**UNIVERSITY OF VAASA**

**SCHOOL OF TECHNOLOGY AND INNOVATIONS**

**INDUSTRIAL SYSTEMS ANALYTICS**

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# BREAKTHROUGH IN FORMER SOCIALISTIC ECONOMIES

Case Wärtsilä Oyj

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PREFACE

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Valtteri Hukkanen

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# SYMBOLS, ABBREVIATIONS AND TERMS

| | |
|---|---|
| B2B | Business to Business |
| CCGT | Closed cycle gas turbine |
| CF | Capacity factor |
| CRM | Customer Relationship Management |
| CLV | Customer Lifetime Value |
| EEQ | Engineered equipment delivery |
| EPC | Engineered Procurement Contract |
| GDP | Gross Domestic Product |
| ICE | Internal combustion engine |
| IPP | Independent Power Producer |
| LNG | Liquefied Natural Gas |
| Mt | Million tonne |
| Mtoe | Million tonne of oil equivalent (=4,18x 10^16 Joules) |
| NB | New built |
| OCGT | Open cycle gas turbine |
| PPP | Public-Private Partnership |

| | |
|---|---|
| PV | Photovoltaic |
| RES | Renewable Energy Sources |
| ST | Stem turbine |
| USD | United Stated Dollar |
| 0-IPP | Zero- Independent Power Producer |

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## ABSTRACT

The future market situations force companies to dynamically evolve and adapt strategies that will boost sales and provide value, without forgetting the customer focus. There is a need for multidivisional international companies to critically view and adapt their strategies so that they are easy to follow and provides the needed edge in the markets they operate in.

This thesis investigated the market potential and a strategic guideline to be implemented into the sales for two countries located in Central Asia. The thesis was made for Wärtsilä Energy Business and particularly Wärtsilä Business Development and Sales East Europe as a case study. The case company needs to find new business areas to explore, as the countries in this thesis have a big potential to create new revenue streams. Wärtsilä Energy Business has a good foothold in countries with IPPs, however, it is important to find a strategy for breaking the markets in 0-IPP countries. The thesis consisted of scientific research about how and why to make a breakthrough sales strategy to increase the revenue flow taken in consideration the customers. This thesis also goes through the reasons why these two countries in Central Asia were chosen and how their energy sector looks like.

The methodology used for this thesis was a case study where qualitative and quotative research were concluded. In the quantitative research the thesis went through the target countries energy markets and the way they are possible heading. Energy market stochastic analysis was made with a simulation program called Plexos. The qualitative study was made with a benchmarking interview with other Finnish multidivisional company operating in these areas where the results of the interview was conducted to a PESTEL model. Other strategic tool to gather the key points and put them in a clear way for both countries was the use of business model canvas.

The results of this thesis show that Wärtsilä should primary focus on engine sales and later integrate the renewable energy. The reason for this is that the markets are highly dependable of the gas price, which is steered by the government of the country. Plexos model gave us an understanding to find a balance between cost and $C0_2$ emissions. Also, a local presence or CRM should be established to fully understand the customer and have the ability to act proactively to a problem.

**KEYWORDS:** Strategy, sales, customer, value, energy

# 1. INTRODUCTION

The future market situations force companies to evolve and adapt strategies that will boost sales and provide value, without forgetting the customer focus. This thesis investigates the market potential and strategic guidelines to be implemented into the sales for the countries in Central Asia. The goal of this thesis is to gain in-depth knowledge of the market situation in two specific Central Asian countries, their energy sector and a best way to gain market access and strategic viewpoints to stay competitive for the long-term for the case company. The thesis was made for Wärtsilä Business Development and Sales as a case study, which is a part of Wärtsilä Energy Business organisation. We will later in this thesis refer for simplicity the case study company as Wärtsilä.

Wärtsilä needs to find new business areas to explore, that is one reason why these countries were chosen for this thesis as they have a big potential to create revenue for the business. Wärtsilä has a good foothold in countries with IPP, however it is important to find a strategy for breaking the markets in 0-IPP countries. This thesis also investigates how Wärtsilä can improve its sales process in Central Asia and problems to take into consideration. As Sparrow and Cooper (2014) emphasized business in today's world is changing fast and with a speed that one has difficult to follow up, that is why companies need to continuously adjust themselves and learn from the past experience.

The thesis research was conducted using case study method together with a mixed-method approach, which consist of qualitative and quantitative data. The qualitative approach consists of an interview where it is used to create a benchmarking process and later for a strategic tool set up. The energy sector simulations are done using a simulating program called Plexos, where the data gathered are considered as quantitative approach.

## 1.1 Objective of the Thesis

The objective of this thesis is to investigate the two potential markets located in Central Asia. The outcome of this thesis is to find the most suitable sales strategy guidelines for these countries to implement it in an understandable way and provide solutions to taken into further consideration.

In this thesis the goal is to create an understandable guideline for strategy setup which are easy to follow and explore the opportunities in the countries of Central Asia which will in the future create a potential partnership between Wärtsilä and these countries. In the analysis section of this thesis we conclude what is the key sections to reviewed for a successful strategy implementation. In the end we critically analyze if Wärtsilä can move forward with the researched and applied strategic viewpoints and conclude the development needs.

The first research question for this thesis is: How can Wärtsilä improve their sales strategy for a successful breakthrough in Central Asian markets? The second research question is: How will Wärtsilä's new strategy set up in 2019 beginning be effective in Central Asian countries?

## 1.2 Structure of the Thesis

The first chapter of this thesis consist of introduction, objective of this thesis which will consist of research questions and the structure of this thesis. Chapter two goes through what a strategy is, why it is important, what is customer relationship management, the optimal sales strategy, and risk management. The chapter also gives us an understanding of different strategy tools that is later being used and an understanding of customer and value- based selling.

In chapter three we introduce what is an energy system, the countries evaluated and studied, their culture and briefly their energy markets. Chapter four consist of defining the

research methods used and what is a Plexos simulation tool which is used for the simulation of energy markets in countries studied. Also, in chapter four we gathered the data from Plexos and analyzed them. Chapter five is about analyzing the outcome of the results gathered and putting together a strategic guideline what to follow for successfully making business in these countries. Chapter six concludes the thesis, where the limitations and further research are being evaluated.

# 2 THEORETICAL FRAMEWORK

The theoretical framework focuses on previously done research about relative topics for this thesis and gives this thesis a comparison and guidelines when making the case study. Firstly, it is defined what is a strategy, then in the section two it is explained why strategy is important. In the third part optimal sales strategy for business to business sales is defined, where customer relationship management follows. The selling process of this case study is about project selling with a service mindset. The fifth part consist of value-based selling and in the sixth part of the literature, strategic tools used for this thesis are researched. The last part of this theoretical framework introduces the reader to risk management.

## 2.1 What is a strategy

Strategy is a plan, where companies are able to allocate resources to achieve goals set up. (Panagopoulos & Avlonitis 2008). Strategy usually exist everywhere in a company for example in multiple divisions and even in single projects. A great strategy will give to the company right direction to make decisions and take effective actions, which will often provide success if implemented correctly. Strategy word is originated from the Latin word "Stratego" and was firstly used in wars when generals thought ways of winning wars. (Vuorinen 2014: 15; Peng 2009.)

Every company has set up their own corporate strategy, which the divisions and its employees are following, but there still exist strategies within the division and even within single group of people, which will support the corporate strategy. Usually the corporate strategy set by the board of directors and management team conclude the big picture of the company and the markets they are in. That is why it is important for the divisions and projects to have an own strategy what to follow, it is usually more tactical based, where customers are involved daily. Watkins (2007) defined that a strategy is how people make decisions with given resources to obtain the most profitable outcome. He also emphasized

that a good strategy gives guidelines how people should implement these given tasks and what things to prioritize the most.

Panagopoulos & Avlonitis (2008) defined three different types of strategies that exists: Corporate strategy is a specific segment of business that the company chooses to be involved in. Business-unit strategy refers to a way that the business unit will operate and compete in the market. Functional strategy will focus more on resources for each special function such as sales, production and marketing.

There is also a difference between marketing strategy and sales strategy. Marketing strategy tries to generate and develop a competitive advantage for a company in a specific market. This is done by selecting a market where to operate and thoroughly research the needs of the customers in target markets. Sales strategy is more focused on single customer and how their needs are met, this is done by building up a sales team, allocating resources and getting in contact with the customers within the specific market segment. (Panagopoulos & Avlonitis 2008.)

Usually a strategy consists of the following linear steps: Specification of a strategy, planning of a strategy, execution of a strategy, following up a strategy, evaluating a strategy and lastly updating it consistently. There are three different phases in implementing these steps, the first one is analyzing of strategic position, here the existence of the company and its competitors are analyzed, this often happens using strategic tools such as SWOT and PESTEL analyses. The second one is called strategic choice, where it is set what is the company competitiveness and which is the way that the company wants to evolve. The third one is implementing of the strategy, where the motivation of employees, training and leadership takes place. These three phases do not necessarily come in a chronologic order, the order must be established where the company has the greatest advantage of these three. (Vuorinen 2014:41-42.)

Viitala (2014) pointed out that a strategy is dependable of the employee-based resources and knowledge. A good strategy is able to utilize the power of the people when a bad strategy is just words that no one understands, and it does not provide any value. This

mindset of good strategy is often linked with Lean thinking, which has a goal of utilizing people to their maximum potential but eliminating the waste.

## 2.2 Why is strategy important

As Terho, Eggert, Haas & Ulaga (2015) defines "effective implementation of an average strategy, beats mediocre implementation of great strategy every time." They also indicated that a successful implementation of strategy can create a competitive advantage in the business market. Vuorinen (2014:15) defined that a strategy will provide to the organization direction in the changing world. He also pointed out that right strategy when implemented correctly gives the employee's logical answers towards goals and how they are achieved together. The number one outcome using a strategy is to be able to do things more efficient, providing value to customers and finding new profitable markets to operate. The second reason why to implement a strategy is to be able to make something new and different.

For the salesperson it is important to be able to understand from the strategy the benefits of customer orientation, how it provides value to the customer and to the company Terho et.al (2015). They also emphasized that companies who invest in customer research have better understanding of customers business need, which provides long-term value. Panagopoulos & Avlonitis (2008) verified also that if customer preferences are not investigated thoroughly and not known by the organization can it create mismatch between company's offering and customer need, which is waste of resources which could lead to unsatisfied customers. Sales strategy will provide for the companies the ability to think rationally in highly uncertain markets where customers need can change and the focus can be turned towards more profitable customers or even acquiring new customers. (Panagopoulos & Avlonitis 2008.)

Different strategies and different ways of implementing them has shaped companies into new directions and understanding the global trends. In 1990 a new strategic viewpoint set foot in the world, which was called core competence. This means making one or few

things better than competitors in the same market. Before 1990 there was a trend which was called “chess-playing”, which meant that companies could change the markets or even business sections to search for the most profitable markets. (Vuorinen 2014: 23.) 2010 century has brought us a new strategic viewpoint how companies can serve customers better and be more profitable. The strategic viewpoint which is called “service business” that has transformed the world how we see it. For example, world’s largest taxi company Über does not own any taxis, or the world’s largest accommodation provider Airbnb does not own any apartments. Also, one of the biggest technology companies Apple does not manufacture any of their phones themselves, they have a contract with a subcontractor. The change towards service business has been possible with the opportunities that the internet has provided. Similar change is happening with businesses all over the world in different sectors.

