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POLAR-WHITE IS THE NEW GREEN:
GREEN TRANSITION SCENARIOS IN THE ARCTIC REGION BY 2030

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ABSTRACT

When the words "Energy" and "Arctic" occur together within the global context, in most of the cases, the ideology creates an image and ideas of large fossil fuel projects, oil and gas rigs, and ship tankers. Governments, institutions, business actors, and other key stakeholders from the energy sector in the Arctic region face pressures that could be translated as green transition, low-carbon age, or data are the new oil. The green economy is a significant concept that interacts with green transition of energy resources in the Arctic region. This particular chapter derives from numerous global trends, key driving forces and assumptions that have a direct impact on the future evolution of green transition in the Arctic region by the year 2030. The primary goal of this chapter was to create and draw potential future alternatives for the development of transition to green energy in the Arctic region by 2030. Hence, authors developed three green transition scenarios which do not aim to strictly project and forecast the future, instead, the aim is to identify possible alternatives of green transition evolution in the Arctic region by 2030. In addition to that, authors developed framework of key driving forces influencing green transition in the Arctic region, and introduced wild scenarios of green transition in the Arctic region.

KEYWORDS: Green transition, Energy, Arctic, Scenarios, 2030

1. INTRODUCTION

Relevance of the scenarios

When the words “Energy” and “Arctic” occur together within the global context, in most of the cases, the ideology creates an image and ideas of large fossil fuel projects, oil and gas rigs, and ship tankers. However, the evolution of the world energy system is currently in the phase of active and dynamic changes in the global processes, trends, practices, and policies. Governments, institutions, business actors, and other key stakeholders from the energy sector in the Arctic region face challenges that could be translated as green transition, low-carbon age, or data are the new oil (DeGeorge, 2020).

Green transition can be interpreted in other words like a shift and transition towards cleaner and green energy alternatives. Hereby, to understand more clearly, the green transition aims to replace fossil fuels with renewable energy sources, to conserve energy by efficient use of energy resources (Georgeson, Maslin, & Poessinouw, 2017).

Altogether, there are numerous global trends that have direct impact on the future evolution of the green transition in the Arctic region as well as they have impact on the formulation of policies, integration of energy technologies, and most importantly integration of renewable energy to the world’s energy system. For instance, to mention few global trends, technological development as one of the key drivers of innovations can facilitate and enable renewable energy sources with the help of digitalization. Secondly, climate change as one of the key drivers of sustainability, and responsible governance can ease up shift towards low-carbon and carbon neutral world. Last but not least, globalization as one of the key drivers of economic growth can succour the chances to sustain renewable energy sources.

Aims and goals of the scenarios

This particular chapter derives from numerous global trends, key driving forces and assumptions that have a direct impact on the future evolution of green transition in the Arctic region by the year 2030. The primary goal of this chapter was to create and draw potential future alternatives for the development of transition to green energy in the Arctic region by 2030. As a result of that, authors of this chapter developed three green transition scenarios for the Arctic region by 2030.

All of the three green transition scenarios that were developed, each of them was assigned with the nickname, in fact, the nickname was connected to the basis on which the scenario will be driven by. Hereby, green transition scenarios do not aim to strictly project and forecast the future, instead, the aim of the green transition scenarios is to identify alternatives of possible green transition evolution in the Arctic region by 2030. As a consequence of that, green transition scenarios aim to prepare for full range of possible future events including so-called “Black Swans”.

2. LITERERATURE REVIEW

Scenario analysis method

The scenario analysis method seems to be a promising and significant tool in the management processes across a variety of sectors to plan, foresight and prepare for uncertain future outcomes and events. With this in mind, the scenario analysis method from the management point of view is described among scholars and researchers as a process and valuable instrument in strategic planning. The strategic planning is a phase of strategic management process which focuses on the long-term future, usually, on time horizon scale it is three and more years (David, David, & David, 2013). In the past, the concept of preparation towards future was to predict, in other words to “*forecast*” rather than prepare, in other words to “*foresight*” the future with possible evolution and developments that may occur over time (Mietzner & Reger, 2005, p. 235).

According to Mietzner and Reger (2005, p. 223) the main objective of the scenario analysis method is to *"establish future planning which can minimise surprises and broaden the span of managers' thinking about different possibilities"*. In this context, to help us understand more clearly, the aim of the scenario analysis method is to prepare high-profile representatives in executive roles within governments, corporations and organizations for possible futures, whereas, scenarios in some cases might be key aspects in decision-making process.

Obviously, the scenario analysis method appears to be a driver to improvement of decision-making process, however, scenarios bring with them specific constraints and limitations, which eventually makes scenario analysis method prosperous and disadvantageous in certain situations. To illustrate, from the scientific perspective, there is still a lack of systematic approaches to generate, validate, and analyse scenario analysis (Hsia et al., 1994, p. 33).

The golden rule of the scenario analysis method is the quantity of built scenarios. In the article *"Scenario building: a suitable method for strategic property planning?",* author claim that appropriate number of scenarios should not equal to four, while, not less than two. The golden rule with this statement would be that three scenarios are appropriate and sufficient amount to foresight the future (Ratcliffe, 2000).

Advantages & strengths of scenario analysis

Undoubtedly, the prime advantage of the scenario analysis method is the fact that this method takes into the account and considers numerous futures rather than one particular foresight (Mietzner & Reger, 2005, p. 234). The world's energy system is currently in the flux of changes caused by variety of global processes and trends. Namely, energy sector faces global trends that could be translated as low-carbon age, green transition or data are the new oil.

In such turbulent and uncertain times, the scenario analysis method can advantage decision makers with formulation of strategies, which ultimately could lead organizations to sustain and thrive their competitive advantage. As a result of that, organizations could greatly benefit from integration of scenarios into their strategy practices (David et al., 2013).

In addition to advantages of the scenario analysis method, this concept serves energy companies in the Arctic region with numerous strengths. To illustrate the major strengths of scenarios for energy companies, authors of this chapter decided to portray seven strengths of scenario analysis in **Table 1.** with implications[1] on energy sector.

1 Authors implied strengths of scenario analysis method on energy sector based upon data from (Mietzner & Reger, 2005, p. 235)

Table 1. Seven strengths of scenario analysis method with implications on energy sector in the Arctic region [Authors own work, Data: (Mietzner & Reger, 2005, p. 235)]

Scenario's strengths	Implications on ARCTIC ENERGY SECTOR	Source
1. Quantity	The energy companies can foresight the future more effectively with numerous scenarios rather than one particular forecast.	(Mietzner & Reger, 2005, p. 235)
2. Imagination	Managers of energy companies can use scenarios to enable radical imagination to formulate and monitor the corporate and business strategies.	(Mietzner & Reger, 2005, p. 235)
3. Recognition	Energy companies can easily recognize the weak spots within their organization, disruptive factors in operational environment with the help of scenario analysis.	(Mietzner & Reger, 2005, p. 235)
4. Communication	Scenarios can help energy companies and other key stakeholder to communicate strategic objectives and issues within the energy sector.	(Mietzner & Reger, 2005, p. 235)
5. Coordination	Within the scenario building process, goals, threats, opportunities, and strategies are shared among key energy stakeholders whose plan to implement certain actions towards the scenarios.	(Mietzner & Reger, 2005, p. 235)
6. Suitability 7. Flexibility	Scenarios are very flexible and suitable foresights for the energy companies which allow them to adjust and integrate the scenarios even to specific project or task.	(Mietzner & Reger, 2005, p. 235)

Disadvantages & Weaknesses of scenario analysis

Contrary to strengths, scenario analysis method consists of multiple drawbacks. According to Mietzner and Reger (2005, p. 236) authors argued that scenario analysis method is without any doubts extremely time-consuming process. For example, building scenarios cannot be done throughout a day, the building stage of scenarios requires a lot of time. This is tremendous challenge in practice, because energy companies and policy makers do not have always enough time.

Secondly, authors argued that scenario analysis method should be more qualitative based rather than quantitative. In practice, this is difficult task to be fulfilled because selection of numerous significant and appropriate qualitative factors makes the scenario building process subjective to some extent.

