture and manufacturing. The green transition strives to lessen the negative environmental impact of human activities and to solve the issue of climate change (Ministry of the Environment, n.d.). The Finnish government has proposed to boost investments in the green transition which aims to reduce the dependency on fossil energy in Russia and focus on ecologically sustainable economy.

Green transition EU: The European Union has set ambitious targets for the Green Transition, aiming to become carbon neutral by 2050. In order to accomplish this target EU is focusing in higher use renewable energy such as wind, solar and cut the use of fossil fuels. The EU also plans to improve energy efficiency in buildings, industry, and transport. Additionally, the EU is investing in new technologies, innovation and making improvements in the current appliances such as carbon capture and storage to reduce emissions from industry. The EU has also set an ambition to reduce its greenhouse by at least 55% from 1990 levels by 2030 and reaching net zero emissions by 2050.

To achieve this, the EU has implemented various measures and regulations, including the Effort Sharing Regulation, which sets binding annual emissions targets for non-ETS sectors such as buildings, transport, agriculture, and waste. (climate.ec.europa.eu, n.d.)

Green transition Finland: Finland has put in place several plans to boost its green transition and reach its goal of carbon neutrality by 2035 (Valtiovarainministeriö, n.d.). Finland has focused on the need for a green transition to address the challenges posed by climate changes and environmental degradation. The commitment to the green transition is reflected in the sustainable growth programme. It addresses developing a solution for reducing emissions and improving energy efficiency. It also focuses on developing hydrogen and circular economies, emission-free energy systems, and solution for the environment to accelerate the transition to fossil-free transport and heating. The roadmap to the low carbon emissions for industrial sectors is a crucial component of the sustainable growth programme in Finland. Industrial sectors produce more greenhouse gas and reducing the emissions in these sectors is critical to achieving carbon neutrality. Low-carbon roadmaps can help industries to develop and adopt sustainable practices to reduce emissions. Meanwhile, for reaching carbon neutrality it needs coordinated effort across all the sectors of society including government, industries, and individuals and this programme is playing a vital role to reach carbon neutrality goals.

One of the key significance of these plans is the growth in the proportion of renewable energy in total energy intake to 50% by 2030(Haukkala, 2018). This will be achieved through the expansion of wind, solar, and bioenergy. The development in the new technologies and innovation can assist to reach towards the planned green transition. Furthermore, Finland has made a commitment for energy efficiency by 30% by 2030 to mitigate the impacts of climate changes. To achieve this goal, it needs implement policies and take measures to promote energy efficiency in various sectors like buildings, industry, and transport. It needs to improve its existing buildings with energy-efficient insulation, heating, and cooling systems. One key aspect of Finland's

green transition plan is its focus on bioeconomy, which aims to promote the sustainable use of renewable biological resources. This involves boosting the use of wood-based goods such as biofuels and investing in innovative biomass-using technology. It also aims to become the leader in hydrogen and circular economy. However, the authorities goal is to gain low carbon by 2050 for which they are making an investment in low-carbon technology like as carbon capture and storage, in addition to nuclear power for energy generation.

Finland's and the EU's backward steps away from the green transition in order to ensure short-term energy supplies:

Finland´s and European Union´s reliance on imported gas from Russia has been a concern for the policymakers. After the dispute among Russia and Ukraine, this problem has been delivered into a sharp recognition. The International Energy Agency (IEA) has analyzed the situation and proposed a series of measures that could reduce the EU´s and Finland reliance on Russia gas. IEA suggests switching away from gas consumption in the power sector by increasing the used of coal-fired power plants or alternative fuels. This is only suitable for the short term but the alternative should implemented as soon as possible as it mitigate the climate condition. This step can lead to increased greenhouse gas emissions and would be inconsistent with the EU`s climate ambitions and the green deal.