The core of any business strategy is in the customer value propositions, which includes customer relationship, product or services and an image that the company offers, which is often called a brand. A strategy must be able to describe the question of how a company can achieve the desired outcomes, where employees, shareholders and customers are happy. (Kaplan & Norton 2000). Juuti & Luoma (2006:27) described that strategy has the potential to unite people to strive for a common goal and gives an identity for the group following the strategy. Strategy provides for the companies the opportunity to provide milestones and targets for growth and profitability.

## 2.3 Optimal sales strategy

Sales strategy has been in earlier researches defined as the following: “the extent to which a firm engages in a set of activities and decisions regarding the allocation of scarce sales resources (i.e., people, selling effort, money) to manage customer relationships on the basis of the value of each customer for the firm” Terho et.al (2015.) Sales in a company is the only part of the organization that brings revenue to the company.

Terho et.al (2015) emphasized in their research that the role of selling has become more analytical, where the sales strategy is linked with how the markets perform. This is mainly due to the changes in company way of thinking from product base selling into service-based selling. Terho et.al (2015) indicates also that sales strategy has gone from tactical based selling into more strategy -based selling, which means more customer focus selling. Peng (2009) defines that there exist three different strategic choices, they are cost leadership, differentiation and focus. On cost leadership the strategy for success is based on low costs and optimal prices. In Differentiation the focus is on delivering value for the customers by making the service match the need of the customer. The last choice is focus, here the service is provided to a particular segment of people, the segment can be divided into geographical market or a type product type that the customer like.

It is important to know how sales strategy is implemented into operation and what kind of affect it has on performance. (Terho et.al 2015). The research also points out that sales strategy affects different ways salesperson's performance, the sales strategy should firstly support salespeople in their sales effort. Panagopoulos & Avlonitis (2008) also analyzed that sales strategy is linked with performance, but it is not researched much of how the sales strategy should be developed. Sales performance is viewed as salesperson's contribution to be able to achieve goals set by organization. As Johnson (1996) established, one key point of a successful strategy is to know why the employees are willing to follow the strategy.

An effective sales strategy should be multidimensional, consisting usually from four different dimensions: customer segmentation, prioritization of customers, developing relationship and the use of multiple sales channels. (Panagopoulos & Avlonitis 2008). They also indicate in their research that for a sales strategy to be effective managers should be able to adopt transformational leadership, know changes in demand and be able to provide for the customers solution.

Sales strategy will allow salespersons to be able to focus on customers more and create long-lasting relationships when the resource allocation is set in sales strategy. These will also in the long run increase company financial performance as happier customers creates

more revenue. (Panagopoulos & Avlonitis 2008). Horn et al. (2005) asserts that most sales strategies are based on a specific case, they do not take into consideration previous market entries and how the company managed to be successful on them. One aspect of the optimal sales strategy is for the salespersons to be able to identify customers who can be influenced to buy the product or service which they have not even thought of. (Haas et al. (2012).

A company strategy for market penetration should have a segment with the price of the product or service. If the need in the target country for the product or service is high, then the pricing strategy does not play such a critical role. Looking for the optimal sales strategy the outcome is usually money, but as Vuorinen (2014:15) defines, it can be something else, for example gaining market share or getting new customers. The optimal sales strategy consists of analysis made internally and outwardly. Here the strategic position is set as well as goals and objectives. A good strategic framework on the other hand does not work if it is not executed correctly, that it is why execution in optimal sales strategy is important.

## 2.4 Customer Relationship Management and Lifecycle Management

Customer relationship management is a way of doing business, it includes taking care of your customers and becoming a customer-centric organization (Buttle 2004). Buttle (2004) also emphasized that customer centric focus is a trend which will stay in the companies' DNA, mainly because customers expect exceptional customer treatment every time. Customer satisfaction is no longer an advantage asset, it has become a business necessity to do business. As Peppers & Rogers (2011:3) validates, customers are company's source of revenue, without customers one does not have a business.

CRM is seen as company ability to introduce right service or product to the right customer at the right time through right channels to satisfy the customer need. (Yean & Khoo 2010). Horn et al. (2005) asserts that sometimes companies can be to egoistic, especially if they

rely too much on employee opinion about how great a product or service is, and the customer may not think similarly.

CRM can be viewed from three different levels, which are strategic, operational and analytical. In strategic CRM the focus is on developing the customer relationship and the culture to be customer-centric. Strategic CRM is based on acquiring, keeping and delivering value to customers better than competitors. Operational part of CRM focus on customer-facing part, this means taking actions to solve customer problems. Analytical CRM is linked with gathering data from the customers and compare them to company values. Analytical CRM brings information to the company how they can deliver better solutions to the customers and utilize the data gathered from the customers. The main reason why companies want to build long-lasting relationships with the customer is mainly an economic reason (Buttle 2004.) One tool that companies use for better CRM is customer journey mapping. As Richardson (2010) asserts, customer journey map is a diagram what shows the customers engagement with the company, which provides the knowledge to the company how the customer interacts and potential issues in the journey.

Customer lifetime value is a crucial thing to take into consideration when making business, it gives the companies the decision of how much to invest towards customers to gain higher returns. (Yean & Khoo 2010). CLV gives companies the hard data of how much revenue can one customer generate, this gives the company an excellent market and customer strategic viewpoint. As Grönroos (2006:165) also verifies that calculations of CLV should be calculated to support better managements decisions, where the net profit from the customer should cover the expenses from the fixed costs of customers. He also disputes that new customers tends to be more costly than old customers, but in the long-term this can also turn into a profitable relationship. Unprofitable customers are not straight bad customers, there does not exist such thing, only bad strategy and its implementation. Companies should view unprofitable customers as opportunities to turn them into profitable customers in long-term. Grönroos (2006:176). Management should of course have business sense of which customers to focus on and which customer relationships would be better to let go.

Peppers & Rogers (2011:124) explains in their research that there needs to be two different evaluation of customer value, which are actual value and potential value. Actual value is the value that the company can be sure of and potential value is the value that is uncertain and may contain some risks. Nenonen & Storbacka (2016) suggest that a CLV model should have three basic elements, which are revenue from the customer, the cost of serving customers and retention rate of the customer.

For service- companies to remain competitive they need to develop customer relationships and reduce risk for the customers. The relationship building starts first with a contact, often small talk and later meeting with the potential customer, this creates the needed connection between both parties. It is important to remember for both parties that they represent the company they are employed in. (Kaski, Niemi & Pullins 2018.) There exist of course cultural differences, where the salesperson should be able to adjust and understand the customers way of behaving and making business. Sometimes the business does not happen between the participants if the customer does not know or trust the salesperson.

Yang et al. (2017) defined that the less customers expect from the service combined with a high quality of service, the higher the customer satisfaction is. Söderlund and Sagfossen (2017) research shows that if a service provider contributes more effort to the service than the customer expect, will it provide a positive attitude which will lead to more customer satisfaction in long-term. Rocca, Moscatelli, Perna & Snehota (2016) stated in their research that integrating customers in the innovation of the service process generates new kind of solutions and helps the service to provide value for both parties. Moscatelli et.al (2016) also illustrated that sometimes customers do not fully understand their own need to a complex problem, that is why a salesperson needs to be able to provide a specific solution to the problem.

From Figure 1 we can see that in CRM there exists three crucial key points: Customer satisfaction, Customer loyalty and Business performance. In Customer satisfaction it is important to be able to understand customer requirements, meet customer expectations and to be able to deliver value to customers. The second key point is Customer loyalty,

where behavioural and attitudinal loyalty are set. In Business performance revenue growth, share of customer and customer tenure are viewed. Before all of these steps it is crucial for the companies to be able to acquire customer's, without this step the later does not matter.

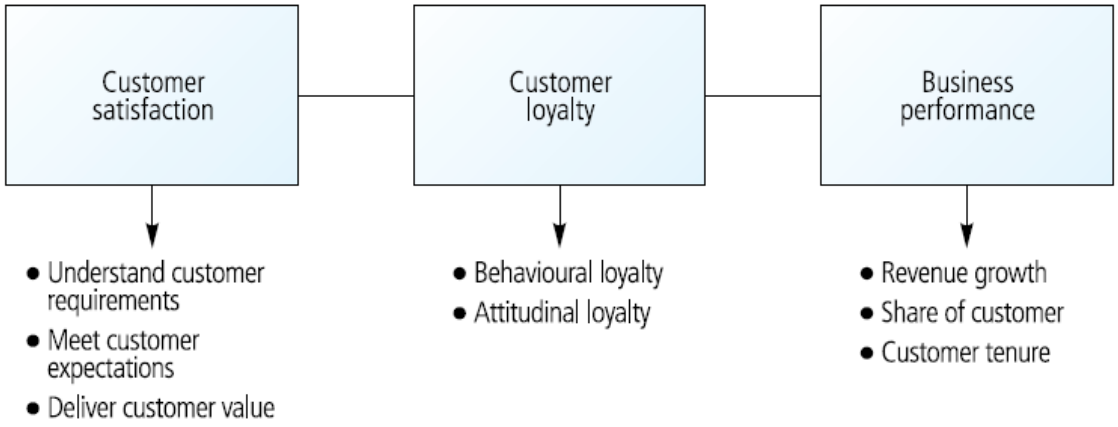


Figure 1. Customer Relationship Management box (Buttle 2004)

It is good for the companies to remember to not only focus purely on customers, because without happy employees there can't exist happy customers. (Hatane 2015). Employee satisfaction as well as customer satisfaction will together create financial results to the company. According to Hatane (2015) employee satisfaction is employee feeling, which they have on their job, past experience, the ability to continuously learn and current expectations on their work. Chi & Gursoy (2009) also pointed out that there is a link between satisfied employees, which will create satisfied and loyal customers. These two combined will often provide higher financial results, this phenom is called service- profit chain. The service-profit chain provides for the companies an understanding of how the service investments are related to customer behaviour and how it translates into positive financial performance. (Chi & Gursoy 2009.)

## 2.5 Value based selling

It is important for the employees and for the whole company to be able to define the reasons why they sell. Usually the reason is growing of sales and revenue, sometimes it can be following a strategy set by the management. B2B selling has in recent years gone towards more solution related relationship selling, which includes concentrating more on building and maintaining long-term relationships with profitable and major customers (Koponen, Julkunen & Asai 2019). Panagopoulos & Avlonitis (2008) puts forward in their research that sales force management program is important, by this they mean training and making sure every salesperson understands the sales strategy set up. Koponen et al. (2019) states it is important for managers to know how and why train their salespersons so that they can provide solutions for the customers best interest. As Grönroos (2015:12) validates value is defined by how customers feel after the service has been delivered together with co-working between the service provider and the customer. The role of sales has for long been a pivotal part of generating value, as the first contact a customer has on a company is through the sales department. Haas et al. (2012).