Thirdly, authors claimed that another weakness is validity and credibility of the scenarios. With this in mind, scenarios should not be taken for granted or considered reliable unless collection of information and data was done under deep investigation of external driving forces with deep understanding of industrial knowledge. In this case, deep knowledge of the Arctic energy sector and its key stakeholders as well as how external forces drive the operational environment.

Last but not least, the fourth weakness authors argued in their article was the weakness of focus on positive-negative, black-white or optimistic-pessimistic scenarios in the scenario-building process.

Wild scenarios – "Black Swan"

Scenarios as such, usually create the question about future events with high impact and low probability. So-called wild cards, or out of the box scenarios refer to these events with drastic impact and low chances of probability (Overland et al., 2015, p. 27). However, in the case of *"Black Swan",* the theory relies on the fact that future event will have dramatic impact. Therefore, in the case of black swan events the factor of probability is irrelevant because black swan events will come as a surprise. Hence, the probability is unknown, however, the black swan will happen surprisingly as it is unknown and improbable event in the future (Krupa & Jones, 2013, p. 286).

In the energy world, black swans occurred over the time and have “shuffled cards” in the world’s energy system. As an example of black swan in the world energy system was the oil crisis in the 1970s. Particularly in 1973 the Organization of Arab Petroleum Exporting Countries sanctioned several nations including United States in the form of embargo. The reason for this embargo was due to collective support of these countries to Yom Kippur in Israel. As a consequence of this embargo, black swan occurred in the form of rising crude oil prices in the following 7 years, whereas, the increase of crude oil prices accounted for more than 500% (Krupa & Jones, 2013, p. 287).

Another black swan in the world’s energy system was the evolution of Chinese energy demand and supply. In 1950s the overall consumption of oil, gas, coal, and hydro in China accounted roughly for 55 million tons of coal equivalent (MTCE), whereas, in 1996 the overall consumption of energy sources grew radically, and accounted for more than 1.350 MTCE. This in fact was caused due to certain disruptive actions in the China like decentralization of policies, structuralizing reforms, and new market incentives that influenced Chinese energy sector (Krupa & Jones, 2013, p. 288).

Most recently, as one of the black swans in the world of energy was the still ongoing pandemic situation caused by coronavirus. The pandemic has brought an extraordinary year for energy sector all around the world. The overall energy demand during the pandemic has declined by approximately 5% year-on-year. During the last century, only global processes like wars and financial crisis in 2008 have created a greater decline in energy demand. In fact, there are anticipations that pandemic and its consequences will bring decline in coal demand by 7%, and oil demand by 8% (IEA, 2020b, p. 30).

Scenarios in practice – International Energy Agency

Three energy-related scenarios were introduced in 2020 by the leading governing body in the world of energy – *International Energy Agency (IEA).* Annually, the organization releases so-called World Energy Outlook, in 2020 this outlook introduced four scenarios for energy evolution in the world (IEA, 2020b, p. 29).

The first one, was the stated-policy scenario, abbreviated as STEPS. This scenario relies on the fact that world’s energy system will continue with current policies in fields like energy, climate, security. Therefore, STEPS scenario assumes that political targets, and ambitions that were announced by policy makers, and governments will be ratified and legalized on the national as well as international level (IEA, 2020b, p. 29).

Secondly, IEA developed sustainable development scenario, abbreviated as SDS. This scenario relies on the same facts like in the STEPS scenario but in addition to that, has more emphasis on the environmental aspects like clean air, climate change, and energy access objectives. From the economic perspective, SDS scenario assumes that resilient energy systems can empower employment and economic growth, whereas, from technological perspective the SDS scenario assumes that energy technologies will boost efficiency of energy systems (IEA, 2020b, p. 29)

The third scenario that IEA developed was delayed recovery scenario, abbreviated as DRS. This scenario can be translated as more *“pessimistic”* because of its outlook towards evolution in the economy, and public health situation. DRS scenario assumes that pandemic of coronavirus will have long lasting, and deep impact on the world of energy (IEA, 2020b, p. 29).

Green transition can be translated in other words like a shift and transition towards cleaner and green energy alternatives. Hereby, to understand more clearly, the green transition aims to replace fossil fuels with renewable energy sources, to conserve energy by efficient use of energy resources (Georgeson et al., 2017).

3. SCENARIO APPROACH AND METHODOLOGY

When the three scenarios of the green transition in the Arctic region by 2030 were developed, authors have adopted notoriously well-known framework introduced by Royal Dutch Shell (Cornelius, Van de Putte, & Romani, 2005). Instead of probability – that cannot be quantitatively determined without accuracy for future complex developments – the criteria for green transition scenarios in the Arctic region are therefore based upon internal coherence and plausibility of assumptions and key driving forces. In addition to that, rather than uncertainties authors have integrated key driving forces that will have primary impact on the future evolution of green transition in the Arctic region. With this in mind, green transition scenarios do not aim to strictly project and forecast the future, instead, the aim of the green transition scenarios is to identify possible alternatives of green transition evolution in the Arctic region. As a consequence of that, green transition scenarios aim to prepare for full range of possible future events (Overland et al., 2015, p. 12).

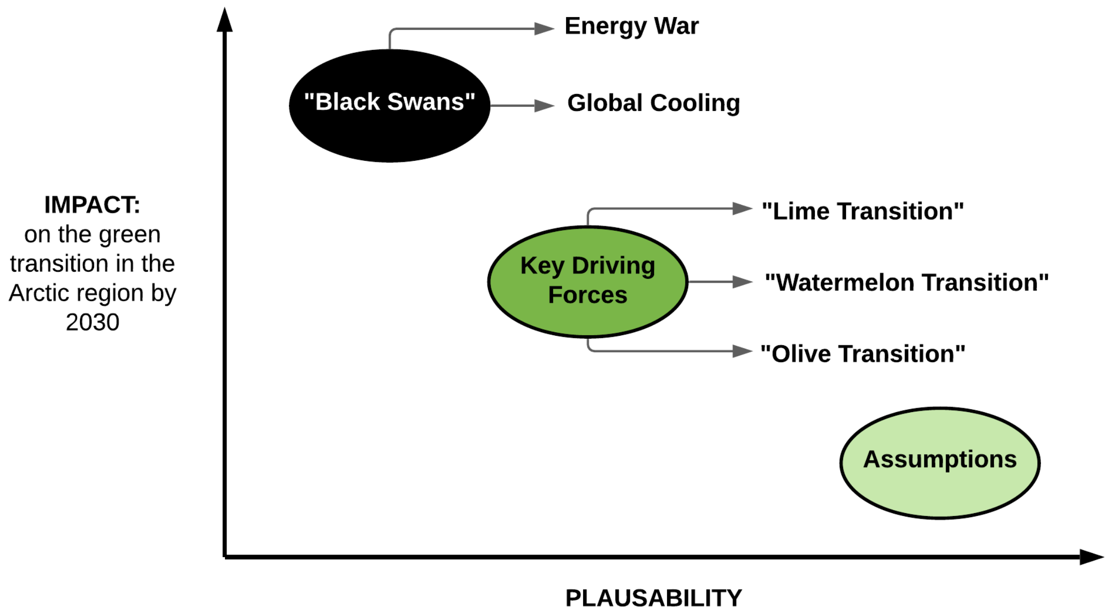

Figure 1. Diagram above illustrates framework of scenario building with application on green transition scenarios in the Arctic (Authors' own work)

Moreover, when green transition scenarios were developed, the process consisted of 2 stages. First of all, authors listed dimensions that are hereto referred as "Assumptions". This section identified and briefly indicated the main assumptions that will have a direct and mild impact on the evolution of green transition in the Arctic region by 2030. In this context, "assumptions" are dimensions that have a high degree of probability to happen as well as they are more probable than any other future developments, events, and trends unless they are not already in effect. It is important to note that assumptions are dimensions that are certainly going to happen, or already have taken place and will impact further evolution of green transition in the Arctic region by 2030. In other words, assumptions are dimensions that will have a lower impact and a high probability of influence on the green transition in the Arctic region in the future.