The IEA´S 10- Point Plan to Reduce the European Union´s Reliance on Russian Natural Gas includes measures such as increasing the use of renewable energy, boosting energy efficiency, turning more to other suppliers, focus on wind and solar projects, maximize power generation from bioenergy and nuclear. This plan can reduce the EU´s reliance on Russian gas by over 40 billion cubic meters annually. However, reduction of Russia gas will not be easy, and it requires a sustained policy effort across multiple sectors. The effort must be supported by strong international dialogue on energy market and security. There are also

multiple links between Europe's policy choices and broader global market balances, which means that strengthened international collaboration with alternative pipeline and LNG exporters, as well as with other major gas importers and consumers, will be critical. The implementation of the plan requires clear communication between governments, industry, and consumer. This is important to build trust, ensure transparency, and create awareness of the benefits to low-carbon emissions. It is also crucial to acknowledge that the green transition will not appear fast, and there may be several hurdles along the road. However, the right policies and invest in clean energy will play a vital role to ensure the sustainability of energy in future. (IEA, 2022)

The impact of Finland’s new nuclear power station at Olkiluoto, which should be coming on stream this month.

The Olkiluoto Nuclear Power Plant is one of the important projects of Finland´s energy mix. The project is owned and operated by Teollisuuden Voima Oyj (TVO) with Pohjolan Voima as the majority shareholder with 58.5% total share, Fortum Power and Heat (25.8%), Oy Mankala (8.2%), EPV energia (6.6%) and Kemira(0.9%).The plants consist of two boiling water reactors producing 890 MW of electricity accounting 22% of the country´s total electricity generation in 2020 and a third reactor will be producing 1600 MW which will satisfy 14% of the country´s electricity demands. This expansion of the Olkiluoto Nuclear Power Plant with the development of a third reactor is expected to have a good sized impacts on Finland´s economy, environment and majorly on energy security. The project will help to increase Finland´s energy independence and help to generate 30% of Finland´s electricity from one island. (www.tvo.fi, n.d.).

The electricity produced by the Olkiluoto Nuclear Power Plant's third reactor, Unit 3, will produce 12 terawatt-hours per year which will heat 5.2 million apartments or charge 3.6 million electric cars. Finland’s self-sufficiency in clean electricity is expected to increase and the share of carbon-free electricity

will rise from 87% to 90% which will help to achieve its energy and climate goals. (www.tvo.fi, n.d.).

Budget:

The total of the project is estimated to €11 billions which is 3.5 times more than the original estimated cost. The project was originally scheduled to start in 2009 but, faces significant delays in the construction taking leading series of technical delays, legal disputes, and cost overruns (News, 2022). The legal disputes were settled by an International Chamber of Commerce (ICC) arbitration in favor of TVO with €450 millions compensation for the losses caused by delay in project completion (Anon, n.d.).

Benefits for Finland:

The production from the Olkiluoto plant will reduce Finland´s reliance on imported electricity. The regular production of OL3 will generate 30% of total Finland´s electricity. The electricity production OL3 will reduce Finland´s import of electricity by about 60%. This is particularly significant given the Finland´s location and its heavy dependence on imports, especially from Russia. The increased capacity will help to create a reliable source of electricity which is important for maintaining the functioning of country´s energy intensive industries. The OL3 project has also helped to create Finland´s expertise in nuclear technology and related industries.

Nuclear power is considered as a solution for reducing emissions from district heating and production of hydrogen. By using nuclear power to generate electricity for district heating Finland can reduce the green house emissions and can contribute to its climate goal. In the recent survey by Finnish Energy majority of Finnish society supports increasing the amount of nuclear power with 65-67% of respondents in favor of additional construction. The Russian invasion of Ukraine has indeed impacted energy politics in the EU, particularly in relation to reducing dependence on Russian gas. Nuclear power has emerged as the option to meet the need of energy demand, EU has plans to diversify its energy sources and reduce the dependency on Russian gas. As

nuclear power can produce electricity without emitting greenhouse gases, it has emerged as the potential for meeting the need of the energy. (ANNUAL AND SUSTAINABILITY REPORT, n.d.)