A salesperson needs to be able to understand and solve customers' problems and make sure that the supply and demand match with each other. Sometimes of course the customer does not know what they want, they only know the problem and want a solution. That is why a good service company needs to know the customer and a possible solution to the problem with competitive price. For a company to be able to receive valuable information from the customer does it require extraordinary value-based selling skills, as the customers often do not know how to solve a problem, they only know that there exists a problem to be solved (Peppers & Rogers 2011:159.) Hohenschwert & Geiger (2015) also described that salespeople needs to find ways to find solutions to problems that the customers are not even aware of. As Grönroos (2015:272) acknowledges, every single customer must have a unique feeling that they are served correctly and that companies need to remember that customer relationship requires trust and it needs to be earned.

For a company to be successful in business and achieve growth it needs to be able to acquire new customers, but still trying to keep the rest of customer base happy. Keeping

the old customers satisfied requires contact persons from the company to have a deep engagement with the customer. (Kaski, Niemi & Pullins 2018). It is crucial to have employee involvement making strategy plan as they tend to have the first impression of what the customer wants and about the process overall. It is hard to analyze profits a value will create for the customer, that is why it is crucial for the salesperson to be able to provide something else than cheap prices and high profits. (Grönroos 2015:177).

Koponen et al. (2019) claimed in their research that salespeople need to provide solutions even complex ones, be culture sensitive, emotionally intelligent and to be able to implement strategic decisions to achieve growth. Green & Sergeeva (2018) observe in their research that value can be created two different ways, hard way and a soft way. In hard value creation, the attention is being directed towards cost reduction and in the soft value creation the attention is focused towards shared understanding between the service provider and its customers. As Haas et al. (2012) notes value- creating process has been a key point in success for businesses and a source of creating competitive advantage.

One of the best marketing strategies is to win customers over, as they create a positive word of mouth, which is more effective than regular marketing done by companies (Grönroos 2015:316). Peppers & Rogers (2011) indicate that one of competitive advantages of doing business is to create a mutual trust with the customer and provider. They also emphasize that a lasting business advantage would be to offer a service or product that is unique and do something that competitors cannot copy easily.

## 2.6 Introduction of selected Strategic tools

There are a lot of different strategic tools invented and used, some more successful than others. The theory we go through in this section is the strategic tools we will later be using in creating our best strategic guidelines for the case study. The strategy tools selected for this thesis were Business model canvas and PESTEL. The tools were selected based on their simplicity, easy to follow, easiness to update them and the ability to use these tools in multi international environment. Kaplan & Norton (2000) explained that strategy tools

provide for the employee a coordinated way of working towards company set goals, they also show the cause-and- effect links. Strategy tools provide for the company a clear insight of potential customer markets.

As services has become key success factor for companies of doing business today it is hard to be able to describe them and know exactly what the value proposition is with the help of a strategic tool. The best way to start building these kinds of strategic tools is to start from the destination and step by step implement ways to achieve it, this viewpoint is often called top-down. (Kaplan & Norton 2000.)

### 2.6.1 Business Model Canvas theory

A Business Model Canvas is a tool for strategy, but it is often very different from the rest of the strategy tools. As earlier disputed a strategy aims to provide value in long-term and is linked to company's vision. Business model canvas is more for short-term insight and is a tool which enables a strategic plan to be implemented into reality. That is why it is important to be able to have ambidexterity approach from these two when making a strategy that could work. Hedman & Kalling (2003) defined that the purpose of a business model is to describe all the key reasons why a company's business would be successful.

A Business Model Canvas provides for the company the ability to understand how to generate revenue with a reasonable cost, it also provides the information how a company can create more value (Gambardella & McGahan 2010). Chesbrough & Rosenbloom (2002) emphasized also that business models' main purpose is to create value to the customers and for stakeholders. There are nine different blocks of elements in business model canvas, Osterwalder and Pigneur (2010:15-51) have concluded these nine blocks with business process and how they can generate profit in a business segment. The nine blocks are as seen from Figure 2: Key partners, Key activities, Key Resources, Value Proposition, Customer Relationships, Channels, Customer segments, Cost Structure and Revenue Streams.

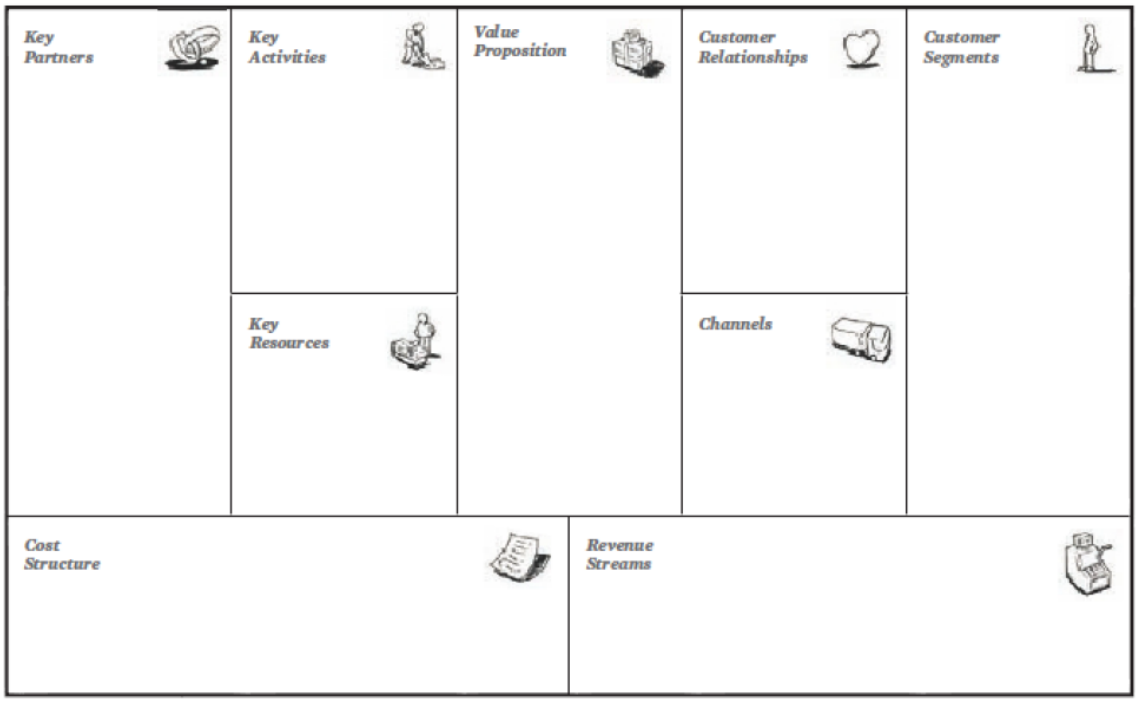


Figure 2. Business Model Canvas (Osterwalder & Pigneur 2010:44)

If the company creating the Business Model Canvas can create a business model, which is unique and hard to copy will it create a competitive advantage. Business Model Canvas should be emerged with the strategy set up and used as a guideline for building a strategy. Osterwalder and Pigneur (2010:160) analyse that Business Model Canvas is an effective strategy tool for visualization of business model and what it consists of. It is straight forward and easy to understand, which is one crucial element to consider when making a successful business strategy. For a business model to be the most successful it needs constant updating because company's short-term goals could change with fast timeline.

### 2.6.2 PESTEL theory

PESTEL analysis observes the surrounding of the company's political, economic, social, technological, environmental and legal perspectives. PESTEL tool allows organizations to have knowledge how these six-different aspects affect company's dynamic change (Vuorinen 2014:220.) PESTEL tool is an excellent strategic tool to view where change will happen but using only PESTEL analysis is not an effective way of viewing strategy,

it should be used together with other strategic tools. The tool gives its user a holistic viewpoint of what things to take into consideration when creating a strategic focus. (Vuorinen 2014:226.)

## 2.7 Risk Management

One crucial aspect for the companies to evaluate deeply is how to handle risks, in other words risk management. Risk is a problem, where the outcome is unclear and one of managements duties is to see if the risks are in acceptable level or not (Capinski et al. 2014:98-99).

Nechaev, Ognev and Antipina (2017) evaluates that risks are the results of economic decisions, with positive or negative outcome. Risks can be categorized either as opportunity or threats, where both risk types are tied up with making business. There can be many kinds of risks, the most common risks in business is usual commercial and country-based risks. According to Chapman & Ward (1997) one crucial element is to be able to identify potential risks as early as possible and to have a plan of how to handle those risks, so that it does not affect business in a negative way. Risks can also be categorized as controllable and uncontrollable, where the difference in these two is the amount of control that the company has on the risk.

Risk is often reduced when the service provider and the customer learn more about each other (Buttle 2004). Themsen & Skaerbaek (2018) noted that successful risk management should have risk identification, risks assessment, risk response planning and risk monitoring phases in the risk management plan.

# 3 CENTRAL ASIA ENERGY SECTORS

This part of thesis goes through first the energy systems theory, then investigated the markets in Central Asia countries, their culture, briefly their energy sectors and systems. It is important for the case company to know what the country is in a need of and how will the economic situations affect the sales strategy. These countries have not only common that they are Central Asian countries, but they are post-socialistic countries. This indicates that they have extremely high energy consumption per GDP, heavily using fossil fuels and a need to find a more sustainable and cheap option.

Batsaikhan & Dabrowski (2017) also analyzed that the main policy for the Central Asian countries is to be able to move away from commodity-based growth strategy and to be able to make the atmosphere more market oriented. They also verified why the economic growth of these countries has not taken big steps forwards, the reason is mainly the fall of Soviet Union, which caused inflations to skyrocket and the location of the countries infrastructures.

## 3.1 The theory of energy systems

Societies rely heavily on energy consumption where it is linked with GDP (Elovaara & Laiho 1998:13). The energy systems are different in different countries, but the megatrend of climate change has set countries to think more about how to produce energy in a more sustainable way. Still, the energy consumption relies heavily on fossil fuels, such as coal, oil and gas. This kind of energy consumption in energy systems are called traditional energy systems or fossil fuel-based energy systems.

The change towards more sustainable energy production won't happen in an instant, there needs to be more evolvement in technology and especially change in the mindset of people. The energy system technologies that Wärtsilä provides for the customers are engines, energy storage and LNG solutions. The central Asian countries have outdated Soviet era energy systems which leads to a demand of updating of their power systems.

## 3.2 Uzbekistan

Uzbekistan is a country located in the Central Asia which has large amount of energy recourses to offer, however there still lies problems in terms of security, sustainability and affordability (Gomez, Dopazo & Fueyo 2015). According to Gomez et.al (2015) Uzbekistan is the most populated country in the region of central Asia with around 30 million people, which indicates the fact that growth within population, economy and urbanization will happen in the future, which will in the long run strain the energy system if the energy system remains the same. Aripdjanov (2019) concludes that Uzbekistan is one of the few countries in Central Asia that is totally energy- independent and is able to export its energy resources.