The previous section – assumptions, focused on relatively common, certain, and definite dimensions for the green transition in the Arctic region by 2030. The second stage of scenario building identified and briefly indicated the main "Key driving forces" that will have a direct and strong impact on the evolution of green transition in the Arctic region by 2030. In this context, "key driving forces" are dimensions that will strongly influence the development of green transition. The evolution and pathway of key driving forces are unknown to what direction they will lead. Within the forecasting process in the scenario planning stage, the goal is to reduce and decrease the level of uncertainty as much as possible, however, in this case, the goal is to present key driving forces that will influence the green transition in the Arctic region by 2030.

4. ASSUMPTIONS

Global and national climate policies

There is a significant development of climate policies around the world. Countries adopted climate policies, and joined Paris Agreement to ensure that our mother Earth will remain viable for future generations. Even in an advanced economic country like Norway, petroleum was considered as welfare, consequently, petroleum became a risk due to the adaptation of climate policies. This created tremendous opportunity and leverage for renewable energy sources. The reason for that is due to the limits of the earth's carbon budget. When looking at fossil fuels, petroleum is one of the most environment-harming fossil fuels, and is highlighted within the climate policies as a resource that needs to be replaced and reduced in order to achieve a lower degree of emissions because reduction of fossil fuels will play a crucial role in the decline of greenhouse gas emissions. As a particular consequence for this reason, to some extend green transition as a global process was born and created multiple opportunities, challenges and constraints (Bang & Lahn, 2020).

Delayed COVID-19 recovery

The spread, fight and response to the novel coronavirus known as COVID-19 still affects the world, which ultimately reflects on the world energy system. Delayed recovery from the pandemic is to certain extend caused due to new variants and mutations of the coronavirus, lack of emergency and response measures as well as vaccination drawbacks. As a result of delayed recovery from global pandemic, assumption relies on the fact that world energy system and world's energy were placed into slow motion. This resulted in slow down of the green transition process in the Arctic region. Decrease and slow down resulted in hold back of energy demand and greenhouse gas emissions. However, delayed COVID-19 recovery is very likely to decrease systematic and strategic investments to the green and cleaner energy alternatives including development of renewable energy sources, technologies and networks. It is because additional expenditure will be required to response and rebuild the world as well as world energy system that was disrupted with the global coronavirus outbreak. With this in mind, governments, private sector actors and energy companies struggle with unexpectable expenditures and costs caused by delayed recovery form COVID-19 (IEA, 2020b).

Circumpolar and Arctic energy policy

Within the energy policy dimension in the Arctic region, it is important to note the trend of the world's energy development. There is systematic evidence of growth within energy production likewise consumption of all energy carriers without exception. Hence, this assumption is considered as one of the key assumptions that will play crucial role in further green transition evolution. Arctic energy policy, in other words, policies of the Arctic member states in regard to energy will be kept up to strengthen, tighten and empower energy security issues of the nations in the Arctic region. According to Provornaya, Filimonova, Eder, Nemov, and Zemnukhova (2020), "as civilization develops, there is a significant diversification and expansion of the range of energy sources consumed, uneven distribution of the main centres of energy production and consumption, uneven energy consumption in developed and developing countries." Therefore, further formulation of energy policies in the Arctic countries might remain keen on sustainable trends within energy world market as consumption and production of energy sources of the Arctic member states diverge.

Desire for Innovations

Innovations can be radical or incremental. In terms of green transition, governments and energy companies in the Arctic region will face both of these types. Undoubtedly, there is a high potential that advanced, better and newer innovations will be demanded within the world energy system, likewise in the Arctic region. Firstly, incremental innovations can be described as innovations with gradual degree of change. In the past, incremental innovations helped energy companies to design appropriate, efficient, and suitable technologies to exploit hydrocarbons, in other words these innovations were favourable for governments and companies to increase effectivity of drilling and extraction of fossil fuels in the Arctic region. On the other hand, radical innovations can be described as innovations with revolutionary degree of change. Recently, radical innovations made policy actors, executives and board members to think about change management solutions. The reason for that is due to renewable energy alternatives like solar panels, wind turbines and new energy carriers like hydrogen. In fact, innovations within energy sector contributed positively to decline greenhouse gas emissions within OECD countries. This in fact is very likely to drive further development of renewable energy solutions and help green transition to be achieved, especially in the Arctic region (Álvarez-Herránz, Balsalobre, Cantos, & Shahbaz, 2017).

Tradeable instruments

Mitigation of climate change is being fought with the help of various climate related tradable instruments. Instruments that intervene to the world energy system, Arctic region and impact green transition process are interpreted as tradeable energy quotas (TEQs). However, within the energy system and energy sector, there are also following tradeable instruments that will have mild impact on the evolution of green transition in the Arctic region: (1) Emission trading systems, (2) Tradeable renewable energy quotas, and (3) Tradeable energy-efficiency obligations. The reason why the impact on green transition will remain mild is due to the fact that these tradeable instruments have been already implemented and countries have started adapting towards the tradeable instruments. Records and results of the tradeable instruments from the practice have been disappointing so far due to several reasons. Firstly, almost all of the emission trading systems suffered because the over allocation resulted in the undermining effectivity of the instrument. Secondly, tradeable energy-efficiency obligations tend to have co-financed investments in the energy, that would in fact take place anyway. Last but not least, tradeable renewable energy quotas struggle due to drawbacks like tariffs and premiums in comparison with alternative systems. To sum up, green transition in the Arctic region by 2030 will face new actions and updates within the current tradeable instruments (Quirion, 2021).

Continuity of international relations and national security

Foreign policy and energy formulate the question about national security. Especially in the Arctic region, which is rich on hydrocarbons and other energy resources. Since "energy has entered the sphere of diplomacy and foreign policy as a result of its rising impact on national security and economy" (Bovan, Vucenovic, & Peric, 2020), therefore future offshore petroleum development and green transition in the Arctic region can easily impact the relationships between the states in the Arctic, and create so-called geopolitical winners and losers (Vakulchuk, Overland, & Scholten, 2020). In terms of international relations and energy development projects, it is significant to pay a lot of emphasis towards the future implications of offshore petroleum development as green transition aims to replace fossil fuels with renewable, green and clean energy solutions. Altogether, it is important to have strong energy diplomacy as an Arctic country to ensure national security (Bovan et al., 2020). Green transition in the Arctic region will face up to 2030 a lot of questions about geopolitics, geoeconomics and its implications on international conflicts.

Investments as social and environmental costs

Firstly, energy industry, energy technologies, and energy facilities, are a lot about investments and finance. In the Arctic region, besides investments to the offshore petroleum development, energy companies are in some countries expected to invest to the social and environmental infrastructure. Therefore, the authorities of the Arctic countries are aware of the fact that "non-commercial investments run counter to the companies' profit interests and are driven by the state and the region's joint social frame. Yet the costs imposed onto the companies are relatively minor in relation to their total investments in large-scale infrastructure" (Aalto, 2016).

Secondly, it is important to note that numerous financial institutions, hedge funds, and banks as well as energy companies reoriented their portfolios of investments towards greener and sustainable alternatives. For example, Deutsche Bank initiated so-called climate change investment universe which focus on cleaner energy and energy efficiency. A lot of emphasis is given particularly towards clean and green power generation, like solar, wind, hydro and other clean power generators (Inderst, 2012). From the energy companies perspective, all of so-called seven sisters[2] already began slowly to retire their fossil fuel technologies and progressed to invest towards green and cleaner technologies like hydrogen, solar panels, wind turbines (Taghizadeh-Hesary & Yoshino, 2020). Therefore, the green transition in the Arctic region is likely to happen only in case when all of the public, private and so-called third sector actors will reorient from exploitation of hydrocarbons towards green energy solutions like offshore wind turbines.

Technological and energy development

Technological advancement, digital transformation, and development of energy technologies turned out to be a development factor and key driver to improve environmental quality and increase energy efficiency. Particularly, the technological development of clean and green energy technologies seems to be a dramatic nightmare for fossil fuel companies that operate in the Arctic region (Álvarez-Herránz et al., 2017). Hence, we can confidently confirm that there is a positive causal link between advanced energy technologies and better quality of the environment. The same applies to the geographical region – Arctic. Due to more effective technologies, with help of artificial intelligence and big data Arctic countries can radically mitigate climate change, improve energy efficiency and thrive towards low-carbon age which will enable the green transition to be more viable thanks to technological advancement.