Impact on Environment:

Nuclear power generates less carbon emissions making it a significant for mitigating climate change. The overall emissions remain at same level as wind and hydro power. In the long run nuclear power plants and their small land use make them more environmentally friendly. There are also some negative effects like it causes slight warming of the surrounding seas areas and minor releases into air, water, and soil during the production. The final disposal of nuclear waste is the issue in the use of nuclear power. Used nuclear fuel contains highly radioactive materials that remain hazardous for thousands of years. Management of nuclear waste is a primary challenge. However, the TVO Group has a unique solution for the final disposal nuclear waste called ONKALO. Finland is the first country in the globe to tackle the problem of nuclear fuel dumping. The final disposal is disposed 430 meters deep in the bedrock which is isolated from organic environment by multiple safety solutions called release barriers. The Finnish solution for nuclear waste disposal is considered as the safe, timely and cost effective. It takes into account the development of the disposal site conditions and the performance of the engineered release barriers for up to 250,000 years into the future (Safely in the ancient bedrock First in the world -final disposal of spent nuclear fuel to begin in Finland, n.d.).

Impact on energy security:

Olkiluoto 3 nuclear power plant in Finland is expected to reduce the dependency on fossil fuels and it will also enhance its energy security. As nuclear power is a source to low carbon it can provide a stable supply of electricity. This will also help to reduce the vulnerability to fluctuations in worldwide energy markets and will play an essential position in mitigating the effects of climate change. After the operation of power plant to full output the Finland share of clean, low carbon electricity sources will increase to 90%

which will further strengthen the country´s energy security. (www.world-nuclear.org, n.d.)

Impact of Russia´s invasion of Ukraine

Russia's invasion of Ukraine is political, economic , social situation which has impacted not only them but also Europe as a whole. One of the main impacts was on the energy and food markets. Since 2021, Europe has seen a sharp increase in energy prices. As a result, the EU leaders agreed to phase out the EU's dependence on Russian fossil fuels in March 2022.

The invasion led to increased concerns about the security of the energy supply in the EU. To address this, the EU is looking to make new connections for energy supply and routes. Investing in energy-efficient buildings, corporations, and transportation, as well as encouraging the usage energy-efficient appliances and equipment, are all critical components of boosting energy efficiency. Additionally, Europe has focused on energy security and decreasing dependence on Russian gasoline by growing the deployment of renewable energy, particularly wind and solar power (European Council, 2022).

a) **Sanctions:** The sanctions imposed on Russia by various countries and international organizations for conquering Ukraine are intended to put pressure and to make it economically weak. These steps are taken to restrict Russia foreign investment and exports to make it economically and politically weaken. This will also assist in limiting Russian banks and companies to international financial system. This economic pressure is intended to impede Russia's ability to fund military activities and other aggressive actions, thus curtailing its ability to wage war. In short, the sanctions goal is to restrict Russia's financial power to make economically weak to deter its military capabilities. The sanctions were intended to put pressure on Russia to withdraw from Ukraine and complying with international regulation. They imposed measures

consisting of asset freezes, travel bans, and restrictions on exports and imports. The sanctions had considerable impact in the Russian economy and it has affected badly in foreign investment which led to drop in the value of ruble. The imposed restriction had a significant impact on Russian energy sector with prohibition from engaging in energy projects in the EU, the United States, Canada, and other countries. This has led to a decline in Russian energy supplies to Europe, with numerous European countries reducing their reliance on Russian gas and they have regarded forward to diversify their energy sources. Russia has been hit badly in the finance sector with some banks and financial institutions being banned from accessing the international financial system, which has limited their ability to raise capital and conduct business abroad. (www.consilium.europa.eu, n.d.)