Gomez et.al (2015) points out that the energy consumption can be reduced in the future by 447 Mtoe, which is 10,2 times less energy consumption than in year 2010. Also, the research concedes that $CO_2$ emissions would drop by 1155 Mt, which is 10,5 times the current annual $CO_2$ emission rate. It is estimated that Uzbekistan's GDP will grow annually by 6,0% (Gomez et.al 2015).

Today Uzbekistan's energy production origins from conventional thermal energy plants, which were built between 1960 and 1980 using Soviet technology. Uzbekistan's primary energy consumption is produced by natural gas with the rate of 86% of the total amount. This has led to a situation where Uzbekistan's household electricity tariffs have risen relatively high when comparing to other countries with similar GDP. GDP is one of the most reliable ways to forecast future energy demand (Gomez et.al 2015.) Uzbekistan's entire energy sector is being monopolized by the state-owned company Uzbekenergo where the biggest concern is limited export capability and energy infrastructure (Aripdjanov 2019)

In the beginning of 2019 Ministry of Energy was formed. This has shown that Uzbekistan government has an interest in making changes in their energy sector, with the help of alternative solutions to fossil-fuels which could be provided by private companies. The change towards flexible energy system requires many years of investments and a changed

mindset towards sustainability. The change can be done by showing the state-owned companies' facts of why a flexible solution is in the long run better than traditional thermal energy with the help of providing excellent customer service. The target for Uzbekistan's RES is 21% renewable energy by 2031 and to install 4 GW solar energy capacity by then (Uzbekistan's energy sector Opportunities for international cooperation 2018).

Uzbekistan's future plan is to build 25 PV stations in the next decade, this is done using PPP with state-owned utility Uzbekenergo. There has been a number of companies who are interested in investing to the solar projects. The project will help in the future to generate the foundation for the investors to invest in the country and companies to do business there (Energo week 13 2019.) Uzbekistan is also considering constructing its first nuclear powerplant, where the country exports a lot of uranium. The nuclear construction project will cost 11 billion USD, which will include two 1200 MW Russian manufactured reactors and the reactors are set to be online 2028.

Uzbekistan has a plan to increase its installed capacity growth to 30 GW in 2030, as it was in 2018 14 GW. The generation is 60 000 GWh, where 60% coming from gas, 19% from coal and 13% from hydro power. The gas price is currently around 1,8 USD/GJ, but it could potentially go up in the coming years. Uzbekistan sells some of its produced gas but buys cheaper and lower quality gas from Turkmenistan.

As seen from Figure 3 the expected power growth increases rapidly from the year 2020 until 2040. Salikhov (2006) claims in his research that Uzbekistan's economy consists of both industry and agriculture. He points out also that Uzbekistan's energy sector should provide energy supply to the national economy and to its population via making more efficient energy system. The goal of Uzbekistan government is to increase the amount of gas produced in the country (Aripdjanov 2019).

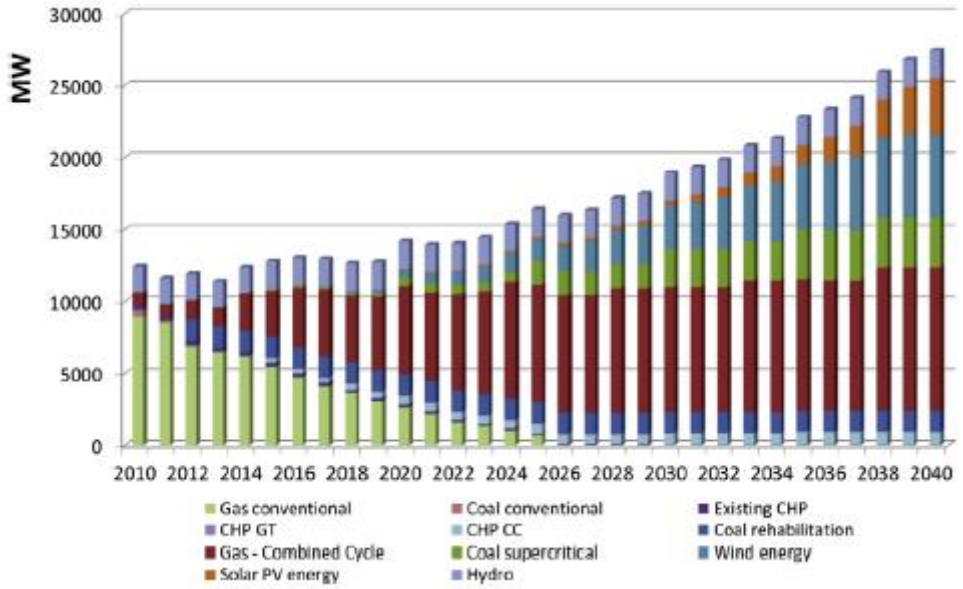


Figure 3. Installed power expected growth in Uzbekistan (Gomez et.al 2015).

As many countries in Central Asia, also Uzbekistan is searching for a solution to eliminate electricity shortages, this can be done efficiently in the long-term with flexible solutions which could potentially include renewable energy and engine powerplant. The power outage losses cost annually 6 $ billion for Uzbekistan (Energo week 13 2019). For the RES to work in Uzbekistan, the country needs to finalize the regulatory frameworks and to make improvements to the country's national grid, so it can withstand the fluctuations that the clean energy often brings.

There exist few challenges for building a sustainable energy system in Uzbekistan one of them is climate difference, as summers can be +40 degrees and winters are below zero degrees. Other challenges are that the country is very mountainous and of course the post-soviet way of thinking, which has in recent years reduced. By post-soviet way of thinking we primarily mean producing energy with Soviet era way, which is often considered gas, oil and coal.

## 3.3 Azerbaijan

Azerbaijan is a country located in Eurasia, in the South part of Caucasus. It is considered to be the borders of Eastern Europe and West Asia. The size of the territory is 86,6 thousand square kilometers, where its neighbor countries are Russia in north, Iran on south, Georgia in north west and Armenia on the west. Nearly half of Azerbaijan's ground is mountains and the country have a rich source of water resources. Azerbaijan is a former Soviet Union country and has currently a rich resource of oil reserves (Vidadili et al. 2017.)

The population of Azerbaijan reaches 10 million where over half of them live in the rural areas of the country. The goal of Azerbaijan's energy policy is to be able to provide energy security into these rural areas and to the whole country (Vidadili et al. 2017.)

Azerbaijan's economic growth will in the near future hit an obstacle as the oil prices has decreases, which will affect the export revenue, also the country still remains largely reliable of fossil fuels (Vidadili et al. 2017). As the oil prices has been dropping in recent years, has it affected negatively on the Azerbaijan's economy. According to Vidadili et al. (2017) Azerbaijan has a great opportunity to be able to diversify its economic growth by implementing RES into their energy systems. The combination of implementing RES into their energy system would give the country a sustainable and reliable energy system. Azerbaijan has an opportunity for RES utilization such as solar, wind, geothermal, hydro and biomass energy to be integrated into the energy system (Vidadili et al. 2017.) Vidadili et al. (2017) also asserts that Azerbaijan's greatest potential in RES is based on wind and solar energy.

The country has seen a decreasing production of oil, but at the same time there has been an increase of natural gas production. The production of natural gas covers 94% of all energy produced, when only 6% origins from renewables. The production of natural gas is in the long-term not a sustainable solution as the reservoir of natural gas here on earth are decreasing rapidly (Vidadili et al. 2017.)

There of course exist some challenges in changing towards renewable and flexible energy thinking. The transition is on short- term costly and would decrease the economic growth for the first years (Vidadili et al. 2017.) There also exist some policy obstacles, where the solution would be to give a reason for changing the mindset towards RES and a regulation to follow the clean energy production. Azerbaijan is currently considering the option of exporting natural gas rather than using it, as it creates large profits.

# 4 METHODOLOGY

In this chapter we define the research methods used in this thesis and go through the energy markets in the target countries, simulate and analyse them using a simulation program called Plexos. The data is collected and analysed in this part and is later used for the guideline of sales strategy. The chapter goes through the methodology of the thesis which consist of mixed method study and a case study in the later part of the thesis. The countries are seen as high-risk business environments, with a large potential. For the clarity of this thesis we call both of these two countries Azerbaijan and Uzbekistan Central Asia countries. This chapter also investigates what things to take into consideration when modelling Plexos for the countries in Central Asia.

With the help of power system modelling Wärtsilä can provide reliable information to the partners and potential customers in these countries about which power system has the optimal solution in efficiency and cost. The best solution gathered using Plexos of course is not automatically the best pick for the customer, as the customers need needs to be researched by the service provider and to be able to find together the best possible solution.

## 4.1 Research Method

The research design for this study is based on mixed method study (combination of qualitative and quantitative) this will give for the case study done in this thesis a plausible guideline to rely on. According to Kothari (2004:8) defining research methodology gives an ability for solving the research problem set. It also gives the reader knowledge and understanding of why a typical research method was chosen.

As Gephart (2004:456) described literature will give the methodology guidelines which to follow and evaluate. The main method of study is based on former literature reviews and mixed study, which is a combination of qualitative and quantitively study. Mixed

study helps in “triangulate” the research found, which means backing up studies found only using one research.

With the interview section considered as qualitative study, Wärtsilä is able to benchmark the results of how to do business in Central Asia with the help of PESTEL model. The interview answers are seen as empirical research method because of earlier experience in business with the Central Asian countries. The quantative study method used in this thesis is the data gathered from Plexos modelling.

## 4.2 Case study

Here we define what is a case study and what things to take into consideration for a successful case study. According to Gephart (2004:458) a case study is a research method that tries to conclude a single event in an analytical way. Case study is a good research method to be implemented when information is gathered and analysed in contextual conditions (Yin 2003:13). Also, Eisenhardt (1989:546) concluded when there is not much data available from previous research about the topic, then case study is needed where the data is collected together with the professionals from the case company.

Case study also enables learning efficiently and gives the ability for how to further develop the research, it is also important to understand how the case study affects positively to the business studied. Gustafsson (2017) verifies that the focus in a case study is usually based on a special business unit and is used to test different theories, which has been earlier researched. A case study answers to the questions of “how” and “why” in the research questions. Also, the case study should be implemented when the researcher has little or no control over events that will happen in the case studied. In a case-study the phenoms are based on real-life context Yin (2003:1). Eriksson et al. (2014) states that a case study can be classified as qualitative or quantitative study.

For the case study to be successful couple of questions need to be answered… what questions to study, which data are relevant, how to collect data and how to analyse them

Yin (2003:20). A case study does not give straight answers to the problems, it gives alternatives how the problem could be handled (Gustafsson 2017).

## 4.3 Analysis Method

In this section the analysis of the planned research methods for this thesis is evaluated. Using a case study is the best way to research this kind of topic because as earlier pointed out a case study is an efficient way of gather complex information together. Combination of two different data types using mixed method gives a more complete understanding of the problem. Mixed method also provides for the researcher the flexibility to choose right methods of collecting data, where combining numbers with in-depth analyses gives a powerful argument about the subject studied.