[2] Seven sisters – a common phrase for seven transnational oil enterprises. 7 sisters currently consists of: British Petrol, Royal Dutch Shell, ExxonMobil, Chevron (Wilkins, 1976).

Table 2. Overview and summary of assumptions for the three green transition scenarios in the Arctic by 2030 (Authors' own work)

Assumptions	Scenario 1 ***"Lime transition"***	Scenario 2 ***"Watermelon transition"***	Scenario 3 ***"Olive transition"***	**Source**
Global and national climates policies	There is a significant development of climate policies around the world. Countries adopted climate policies, and joined Paris Agreement to ensure that our mother Earth will remain viable for future generations.			(Bang & Lahn, 2020)
Delayed COVID-19 recovery	The spread, fight and response to the novel coronavirus known as COVID-19 still affects the world. This results in slow down of green transition in the Arctic region			(IEA, 2020)
Circumpolar and Arctic energy policy	There is systematic evidence of growth within energy production likewise consumption of all energy carriers without exception. Therefore, further formulation of energy policies in the Arctic countries might remain keen on sustainable trends within energy world market			(Provornaya, Filimonova, Eder, Nemov, and Zemnukhova, 2020)
Desire for innovations	Undoubtedly, there is a high potential that advanced, better and newer innovations will be demanded within the world energy system, likewise in the Arctic region.			(Álvarez-Herránz, Balsalobre, Cantos, & Shahbaz, 2017)
Tradeable instruments	Instruments that intervene to the world energy system, Arctic region and impact green transition process are interpreted as tradeable energy quotas (TEQs). The aim is to efficiently mitigate climate change.			(Quirion, 2021)
Continuity of international relations and national security	Foreign policy and energy formulate the question about national security. Especially in the Arctic region, which is rich on hydrocarbons and other energy resources.			(Bovan, Vucenovic, & Peric, 2020), (Vakulchuk, Overland, & Scholten, 2020)
Investments as social and environmental costs	Firstly, energy industry, energy technologies, and energy facilities, are a lot about investments and finance. Secondly, numerous financial institutions, hedge funds, and banks as well as energy companies reoriented their portfolios of investments towards greener and sustainable alternatives.			(Aalto, 2016), (Inderst, 2012), (Taghizadeh-Hesary & Yoshino, 2020)
Technological and energy development	Due to more effective technologies, with help of artificial intelligence and big data Arctic countries can radically mitigate climate change, improve energy efficiency and thrive towards low-carbon age which will enable the green transition to be more viable thanks to technological advancement.			(Álvarez-Herránz et al., 2017)

5. KEY DRIVING FORCES

Total Primary Energy Demand (TPED)

One may argue that with growing consumption, population and economy the result will reflect on the total primary energy demand (TPED). Even the forecast of the world's major energy institution like *International Energy Agency* foresights that TPED will continue to grow. However, in this chapter, authors consider TPED as relatively uncertain factor due to lack of evidence and security. In fact, growth of consumption, population, and economy does not guarantee so-called "birth in hand" that demand for energy will continue to grow. To illustrate, COVID-19 pandemic has dramatically affected energy consumption due to strict lockdowns and preventive measures in order to response and prevent human beings from the global outbreak. According to the same major energy institution, International Energy Agency analysed that these countries under strict lockdowns due to coronavirus pandemic, experienced radical reduction in energy consumption. In some Arctic countries with strict lockdowns, the consumption declined roughly by 30% in comparison with energy consumption before the coronavirus outbreak. Therefore, the coronavirus pandemic has affected consumption and demand for the energy, which ultimately resulted in inconsistency between energy demand and energy supply (IEA, 2020b).

Total Primary Energy Supply (TPES)

Total primary energy supply (TPES) can be defined and observed from various perspectives. From the sectorial perspective, energy is supplied to a variety of industries and sectors. For instance, energy supplies are demanded within transportation, aviation, shipping, buildings, and power sector. On the other hand, from the geographical perspective, supplies of energy circulate across the world's energy markets throughout the years. Hence, the Arctic region is considered as a backbone of the world's energy market and supply because of its rich area of natural and energy resources that can be found there. With this in mind, major energy players in the Arctic region like Russia, Norway, and Canada contribute to the world's total primary energy supply (TPES) with a tremendous share. Although, Arctic region still provides a lot of undiscovered deposits of natural gas and oil, supplies of the fossil fuels are not unlimited. According to Käpylä and Mikkola (2016) authors claim that Arctic region hides more than 30% of undiscovered deposits of natural gas and more than 13% of undiscovered deposits of oil. Both of these commodities that are still being undiscovered are mainly located in the offshore Arctic region. Namely, the energy supply consists of multiple energy sources. Firstly, the raw energy supplies are fuel-based like well-known fossil fuels as natural gas, oil, and coal. Moreover, the energy supply consists of power, and electricity that can be produced from numerous sources including fossil fuels, nuclear power, renewable energy sources like solar panels, wind turbines, and recently also hydrogen found its spot in the world's energy system due to it valuable and prosperous features. Anyway, it is important to note that hydrogen is an energy carrier and not explicitly a source of the energy. Nowadays, hydrogen is being produced from a variety of energy sources like nuclear power, renewable energy, and fossil fuels. As a consequence of that, hydrogen obtained its attribute from the colour scale.

Fossil fuels production and supply

World is still in the phase when millions of barrels of crude oil, and millions of cubic meters of natural gas is produced. In this sense, green transition in the Arctic region by 2030 could be considered and expressed to some extend as *faux pas*. The particular reason for that is due to heavy and rich production and supply of fossil fuels on the world-wide scale. Even Arctic region is not an exception. It is important to note that fossil fuels are group of fuels that consist of crude oil, natural gas and coal. These elements, and fuels belong to the group which results in harsh and harming emissions for earth. To illustrate, in 2019 the world's production and supply of crude oil accounted for more than 95 million of barrels per day. During the same year production of natural gas accounted roughly for 4.1 trillion cubic meters. In addition to that, in 2019 production of coal was higher than in 2018, in particular it was 5625 million tonnes of coal equivalent (Mtce). With this systematic evidence, someone can think that member states and countries from OPEC (Organization of The Petroleum Exporting countries) produced and supplied majority of the crude oil. WRONG! OPEC, in 2019 produced and supplied approximately 35 million of barrels per day, whereas, rest of the world including Arctic region, produced and supplied more than 60 million of barrels per day. With this in mind, Arctic region is still key and major player in production and supply of fossil fuels including crude oil, coal and natural gas which in fact creates doubts and uncertainties about green transition in the Arctic region (IEA, 2020b).

Fossil fuels demand

In 2020, the global energy demand has recorded decline by approximately 4%. With this in mind, the major proportion of global energy mix that consists of fossil fuels, resulted in radical decrease of demand for fossil fuels (IEA, 2020a). In fact, coronavirus pandemic caused restriction on social, mobility, and economic activities which resulted in decline of demand for fossil fuels. Therefore, global recovery of the world's energy system, including demand for fossil fuels may take longer due to lockdowns, preventive measures, and restrictions that were implemented during the global outbreak. Reflecting on the recent trends within the fossil fuels demand, *International Energy Agency* highlighted in their flagship report *"Global Energy Review 2020"* that demand for fossil fuels will evolve as follows. Firstly, demand for crude oil could decline by roughly 10%, in other words 10 million barrels per day which would bring demand for crude oil back to the levels of 2012 (IEA, 2020a, p. 4). Secondly, demand for natural gas could be more moderate, particularly estimation is that demand for natural gas could decline by approximately 2% due to reductions of demand among power and industrial sectors (IEA, 2020a, p. 5). As a consequence of these global events among demand for fossil fuels, authors of this chapter assume that fossil fuels demand in the Arctic region is to certain extent uncertain because of the current global processes and trends not only within the world's energy system.

Green energy production and supply

Contrary to fossil fuel production and supply, there are green energy alternatives such as bio- and renewable energy. Among green and renewable energy alternatives as of today, are the following sources of energy: wind, solar, hydro, geothermal, etc. (IEA, 2020b). However, in the context of green transition, the shift towards renewable energy sources in the Arctic region is still a hot topic and brings numerous challenges, questions, and hypotheses to be addressed from all key stakeholders not only in the Arctic region. The main disruption towards the further production and supply of green energy is once again coronavirus pandemic. *International Energy Agency* assumes that further production of green energy will be put in slow motion. Ultimately, the implications could result in disruptions within the supply chains, and delays in green energy project developments before returning *"back on track"* towards rapid growth.