Reduction of energy supply: The struggle among Russia and Ukraine has led to a reduction in energy supplies in several ways. The disruption in the supply of natural gas is the major impact which is caused by the war. Europe is heavily dependent on the Russian gas and the disruption led by the conflict has concerned about the reliability of the supply of gas. The European energy sector is facing challenges due to price volatility and uncertainty in energy balances. These challenges affect the stability of energy prices and make it difficult for companies and consumers to plan. The crisis among Russia and Ukraine has been a concerned subject for the energy security of Europe. The Nord Stream 1 pipeline which has the ability of fifty five billion cubic meters per year is a key supply of natural gas for lots European countries.If the problem worsens and interrupts gas flows via the pipeline, it might lead to natural gas shortages and higher prices across Europe during the winter months, when demand is normally greater. This led to significant economic and social impacts on the affected countries (Meredith, 2022).

In response to these issues, the EU has been trying to diversify its resources of natural gasoline and make ensure its energy security. As a

result of the dispute, the EU and other countries slapped sanctions on Russia, with certain companies barred from conducting tasks in the EU, US, Canada, and different countries. This has led to a reduction in the energy supply from Russia to Europe, with several European countries like Finland, Germany, etc. reducing their dependence on Russian gas. The war has also led to a cutoff of natural gas and petroleum products in some countries, particularly those that applied to join NATO after the outbreak of war. Russia has used its energy supplies as a weapon in the war , and the decision to reduce the supplies has had a bad impact on the energy supply in Europe (Press, 2022).

b) **Accelerated green transition and reversal of that (readoption of peat and coal):** The conflict between Russia and Ukraine could have significant impacts beyond just political tension. As Russia is the major exporter of natural gas the disruption in the supply has led to increased price of the natural gases. The disruption has given an opportunity to diversify the energy sources as the use of fossil fuel has negative impact on the climate. (www.mckinsey.com, n.d.).

The prolonged dispute ongoing conflict between Russia and Ukraine has the geopolitial implications and the potential impact global conversation on climate change and the transition to renewable energy. If Russian natural gas supplies are delayed or cut altogether, European countries will be required to search for an alternate energy sources.This could lead to increased investment and development in renewable energy sources such as wind and solar power but the disruption could also have negative impact on green transition. In some case countries will be compelled to use coal and peat to reach its demand which is reversal of the transition to renewable energy. The potential reliance on coal and peat for the short term shows the significant value for continued investment in renewable energy infrastructure and technology but this transition cannot be achieved overnight. To reach this goal all the sectors like government, business,

individual should work together for the acceleration of renewable energy to reduce the dependence of fossil fuels.

The Finnish government has taken an initiative to phase out the use of oil for heating and reduce the use of peat by 50% by the early 2030 as it plans to reduce the greenhouse emissions and going towards the sustainable energy. This plan is an important step to reduce the greenhouse emissions and lower the effect of climate change so that transition of sustainable energy sources effectively. (Finland's Integrated Energy and Climate Plan, n.d.). According to the International Energy Agency's Sustainable Development Scenario (SDS) , the growth in clean energy investment will lead to a decline in fossil fuel usage as it is primary source of carbon emissions and this emissions results in the negative effect of the climate condition. There will be shift towards renewable energy like wind, solar, hydropower which ultimately will lead in fall for the demand for coal, natural gas and oil. It is moving on right track to meet net-zero emissions by 2050, with an aim of reaching global warming under 1.5 degrees Celsius as outlined in the Paris Agreement (IEA, n.d.).

Conclusions:

Finland's is heavily dependent on imports of energy particularly from Russia. It is a major challenge for the country, as it exposes Finland to potential energy supply disruptions, increased uncertainty, higher prices, and geopolitical risks. Finland has set the target to increase the use of renewable energy sources, but the transition cannot be achieved overnight. Investments in renewable energy infrastructure and technologies is required to reduce. the dependency of natural gases like coal and fossil fuels.