The interview made for this thesis provides an ability for Wärtsilä to benchmark a company that have had success in Central Asia earlier, this can be utilized using a PESTEL model. A benchmarking process is according to Stroud (2010) a way of discovering the best practices from companies in the same branch, competitors or even companies from different industry. Benchmarking process can be seen as a partnership process, where two companies share their way of working and are able to evaluate how the other company is doing things, this is very different from competitor research, where the information available is gathered from the competitor quietly as possible. Benchmarking process also gives an edge of critical evaluation of this research done later in this thesis using data gathered from Plexos.

## 4.4 Methodology limitations

The limitations of this methodology are related to the fact that are we able to utilize data gathered from the customers, from the markets and are we able to use it in a way which creates value to the company and for the customers? Using a case study method should

create the answer how and why things happen and provide a possible solution and suggestions for further research.

One of the limitations is the researcher's own limitation and knowledge of the topic of this thesis. That is why it is important to have a support team who can give one the basic knowledge and provide the crucial information to be successful with this case.

## 4.5 Plexos

Plexos is an energy simulation tool used for simulating electric, water and gas systems. It provides the preferred choice for modelling and provides solutions for uncertain energy simulation questions. Plexos simulation system is able to read complex data fed into the system and simulates it accurately. Plexos has a wide user base from consultants to policy makers in 43 countries (Energy Exemplar - Plexos 2019.) Based on the simulations Plexos can identify system constraints and configure an optimal power system or provide suggestions based on inaccurate assumptions. The software can also be used for general energy system modelling, capacity planning, power generation dispatch planning with up to 1-hour accuracy and energy price forecasting.

Plexos can be optimized for different time scales, which are long term (1-40 years), medium (1-5years) and short-term, which is less than 1 year. The modelling process is done using deterministic linear programming techniques, where the optimal solution to the problem is established Chiodi et al. (2011). Plexos algorithms works with using Mixed integer programming, where mathematical optimizations happen in a fast and robust way. This method also gives the transparency for the user to see what has been calculated.

Plexos finds the lowest total system costs and gives the user an understanding to support the investment decisions. The simulation program is very popular among companies as it can simulate how renewable power generation has an impact on the markets of the simulated object (Dincer 2018).

Wärtsilä can offer with power system modelling a broad understanding and learning of the future scenarios related to energy markets with the customers interest on focus. Wärtsilä is able with Plexos finding the most cost-efficient model for the customers with the consideration of lowest acceptable risk. Also, Wärtsilä is able to understand the flexibility need in the power system modelling and is able to find an optimal mix of capacity for the customer. There exist of course different scenarios which the customer can choose from and to see which scenario would be the most optimal for them. A global company like Wärtsilä has many ongoing projects, where the optimal plant solution needs to be found with the lowest NPV or the highest IRR. Combining these with the country and customers best interest will create a winning solution for the projects.

For the simulation to run smoothly and to be able to create output data, the system requires first input data. The input data can be as following seen from Figure 4… fuel and emission prices and power plant types (Arima 2012). The input data is collected sometimes from public sources, but to gain more accurate and reliable results the data should be up-to-date and is recommended to be gathered from local partners or from stakeholders. One of the public sources that many companies use is Bloomberg energy financials. Letting Plexos choose some of the input data could create an outcome that the customer or the simulator are not happy with, that is why it is recommended to feed the inputs. In Figure 4 we can see that there exists multiple input data that needs to be feed to the Plexos system.

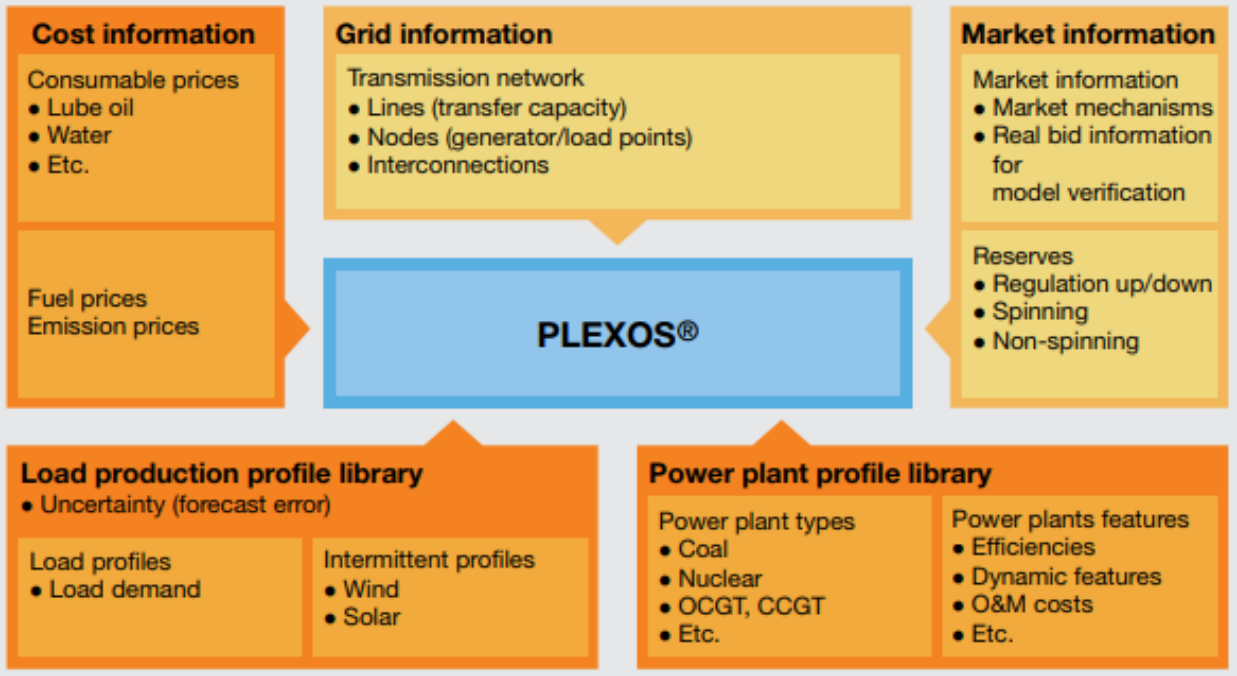


Figure 4. Typical input data (Arima 2012)

The output data that the Plexos gives can be seen from Figure 5, which usually consist of total cost of the power system and the efficiency of the system (Arima 2012). For the simulator it is crucial to be able to understand what the outputs mean, otherwise the Plexos data is only data and does not give any valuable information to the user.

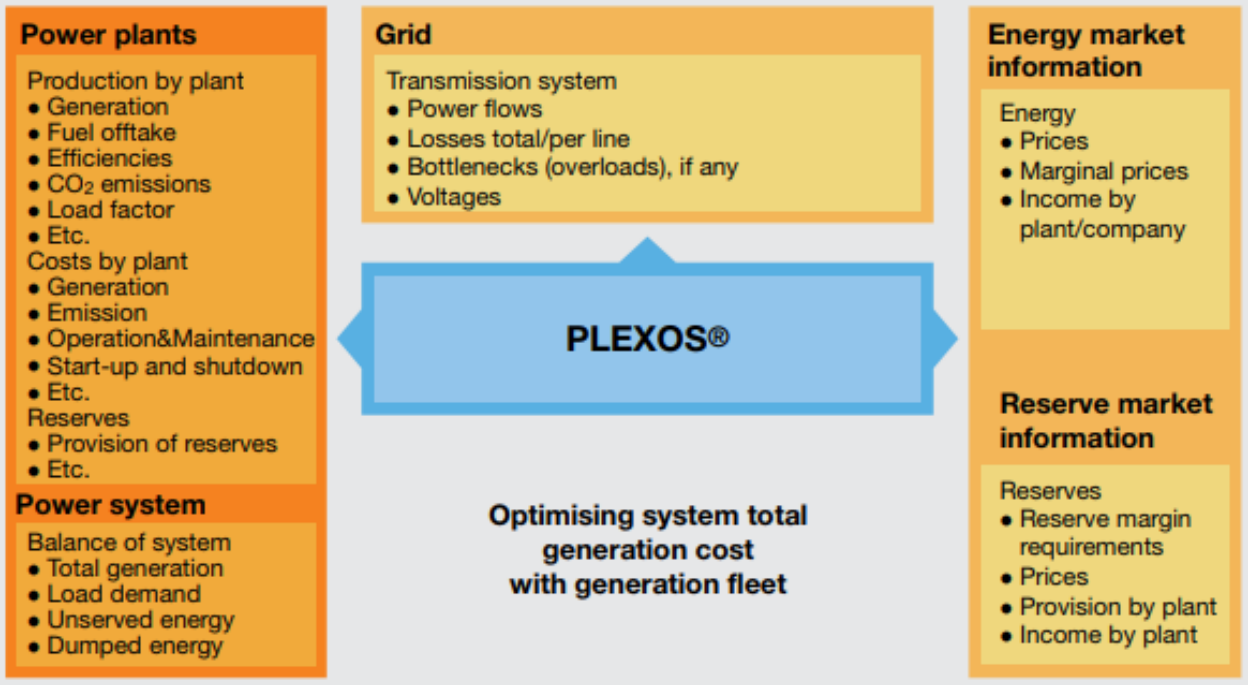


Figure 5. Typical output data (Arima 2012)

Penetration of renewable capacity in the future will need a balancing capacity system, that is why a chronological dispatch model is needed. A chronological model is also called modern power system modelling, here the dynamic parameters and operational reserves are set. The chronological model can give an accurate picture of the future, it is able to balance the costs of the system and discovers the true value of optimization of RES. There is also a possibility to use a faster model, but it does not give as accurate outcomes as a chronological model, the model is called Load duration curve. The load duration curve gives faster and easier access to compute the simulation, it also gives a brief estimation of baseload, cyclic and peak outcomes for the simulation. The Chronological dispatch model gives the user the ability to see the effects based on weeks, where the starts and ramping constrains can be viewed. The Chronological model is more realistic represent of real-life power systems, but it is harder to solve for the system and takes more time. Also, the Chronological simulation gives real dispatch modelling with 1-hour resolution.

In Plexos there exists also different modules when simulating the energy sector, they are long term expansion planning, projected assessment of system adequacy maintenance, medium term and short term. For this thesis we used the Long-term expansion planning

module as it gives the optimal investment decisions for the future, optimizes new build capacity within the given planning horizon and is able to simulate the dispatching of existing powerplants if needed. The planning horizon for this thesis was based on a model of 2019-2030 years.

Plexos gives the user the ability to understand the correlations between inputs and outputs, which gives Wärtsilä the advantage to educate the customer of their own energy markets. The models Wärtsilä has chosen to run with vary with case by case, some simulations run only 10 minutes, while others run for days, this really depends on how accurate does Wärtsilä want the results with the time efficiency taken into consideration. Often 2 hours resolution modeling is time efficient and gives accurate outcomes, that is why we utilized it for this thesis when simulating the Central Asia countries.