Green energy demand

In 2019, within the world's total primary energy demand (TPED), green energy in terms of bio-energy, and renewable energy, which consisted of hydro, solar, wind, and biomass accounted roughly for 15% of the world's TPED. In this case, the overall demand for green energy within the TPED still represents a lower proportion than coal, crude oil, or natural gas separately. However, on the other hand, the overall demand for green energy within the TPED in 2019 represented a greater proportion than the demand for nuclear energy, which accounted only for a 5% share in the TPED in 2019. Beyond that, energy demand within the power sector was more favourable for green energy alternatives. The particular reason for this circumstance is the fact that renewable energy became more cost-competitive with fossil fuel demand in the power sector. In fact, the coronavirus pandemic and the prices of oil which were exposed to risk could enhance chances for green energy alternatives within the power sector (Akhtaruzzaman, Boubaker, Chiah, & Zhong, 2020). Hence, the total share of green energy demand within the power sector was approximately 16%. Nevertheless, the most favourable sector for the green energy was recorded within the buildings, whereas green energy reached level of 25% share on overall energy demand. Furthermore, the following sectors consisted proportion of green energy demand: transport (4%), and industry (7%).

CO2 Emissions

Greenhouse gas emissions are very often expressed in CO2 emissions equivalent. Therefore, in this chapter the contextual meaning of CO2 emissions equal to greenhouse gas emissions including carbon dioxide, ozone, methane, and other vapours. The evolution of greenhouse gas emissions in the Arctic region has recently fluctuated (EuropeanCommission, 2021). When looking at the emissions contributors in the Arctic region, Arctic states' emission contribution can be expressed from two perspectives. The first perspective would be from energy – exploitation of fossil fuels, and the second from the real emissions output of the Arctic member states. From the energy perspective, Russia, Norway, and United States are contributors to significant greenhouse gas emissions with the exploration of fossil fuels in the Arctic region. Whereas, the rest of the Nordic states including Canada can be somewhat considered as eco-friendly from the exploitation of fossil fuels and energy resources perspective. Secondly, from the real emissions output, the major contributors are Russia, Canada, and the United Stated because more than 20% of greenhouse gas emissions were generated by their input in 2015. From the year when Paris Agreement was signed and ratified, all of the Arctic states, except Russia, either sustained or decreased their global share of greenhouse gas emissions. Russia's global share of greenhouse gas emissions has increased by 0.10% which in fact is not drastic when looking at the population, and land size of the Russian state (Ritchie & Roser, 2020). The overall evolution of greenhouse gas emission by the Arctic states from 2015 to 2019 is described in **Table 3**.

Table 3. Evolution of greenhouse gas emissions (GHG) in the Arctic states between 2015-2019 (Authors' own work, Data: [3],[4])

Country	% Share of global GHG in 2015	% Share of global GHG in 2019	4-year national GHG % change
Russia	4.61 %	4.71 %	+ 2.12 %
United States	15.37 %	13.43 %	- 14.45 %
Canada	1.64 %	1.54 %	- 6.49 %
Norway	0.13 %	0.13 %	0.00 %
Sweden	0.12 %	0.12 %	0.00 %
Finland	0.13 %	0.11 %	- 18.18 %
Denmark	0.10 %	0.08 %	- 25.00 %
Iceland	0.01 %	0.01 %	0.00 %

Decarbonization

The decarbonization process is very closely linked with the reduction of greenhouse gas emissions and the mitigation of climate change. Therefore, high relevance in decarbonization is formed actually from the political actors. Actual climate policies have not yet significantly influenced the decarbonization of the energy sector. The responsibility to decarbonize the energy sector is still questionable because of its implications on other sectors such as transportation, buildings, and the power sector. In addition to that, decarbonization will have a drastic impact on the national oil companies (NOCs), and other key energy players whose operations are not the most favourable for the environment. Arctic region is heaven on earth

[3] (EuropeanCommission, 2021)
[4] (Ritchie & Roser, 2020)

for several energy companies, in particular corporations from the oil and gas industry. Hence, precise transformation, deployment, and further development of the decarbonization process will create questions about the retirement of the technologies that are fossil fuel-based and operate in the Arctic region. As a consequence of that, dialogue between policymakers, and energy companies in the Arctic region will play a crucial role in the transparent and revolutionary decarbonization of the energy sector (Åhman, Nilsson, & Johansson, 2017).

6. CORRELATION BETWEEN KEY DRIVING FORCES

Key driving forces that were mentioned above illustrate and represent key drivers for further development of green transition scenarios in the Arctic region by 2030. In this context, every single dimension of the key driving forces will determine how green transition will evolve over the period of time, and look like in 2030.

Therefore, the authors of this chapter developed a framework (see **Figure 2.**) on the correlation between key driving forces mentioned above. The forecast of green transition scenarios in the Arctic by 2030 assumes that each of the elements listed as key driving force will interact and affect further development - the flow of another key driving force. In this framework, the authors connected interaction among key driving forces in the form of arrows. In addition to that, the authors illustrated possible impacts by colour of the arrows. The darker green the arrow is, the higher impact it can cause on the interaction among key driving forces.

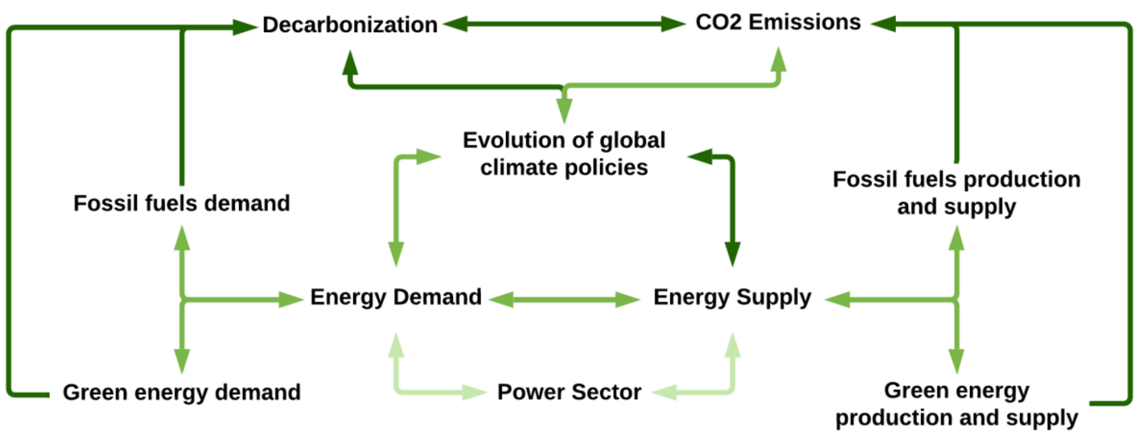

Figure 2. Framework above illustrates correlation among distinctive key driving forces affecting development of green transition scenarios in the Arctic region by 2030 (Authors' own work).

7. GREEN TRANSITION SCENARIOS IN THE ARCTIC REGION BY 2030

Introduction to scenarios

This chapter portrays three possible scenarios for the green transition in the Arctic region by 2030. In the first *"Lime Transition"* scenario, the shift and transition to clean and green energy alternatives in the Arctic region will be soft and light. In other words, the *"Lime Transition"* is hereby described as a scenario that could be translated to the phrase "business as usual". With this in mind, the continuity of transition to renewable energy in the Arctic region by 2030 will be handy but the practical implications will be sour, like the fruit – lime.

In the second *"Watermelon Transition"* scenario, the shift and transition to clean and green energy alternatives in the Arctic region will be "dark" and giant. In other words, the *"Watermelon Transition"* is hereby described as a scenario that could be translated as *optimistic* scenario. With this in mind, the continuity of transition to renewable energy in the Arctic region by 2030 will be notorious and sweet, like fresh watermelon.