The recent tensions between Russia and the EU have impacted on Finland´s energy sector. The supply chain disruptions of energy, the political situation

has also affected the investment flows and demand for Finnish energy products. The higher prices for natural gas in Finland have impacted the profitability of the petroleum and other industry. In terms of economic relations, relations between Finland and Russia are historically strong. But relations between the two countries have deteriorated appreciably in view that 2014 because of Russia's annexation of Crimea and escalating tensions among Ukraine and Russia. As a result, the Finnish government has adopted stricter approach towards Russia and has strengthen relations with other European states and the United States. The war has also had negative effects on Finland´s political and economy. The imposed sanctions by the EU and other countries against Russia has impacted Finland´s economy, particularly on the export-oriented industries. The geopolitical tension between the countries has increased uncertainty and made difficult for companies to make long term investment decisions.

Despite the challenges in the Finnish energy sector, the of completion of the Olkiluoto 3 nuclear power plant has been a main milestone. OL3 has started the full regular electricity production since 15th April ,2023. It is estimated that the unit will meet about 14 % of the country´s electricity need. Despite of many challenges the completion of OL3 is a significant achievement for Finland´s green transition. The power plant will help to reduce the country´s dependence of fossil fuels and increase the energy security during this supply disruptions of natural gases. As nuclear power is a source to low carbon it can provide a stable supply of electricity. This in turn will assist lessen vulnerability to fluctuations in the global electricity market and play an important position in mitigating the effects of climate alternate. After the operation of power plant to full output the Finland share of clean, low carbon electricity sources will increase to 90% which will further strengthen the country´s energy security.

Finland has set an aim of achieving its renewable energy ability to attain 50% of total energy consumption through 2030. It may even help achieve the intention of being carbon neutral by 2035. The Finnish authorities has implemented various strategies to help the green transition, which includes wind, solar, and nuclear electricity. Increasing the share of renewable energy

in its energy mix, Finland is also investing energy efficiency programs to reduce its overall energy consumption by improving building insulation, promoting energy-efficient appliances, and encouraging sustainable transportation options. Planned green reforms in Finland aim to increase the share of renewable energy in the country's energy mix and reduce its dependence on fossil fuels.

The Finnish government's plan to increase the use of renewable energy sources is a step towards energy security as well as an important shift towards reducing green house emissions and addressing the climate change. Increasing the proportion of strength generated from renewable sources to around 90% through 2050 is a focused intention which if performed will substantially reduce the carbon footprint. (International Energy Agency, 2021). Additionally, the target of reducing overall greenhouse gas emissions from the transport sector by 80% between 1990 and 2050 is also a significant step towards decarbonizing the transport sector and further reducing the country's overall emissions (Ympäristöministeriö, n.d.). These targets and plans demonstrate Finland's commitment to transitioning to a more sustainable and low-carbon economy.

Despite the conflict there are still opportunities for cooperation between Finland and Russia. Maintaining a positive economic relationship is needed between two countries to run the economy sustainably. A stable trade relationship will benefit both the countries companies provide a predictable and reliable business environment. This will also help to create opportunities for growth and job creation and increase economic welfare in both countries. A good trade relations can facilitate the transfer of knowledge and technology between companies which can benefit both sides and it can also help to gain positive economic development. In 2021, Russia exported total $8.93 billions which includes products like crude petroleum, nickel mattes, and refined petroleum. However, Finland exported $4.36 billions which includes products like precipitated copper, refined petroleum, and kaolin coated paper (OEC - The Observatory of Economic Complexity, n.d.). Despite this reduced engagement, bilateral trade between the countries remains high.

In conclusion, this transition is likely to continue, regardless of the situation between Russia and Ukraine. Finland may additionally keep to consciousness on increasing the use of renewable power and reducing its dependence on fossil fuels, while additionally running to diversify its strength resources to ensure that supplies are stable.However, if the Russia-Ukraine conflict escalates and disrupts energy supplies, it may become more urgent for Finland to find alternative sources of energy.Nonetheless, the completion of the OL3 nuclear power plant is a significant achievement for the Finland´s green transition and will increase the energy security .However, maintaining good relationship between Russia and Finland is important for promoting economic growth and job creation.

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