### 4.5.1 Uzbekistan Plexos modelling

The Uzbekistan Plexos model had been simulated a few months earlier than this thesis writer had the opportunity to learn and simulate with the Plexos model. Therefore, we implemented some changes to see how the simulation model changed during these different scenarios. We simulated the different scenarios using the Chronological model from years 2019 to 2030, where also a dispatch model was simulated. In the Chronological dispatch model, we simulated for every model years 2019, 2025 and 2030 the dispatch models can be found in Appendix. In the chronological dispatch model, we chose random week to be evaluated, which were selected to be week 12 in every model.

In the Uzbekistan Plexos modelling there exists three different simulations, which consist of different scenarios. Scenario one (named S02) is about traditional thermal with a gas price of 6 USD/GJ. Scenario two (S06) is about flexible solution using the gas price of 6 USD/GJ. The third scenario also named S06 is about flexible solution with a gas price of 0,8 USD/GJ. The fourth scenario is flexible solution of a gas price 2,3 USD/GJ. The second simulation of Uzbekistan was about updating flexible solution of 0,4 USD/GJ of gas price using 7000 MW of RE targets. The third simulation model was about updating of capacity factors, here the simulation was based on similar values as the first simulation.

In all three simulations we implemented a $C0_2$ – and cost comparison between different scenarios. For clarification we created a Tables for different simulations to view the different scenarios, their names, the gas prices and variables that were included. Table 1 is about the first simulation in Uzbekistan, Table 2 is second simulation and Table 3 is about third simulation of Uzbekistan Plexos simulation.

Table 1. Simulation one of Uzbekistan Plexos Simulation

| **First Simulation** | **Name of Scenario** | **Gas Price** | **Variables** |
|---|---|---|---|
| Scenario one (S02) | Traditional Thermal | 6 USD/GJ | Traditional |
| Scenario two (S06) | Flexible (gas 6 USD) | 6 USD/GJ | Flexible |
| Scenario three (S06) | Flexible with new gas 0,8 | 0,8 USD/GJ | Updated gas price |
| Scenario four (S06) | Flexible with new gas 2,3 | 2,3 USD/GJ | Updated gas price |

Table 2. Simulation two of Uzbekistan Plexos Simulation

| **Second Simulation** | **Name of Scenario** | **Gas Price** | **Variables** |
|---|---|---|---|
| S06 7000 MW of RE target | S06 Flexible gas (0,4 USD) 7000 RE Target | 0,4 USD/GJ | 7000 MW of RE Target |

Table 3. Simulation three of Uzbekistan Plexos Simulation

| **Third Simulation** | **Name of Scenario** | **Gas Price** | **Variables** |
|---|---|---|---|
| Scenario one (S02) | New profiles | 4 USD/GJ | CF updated |
| Scenario two (S04) | New profiles gas price of 0,8 | 0,8 USD/GJ | CF and gas price updated |
| Scenario three (S05) | New profiles gas price of 2,3 | 2,3 USD/GJ | CF and gas price updated |

**Scenario one of the first simulation**

The Figure 6 presents how the energy markets in Uzbekistan would look like, if the current energy markets would proceed with traditional thermal at 6 USD/GJ in gas price. This is the first scenario of the first simulation. In the traditional thermal system gas steam turbine would act as a baseload. We can see in the model that there is a growing need for renewable energy even when simulating with traditional thermal, the reason is mainly the high gas price of 6 USD/GJ. The installed capacity for hydro power remains the same and there is an option to build a nuclear powerplant from the year 2027 similarly as building an open-cycle gas turbine from the year 2026. We can see from the scenario that the need for energy is growing and it is satisfied with fossil fuels and renewables. The peak load curve tells us what the actual demand is. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 1.

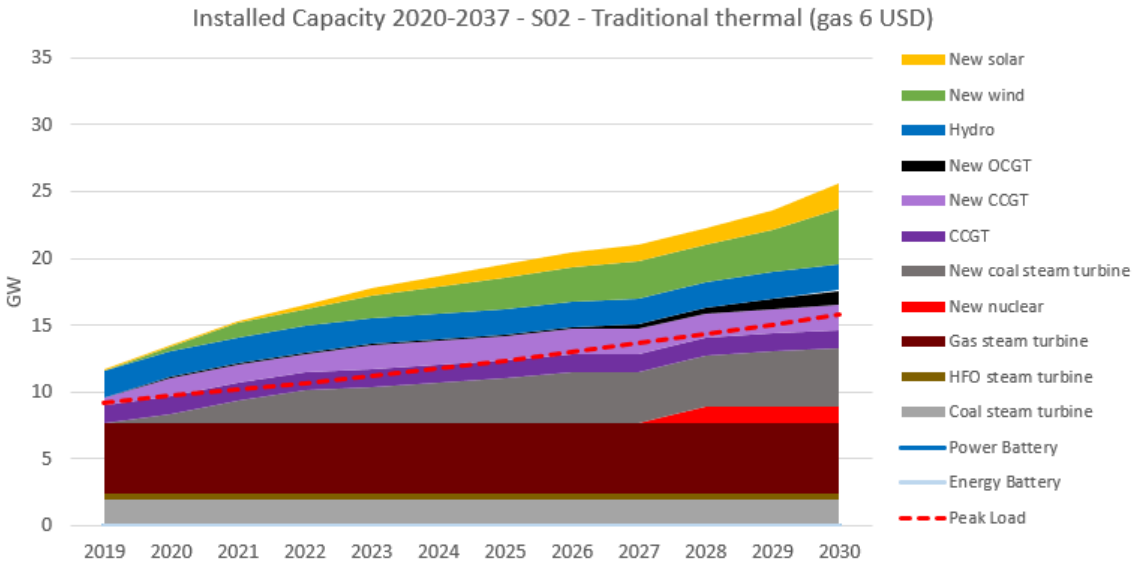


Figure 6. Installed capacity of traditional thermal with 6 USD/GJ in gas price

In Figure 7 we could see what the Plexos model would suggest based on our input data to be built for the capacity. One interesting aspect is that Plexos forces 1,3 GW of nuclear power to be built in the year of 2028. Also, we can see that Plexos does not suggest any new built capacity for hydro power. As we compare the years 2020 and 2030, we can see that new capacity built for renewables has increased, where the wind power is built by one GW the reason for this is old fossil fuel energy production and high gas price.

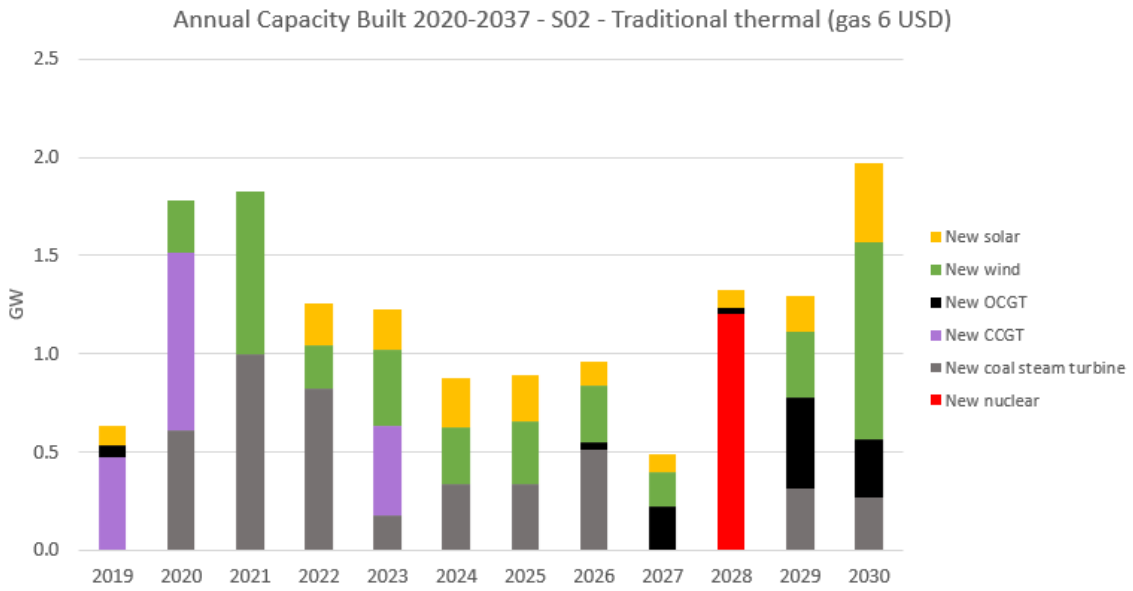


Figure 7. Annual capacity built with traditional thermal 6 USD/GJ in gas price

**Scenario two of the first simulation**

In the first simulation for this thesis there exists two different scenarios with updated gas price, where the first one was based on using a gas price of 0,8083 USD/GJ and the second one had a gas price of 2,3095 USD/GJ. The years we wanted to evaluate were from 2019 up to 2030. For comparison we included also in the simulation a scenario of flexible system, which is a mix of baseline gas, engines and renewable systems as seen from Figure 8 with 6 USD/GJ in gas price. The Figure 8 is very different than the traditional thermal model as this model has the option to be flexible and offer engine solutions. In Figure 8 there exist similar baseload of gas turbines as in traditional thermal, but the flexible solution and engines paves the way to utilize the renewables, which in long-term would be the most suitable for the environment. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 2.

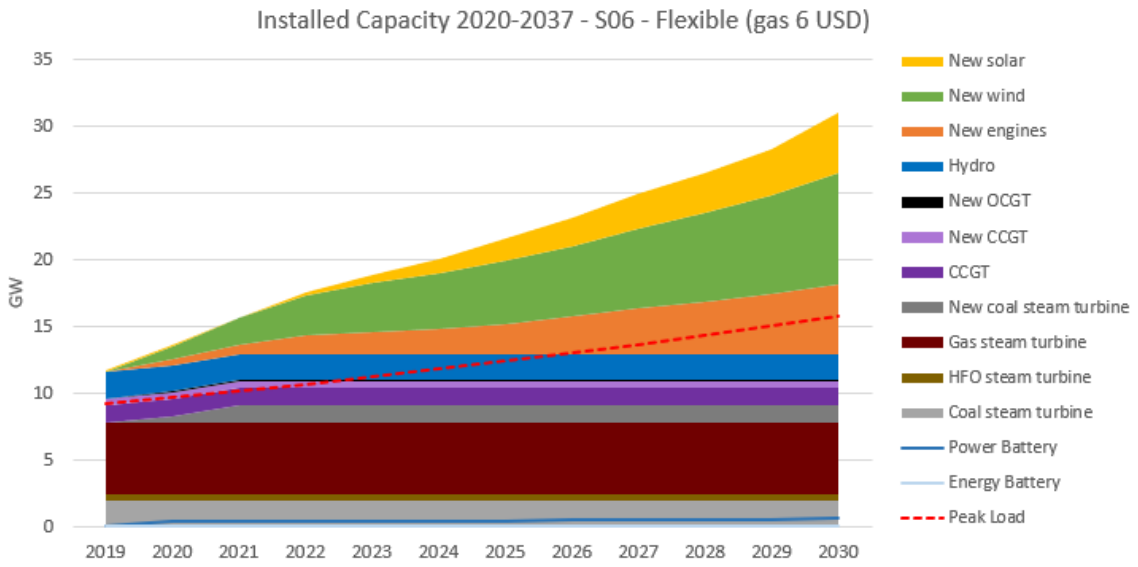


Figure 8. Installed capacity of Flexible solution with 6 USD/GJ in gas price

If we view the Figure 9 which has the flexible solution that Plexos provides with 6 USD/GJ in gas price, we can see that annual capacity-built stops building gas power from the year 2022. We can also notice that engines and renewable solutions are the primary targets for the new build capacity. Plexos also built 0,5 GW of power battery in 2020 and the years after around 0,1 GW of power battery. The reason here for decreasing fossil fuel capacity built is related to the high gas price as the Plexos simulation optimizes cost efficiency.