In the third *"Olive Transition"* scenario, the shift and transition to clean and green energy alternatives in the Arctic region will be negligible and minor. In other words, the *"Olive Transition"* is hereby described as a scenario that could be translated as *pessimistic* scenario. With this in mind, the continuity of transition to renewable energy in the Arctic region by 2030 will be oil-based, like the oil made from olives.

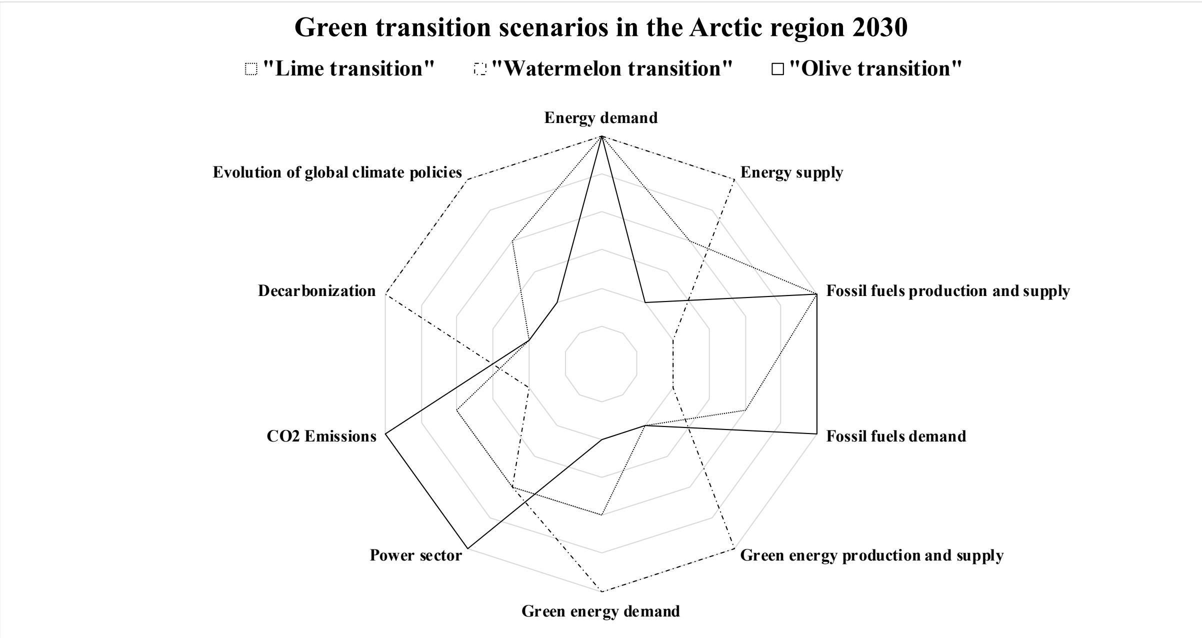

Figure 3. Radar layout of the green transition scenarios and its key driving forces (Authors' own work)

SCENARIO 1: "*LIME TRANSITION"*
- A soft and light green transition that is handy but sour, like the fruit - lime.

In the first "Lime Transition" scenario, the shift and transition to clean and green energy alternatives in the Arctic region will be soft and light. In other words, the "Lime Transition" is hereby described as a scenario that could be translated to the phrase "business as usual". With this in mind, the continuity of transition to renewable energy in the Arctic region by 2030 will be handy but the practical implications will be sour, like the fruit – lime.

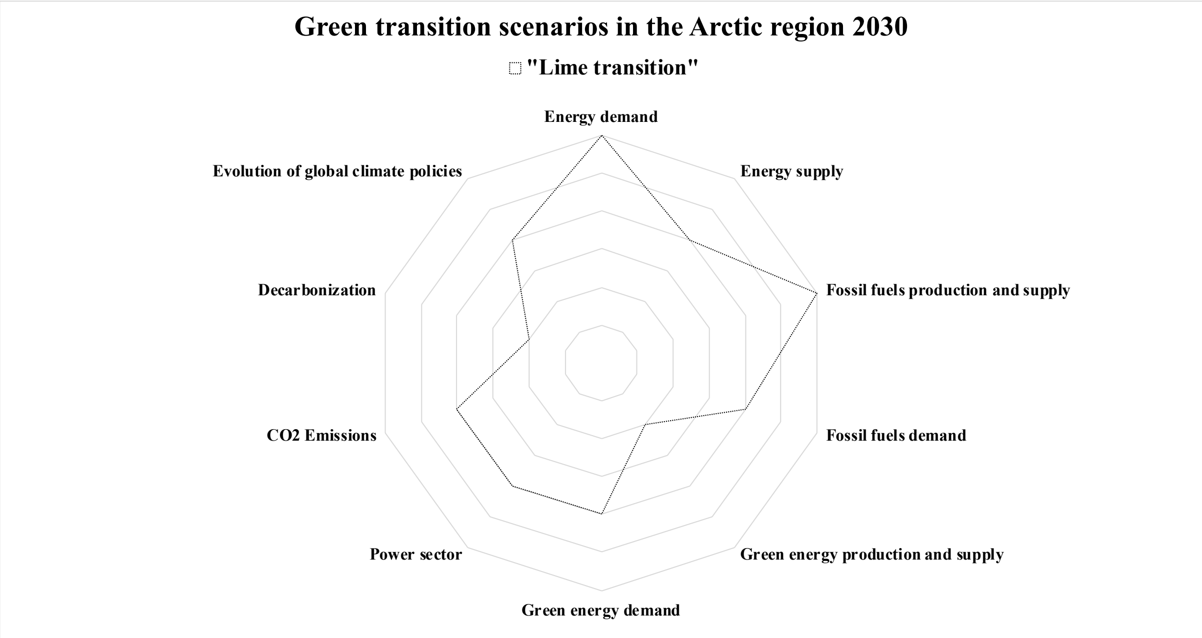

Figure 4. Radar layout of the *"Lime Transition"* scenario and its "Key Driving Forces" (Authors' own work)

To begin with, the forecast of the "Lime Transition" scenario relies on the fact that energy demand will continue to grow, therefore, demand as such will remain stable without any severe changes. For this reason, the demand for fossil fuels might experience a rise and fall movement, however, the general demand for fossil fuels in the Arctic region by 2030 will be at the same pace as it was in 2020 without any significant change. On the other hand, the demand for green energy alternatives will result in a slow level off of fossil fuels. Generally, the energy demand will be still driven by crude oil, natural gas, and coal with a gentle proportion of green energy sources like solar panels, and wind turbines.

Apart from energy demand, the opposite side of the green economy and energy itself is the energy supply. The forecast of the energy supply and production within the "Lime Transition" scenario reflects on the habitual and usual business practices. In this sense, the energy production and supply will continue to grow at the actual level to sufficiently fulfil the energy market needs. However, the trend within the diversification of supplies on the energy market is forecasted to stay the same. In other words, investments, and development of energy infrastructure will be still in this stage led by the production and supply of fossil fuels. To illustrate, the production and supply of fossil fuels will have a strong share in the energy market in the Arctic. In a similar way, the production and supply of green energy will be finding its spot in the Arctic, and will be still somewhat undeveloped as the proportion of production of fossil fuels will outweigh the green energy. In this case, the production and supply of energy in the Arctic region by 2030 can experience the same hesitation to shift from fossil fuels towards renewable energy in the region.

Finally, the evolution of global climate policies, decarbonization, and CO2 emission will not strictly affect the green transition in the Arctic region by 2030. Hence, the transition is compared to lime fruit because it is handy, but the consequences of this scenario can be sour. Not only for the Arctic region but for the whole society, environment as well as further economic development. The world is facing a lot of pressure to shift towards greener and cleaner solutions, in this scenario the forecast highlights that continuity of energy demand growth and production of fossil fuels will be key drivers, whereas, the formulation of global climate policies will be the second priority which will result in lack of green energy integration, decarbonization and decrease of CO2 emissions. Nevertheless, global climate policies will be in place but not prioritized as much as the resolution of energy demand and production of fossil fuels.

SCENARIO 2: "*WATERMELON TRANSITION*"
- A *dark and giant green transition that is notorious and sweet, like fresh watermelon.*

In the second "Watermelon Transition" scenario, the shift and transition to clean and green energy alternatives in the Arctic region will be "dark" and giant. In other words, the "Watermelon Transition" is hereby described as a scenario that could be translated as optimistic scenario. With this in mind, the continuity of transition to renewable energy in the Arctic region by 2030 will be notorious and sweet, like fresh watermelon.