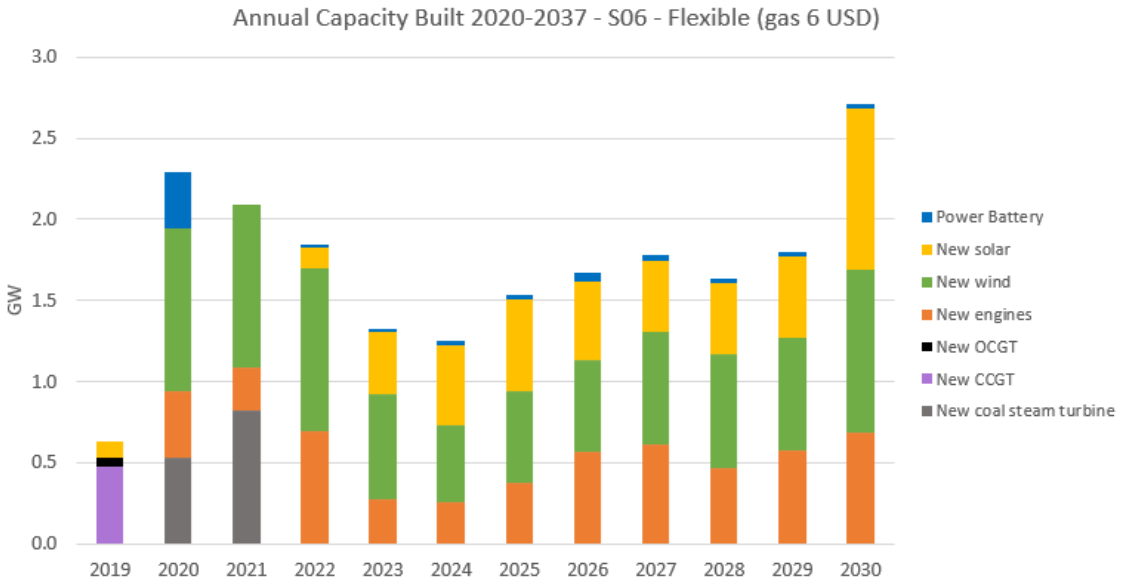


Figure 9. Annual capacity built with Flexible solution 6 USD/GJ in gas price

*Comparison between scenario one and two*

In the Figure 10 we had a comparison with $C0_2$ emissions between Traditional thermal and Flexible solution with 6 USD/GJ of gas price. We can see that traditional thermal solution is first more environmentally friendly than flexible solution, but a change happens for the years 2024 to 2027. One possible scenario that led to the traditional thermal being more environmentally friendly from year 2028 forward was utilizing of nuclear power.

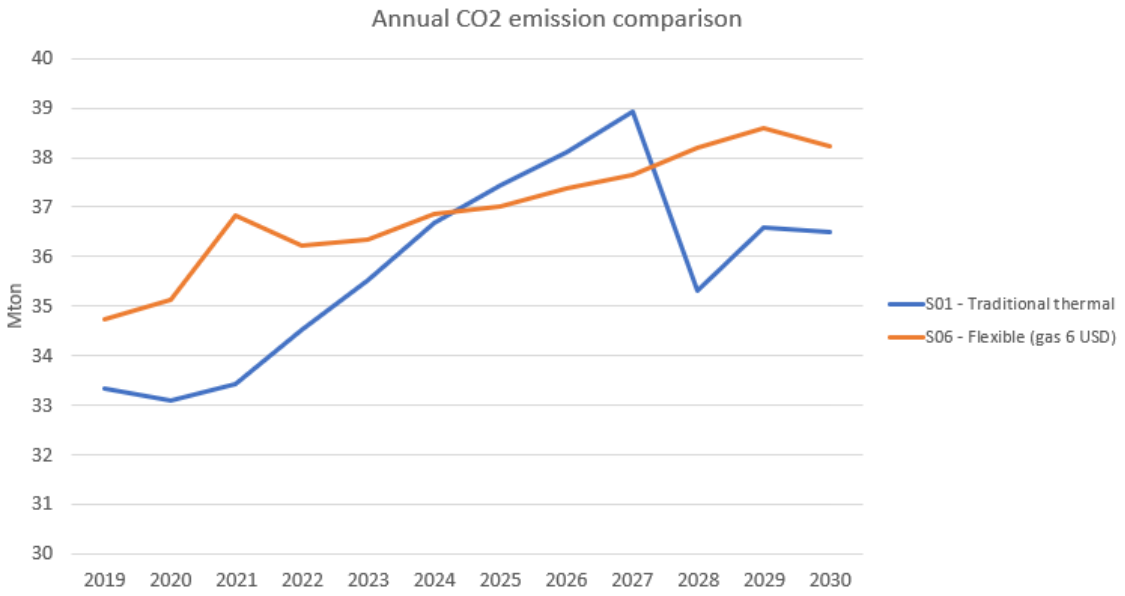


Figure 10. $C0_2$ emission comparison between Traditional thermal and flexible solution with 6 USD/GJ of gas price

In Figure 11 we compared the cost between traditional thermal and flexible solution 6 USD/GJ in gas price. The result show that Traditional thermal is constantly cheaper solution than flexible solution 6 USD/GJ, but the difference is less in 2030 than in 2019. We can also see that the cost increase year-by-year in both scenarios from 3000 Million to 5000 Million USD. The reason for this is mainly the increased need for energy and high gas price.

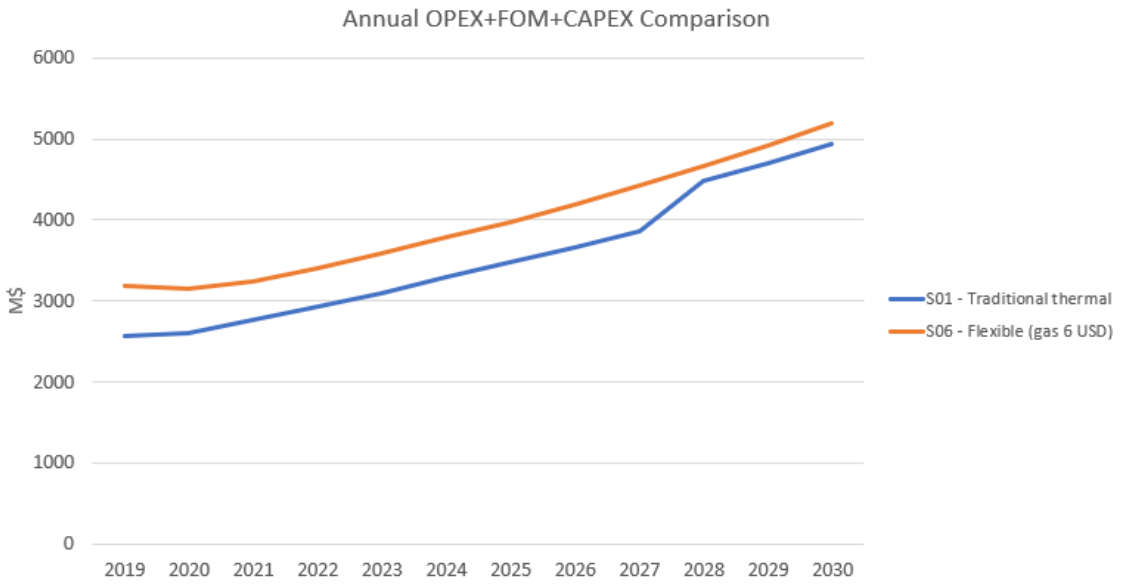


Figure 11. Cost comparison between Traditional thermal and flexible solution with 6 USD/GJ of gas price

**Scenario three of the first simulation**

Next, we have the same flexible capacity mix, but with the gas price changed from 6 USD/GJ to 0,8 USD/GJ. The Figure 12 is very different compared to flexible solution of 6 USD/GJ (Figure 8), here as the gas price is low the Plexos model uses fossil fuels combined with hydro and engines. We can also see that the installed capacity for engines increases year by year. (Figure 13). The reason for utilization of fossil fuels, hydro and engines is due to low gas price. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 3.

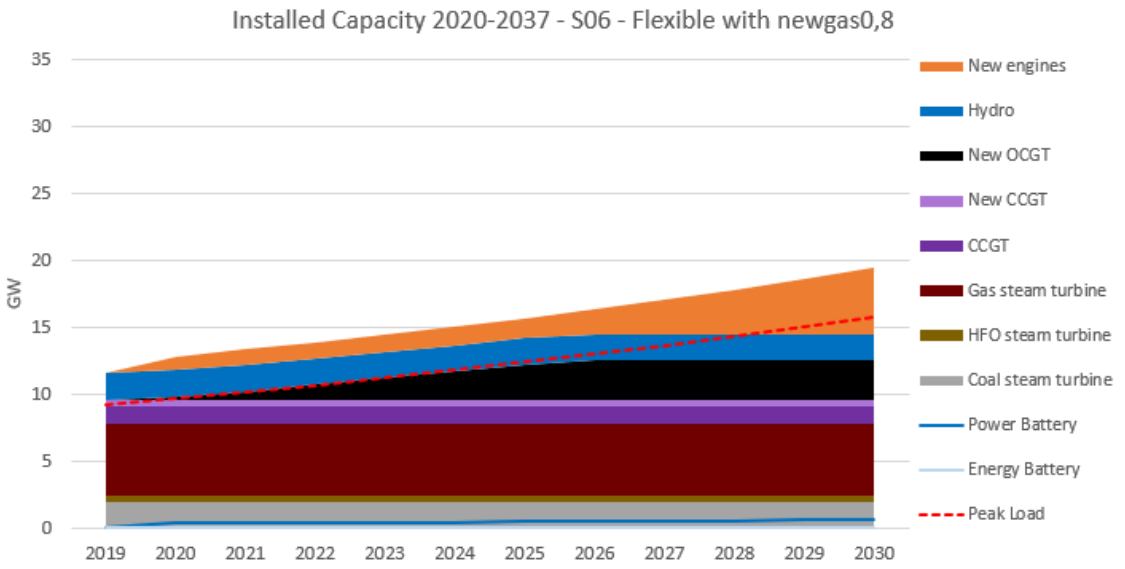


Figure 12. Installed capacity of Flexible solution with 0,8 USD/GJ in gas price

In Figure 13 the annual capacity built for the years 2019 to 2030 are based on engines, open cycle gas turbines with a mix of power battery. From the year 2027 the OCGT built stops and new engines are built the most. If we compare the flexible solution with 6 USD/GJ or traditional thermal we can see that the gas price being at 0,8 USD/GJ the Plexos simulation does not built the capacity as much as with previous simulations, this is mainly due to the low gas price.