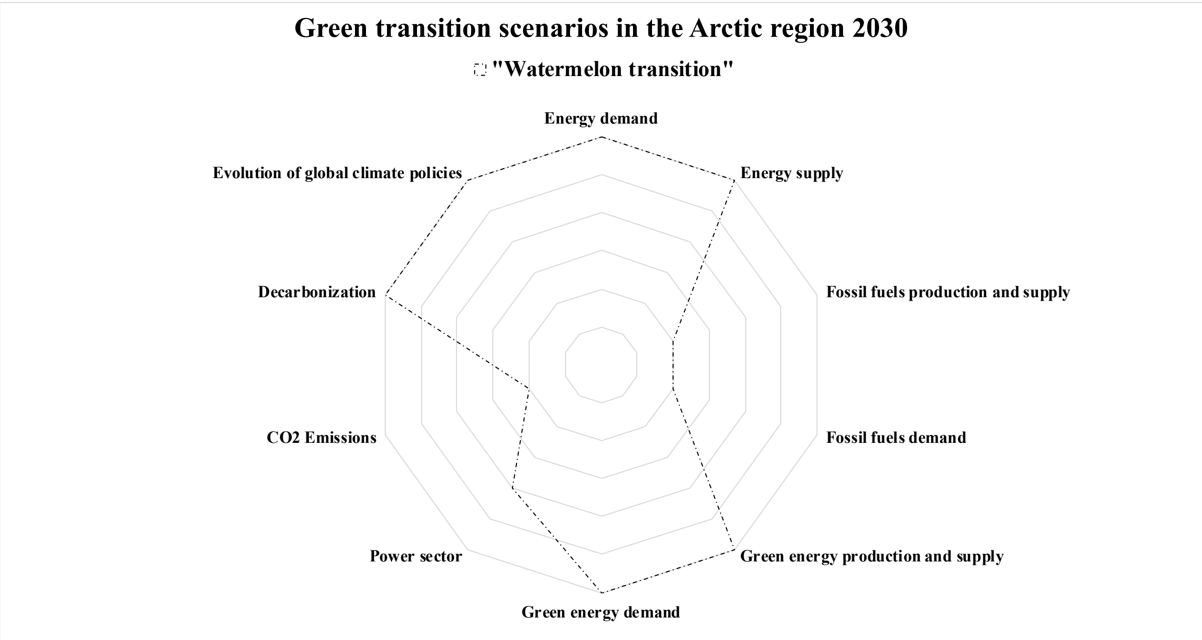

Figure 5. Radar layout of the *"Watermelon Transition"* scenario and its "Key Driving Forces" (Authors' own work)

In this scenario, the forecast of the green transition is based upon numerous sustainable and environmentally friendly driving factors. In fact, "Watermelon Transition" in the Arctic region by 2030 will be driven by the evolution of global climate policies with the aim to decarbonize the energy sector, besides mitigating and decreasing greenhouse gas emissions. As a consequence of that, there will be noticeable growth of green energy demand, production, and supply which will result in a general increase in energy demand and supply. Therefore, this scenario forecast an optimistic perspective on the green transition in the Arctic region by 2030, whereas, practical implications of this change will be challenging but still realistic.

First of all, in this sense, the evolution of global climate policies will become acute and strict about the transition to green, clean, and renewable energy sources. Both national and international authorities will increase the significance of climate policies. For this reason, greenhouse gas emissions and decarbonization will gain substantial attention from the public, and private sector actors that operate in the Arctic region. As a result of high pressures towards decarbonization and mitigation of climate change, the consequence will reflect on the total primary energy demand (TPED) and total primary energy supply (TPES), which will eventually influence energy mix in the Arctic region. Additionally, due to giant green transition in terms of policies, and technology, the practical implications will define “new normal” of Arctic energy in two perspectives. The first perspective will tremendously decrease the heavy exploration and exploitation of fossil fuels in the Arctic region. In fact, this scenario relies on the forecast that fostering of renewable energy like wind turbines, solar panels, etc. will overcome the energy capacity of the major fossil fuel contributors. The second perspective will be driven by empowered business models of renewable and green energy. With this in mind, new energy businesses can find their spot in the Arctic region, as well as a variety of key stakeholders from the world of green energy, can get attracted by the giant shift towards green transition in the Arctic region. As a particular outcome of this event, the results will be reflecting the high-economic growth of sustainable businesses and green energy stakeholders.

Altogether, the dark and giant green transition, in this context "Watermelon Transition" is hereby described as sweet due to its practical implications on the future evolution of the energy system in the Arctic region. In fact, a drastic decrease in greenhouse gas emissions, as well as the exploitation of fossil fuels in the Arctic region due to high pressures of global climate policies, decarbonization of the area, and integration of renewable and green energy sources, can result in sweet consequences for the environment. Undoubtedly, this paradigm may seem challenging, however, key stakeholders of the energy system in the Arctic region would need to act strictly as soon as possible.

SCENARIO 3: “*OLIVE TRANSITION*”
- A negligible and minor green transition that is oil-based, like the oil from olives.

In the third *“Olive Transition”* scenario, the shift and transition to clean and green energy alternatives in the Arctic region will be negligible and minor. In other words, the *“Olive Transition”* is hereby described as a scenario that could be translated as *pessimistic* scenario. With this in mind, the continuity of transition to renewable energy in the Arctic region by 2030 will be oil-based, like the oil made from olives.

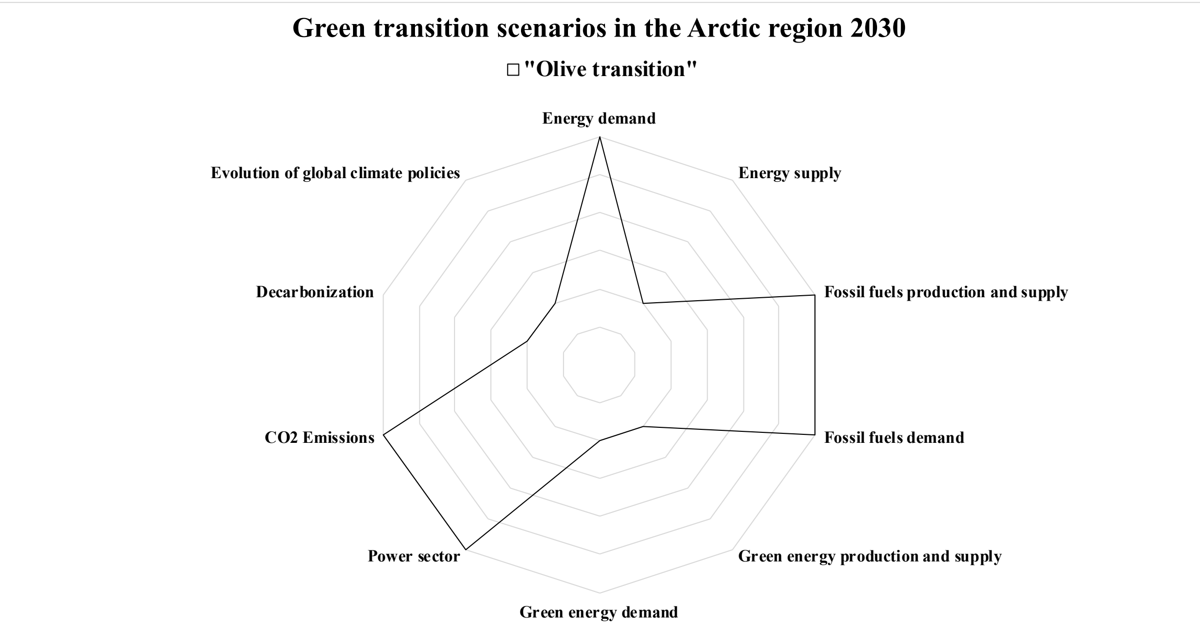

Figure 6. Radar layout of the *"Olive Transition"* scenario and its "Key Driving Forces" (Authors' own work)

As described, the olive scenario will be oil-based, which means that total primary energy demand (TPED) will be driven by fossil fuel energy sources, mainly crude oil, coal, and natural gas. In fact, the olive scenario relies on the four key driving forces that will be negligible in terms of green transition in the Arctic region by 2030. The first driving force is the heavy production and supply of fossil fuels in the Arctic region. Particularly, the scenario highlights heavier exploration and exploitation of crude oil. As a consequence of that, the second driving force will represent an increase in demand for fossil fuels, which will make the Arctic region a global hot spot for further and heavier exploitation of fossil fuels. Hence, it is significant to note that decarbonization and evolution of global climate policies will be eased up, and therefore, further exploitation will not be seen as an obstacle for the key energy stakeholders in the Arctic region. In fact, the attention towards decarbonization in order to stabilize and create a carbon-neutral world will not be attractive, hence, the result will show off in laziness and slow-motion in the evolution of global climate policies.

Furthermore, the third key driving force will represent the power sector. Hereby, the scenario relies on the fact that the power sector will be driven by the production of power mainly from fossil fuel sources. Certainly, nowadays there are cost-competitive sources that could provide the power sector with alternative sources of energy to generate power, however, in this case, oil and gas giants can find their way through lobbying to create an oil-based picture. For this reason, the fourth driving force will be CO2 and greenhouse gas emissions. As described, heavy exploitation of fossil fuels, increase in demand for fossil fuels as well as the role of the power sector will create a minor green transition in the Arctic by 2030. Therefore, a significant increase in greenhouse gas emissions will contribute to a slow-motion green transition shift due to unsustainable practices and lack of attention to decarbonization and climate policies.

In conclusion, the "Olive Scenario" will be negligible and minor in terms of shift towards clean, green, and renewable energy sources in the Arctic region by 2030. Ease up in global climate policies, lack of attention to decarbonization will result in heavier and further exploitation of fossil fuels in the Arctic region by 2030. Therefore, the chance and spot for green energy contributors will be restricted due to high pressures from fossil fuel production, supply and demand. Additionally, the role of power sector will consist of unsustainable practice, whereas, the generation of power will be based on fossil fuels. Hence, the Arctic energy mix will face increase in fossil fuels, and decrease of green energy sources.

Altogether, the green transition scenarios in the Arctic region by 2030 are hereby different due to divergence in the key driving forces. The degree of key driving forces varies based upon correlation among distinctive key driving forces and how they affect each other. Hereby, the degree of key driving forces was developed on three levels; low, medium and high degree of driving force. **Table 4.** below summarizes the degree of key driving forces among green transition scenarios in the Arctic region by 2030.

Table 4. Degree of "Key Driving Forces" for green transition scenarios in the Arctic region by 2030 (Authors' own work).

Degree of key driving forces	Scenario 1 *"Lime transition"*	Scenario 2 *"Watermelon transition"*	Scenario 3 *"Olive transition"*
Energy demand	High	High	High
Energy supply	Medium	High	Low
Fossil fuels production and supply	High	Low	High
Fossil fuels demand	Medium	Low	High
Green energy production and supply	Low	High	Low
Green energy demand	Medium	High	Low
Power sector	Medium	Medium	High
CO2 Emissions	Medium	Low	High
Decarbonization	Low	High	Low
Evolution of global climate policies	Medium	High	Low

8. "BLACK SWANS"

Energy War

Trade embargo and trade war has already taken place in the world in the form of trade sanctions. The Arctic region in terms of foreign policy and energy formulate the question about national security. National interest of each country aims to secure the energy resources; hence, it is going to be crucial to stay keen on international energy diplomacy, especially in the Arctic region to avoid embargo and energy war among the members states of the Arctic region. In fact, energy has entered the sphere of diplomacy and foreign policy, there is systematic evidence showing off the rising impact of energy resources on national security and economy. Therefore, future offshore petroleum development as well as green transition can easily impact the relationships between the states, and create so-called geopolitical winners and losers (Vakulchuk et al., 2020). In terms of international relations and green transition, it is going to be significant to pay a lot of emphasis towards the future implications of offshore petroleum development in the Arctic region in order to avoid so-called "Energy War" on the geopolitical ground. Altogether, if energy diplomacy will fail, Arctic countries may face loopholes in ensuring national security. Additionally, energy conflicts outside the Arctic region can potentially get inside, even in terms of further energy sanctions towards further exploitation of fossil fuels.

Global Cooling

Global warming is a very well-known phenomenon in the world, and age of climate change. In contrast to global warming, the idea of global cooling is freezing. The probability of global cooling and back freezing of the Arctic region is very low, and the impact would represent a lot of issues not only for the energy sector but also for the maritime transport, fisheries, and other critical industries in the Arctic region (Overland et al., 2015). However, in this case, the authors of this chapter describe global cooling as a possible "black swan" because the plausibility of this event is very low, however, the consequences and practical implications could create a lot of glitches among the key stakeholders that operate in the Arctic region. In fact, global cooling would represent a major threat to the world's energy system. As the Arctic's energy sector consists of fossil fuel contributors, as well as green energy players, the back freezing of the Arctic ocean and its icebergs would result in constraints of every single energy contributor. Practically, fossil fuel exploitation would be constrained with access to resources as well as harsh weather conditions.

9. CONCLUSION

The green economy is significant concept that interacts with green transition of energy resources. Based upon the three green transition scenarios of Arctic region by 2030, there is a hypothesis whether Arctic region will become *"low carbon"* region by 2030 or not. In order to achieve low carbon region in the Arctic, this scenario would require radical shift from current global climate policies, energy practices and attitude towards decarbonization. However, there are certain drawbacks that Arctic region can experience along the way within the green transition.

The first drawback of green transition in the Arctic region by 2030 is the current approach to global climate policies. With this in mind, it is possible to say that United Nations introduced agreement that was supposed to set-up new world order in terms of ecology, environment, and climate. Therefore, the goal of the Paris Agreement is to decrease global warming that will be integrated among authorities on the international, and transnational level including Arctic member states. In fact, Norway was one of the first countries in the Arctic region that ratified Paris Agreement on the national level, and the state of oil and gas received new nick name – country of electric vehicles. This proves that Norwegian climate policy was resilient with adoption Paris Agreement goals on the national level. However, other member states of the Arctic region have different approach to further development, which can potentially affect green transition in the similar way.

The second drawback of the green transition in the Arctic region by 2030 are the external "pressures" from the international bodies as well as pressures in form of international lobbying of energy giants in the Arctic region. In fact, every single energy contributor in the Arctic region is to some extend dependent on its partners within economy, policies, and most importantly environment. Hence, Arctic initiatives to tackle climate change are still favourable for energy companies to obey green transition with unsustainable practices.

Thirdly, the carbon taxation is in the authors' sense the most important and crucial drawback of the green transition in the Arctic region. In fact, carbon taxation can define whether Arctic region has the capabilities and competences to become green, and, eventually how green the Arctic region will become by 2030. Norway as one of countries with oil, and gas exploitation in the Arctic region has already shifted towards more green, cleaner, and sustainable solutions in terms of energy distribution and usage. There is a lot of emphasis on sustainable development and inclusive growth in Norway which can help the world energy system to tackle reduction of greenhouse gas emissions. In addition to that, ambitious target within the domestic carbon taxation is very favourable for Norway's low carbon future (Vakulchuk et al., 2020).

However, the green transition, the shift from the fossil fuels to green, clean and renewable energy, in order to achieve carbon neutral world can create so- called geopolitical winners and losers (Vakulchuk et al., 2020). Therefore, authors of this chapter believe that Arctic energy diplomacy, bilateral and multilateral cooperation must stay keen on the possible threats that can arise in the future, because currently Arctic region is one of the key suppliers of energy to the European Union. Therefore, carbon taxation, and collaboration with Arctic members states as well as multilateral collaboration will be important factors that can help Arctic region with green transition by the year of 2030.

Finally, further research of green economy as well as green transition on the international scale is strictly required in order to accelerate world transition towards the concept of the green economy. There is great potential of high impact on the further evolution of green economy in case that research and development in the areas of green economy, as well as green energy will stagnate and lack behind. In addition to that, authors of this chapters argue that there is urgent need for systematic evidence and data from the field of green economy, because the stronger sustainable solutions can empower environmental issues that are closely connected with the energy sector.

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