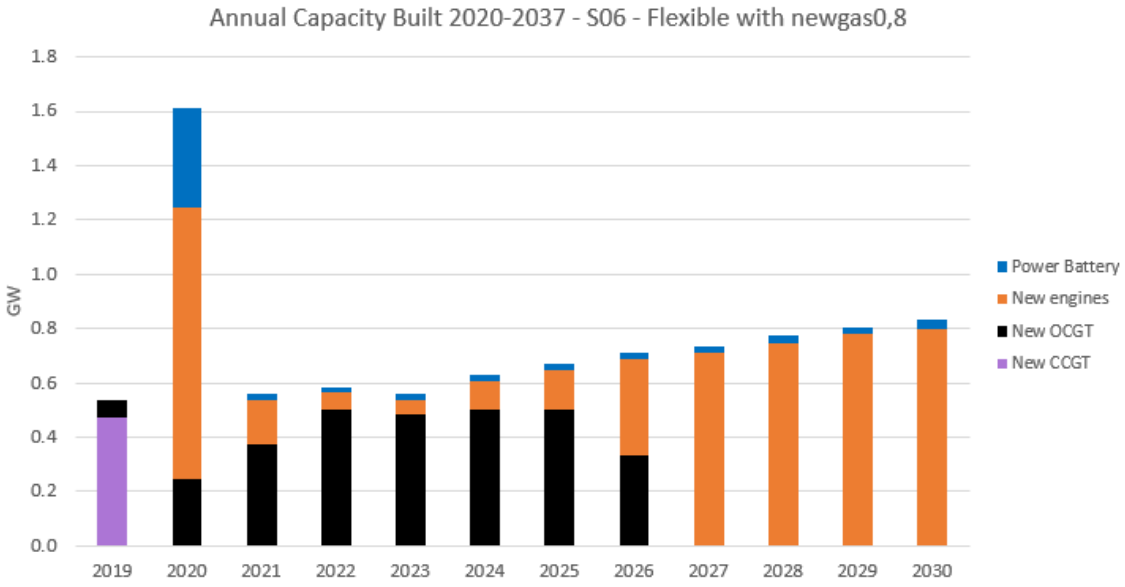


Figure 13. Annual capacity built with Flexible solution 0,8 USD/GJ in gas price

*Comparison between scenario one and three*

In the annual $C0_2$ comparison between Flexible solutions of 6 USD/GJ and 0,8 USD/GJ we can see that the breaking point for $C0_2$ emission between these two scenarios happens in the year 2025. The $C0_2$ amount for Flexible solution with 6 USD/GJ of gas price stays relatively similar, but with 0,8 USD/GJ in gas price we can see an increase of $C0_2$ emissions increase per year except from year 2019 to 2020. (Figure 14).

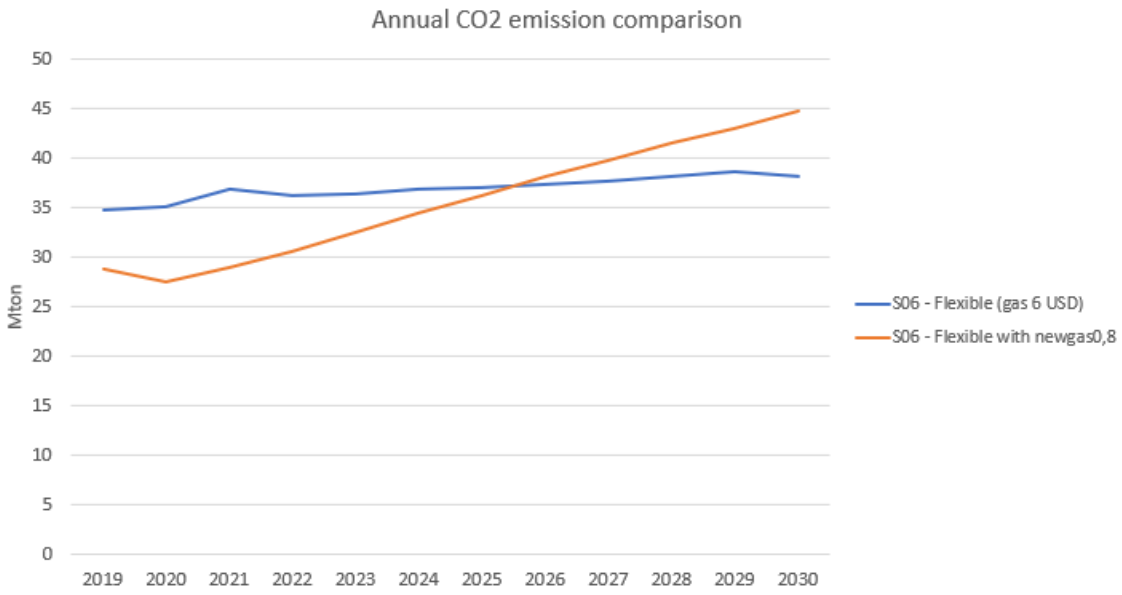


Figure 14. Annual $C0_2$ emission comparison between Flexible solutions of 6 USD/GJ and 0,8 USD/GJ in gas price.

In Figure 15 with annual cost comparison between flexible solution of 6 USD/GJ and 0,8 USD/GJ we can see that the flexible solution with a gas price of 0,8 USD/GJ remains cheaper than flexible solution with 6 USD/GJ in gas price. We can analyse that if the gas price would get as low as 0,8 USD/GJ the total cost of the system would be significantly lower than with high gas prices.

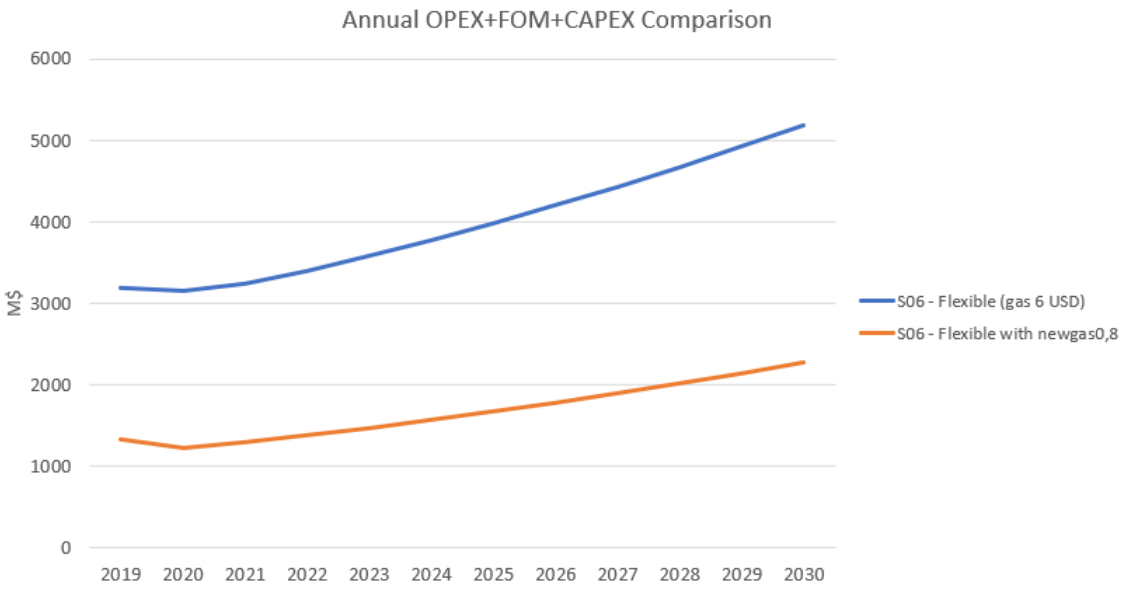


Figure 15. Annual cost comparison between Flexible solutions of 6 USD/GJ and 0,8 USD/GJ.

**Scenario four of the first simulation**

The Figure 16 consist of installed flexible solution with a gas price of 2,3 USD/GJ. Here the baseload consists of gas power combined with hydro power and the instalment for engines are increasing year-by-year up to 20 GW. One of the reasons why Plexos invest into engines as the peak load provider is because open cycle gas turbines and RES are an expensive option to invest with a gas price of 2,3 USD/GJ. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 4.

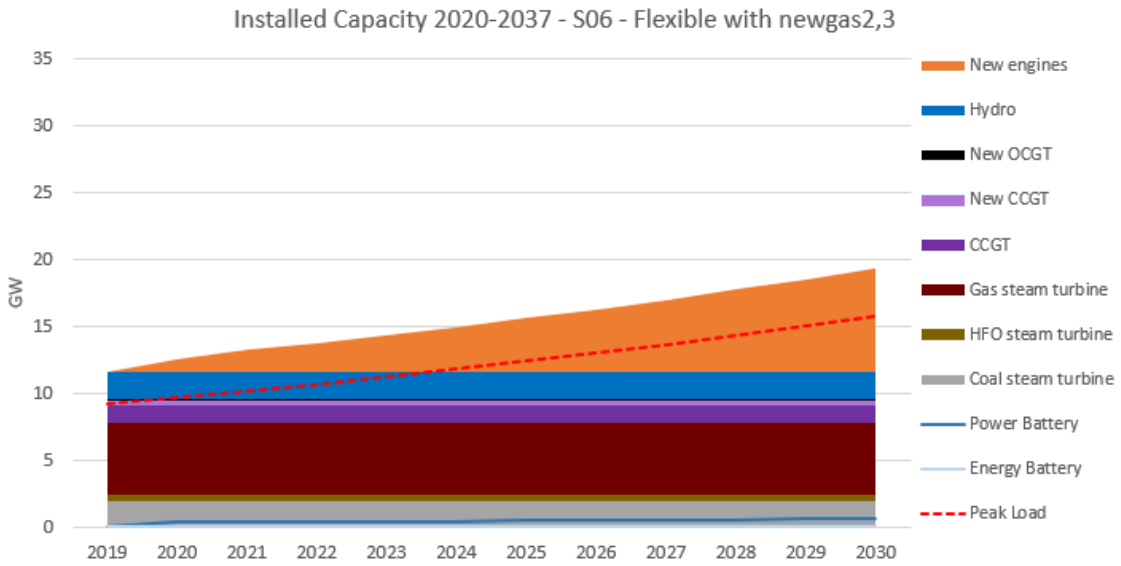


Figure 16. Installed capacity of Flexible solution with 2,3 USD/GJ in gas price

The Figure 17 indicates that as the gas price being at 2,3 USD/GJ the Plexos model builds mostly engine powerplants and 0,4 GW of power battery in year 2020, after that 0,1 GW of power battery with an increasing number of engines powerplant. The main reason for building engine powerplants is that Plexos considers engine powerplant as the cheapest option to build with a gas price of 2,3 USD/GJ.

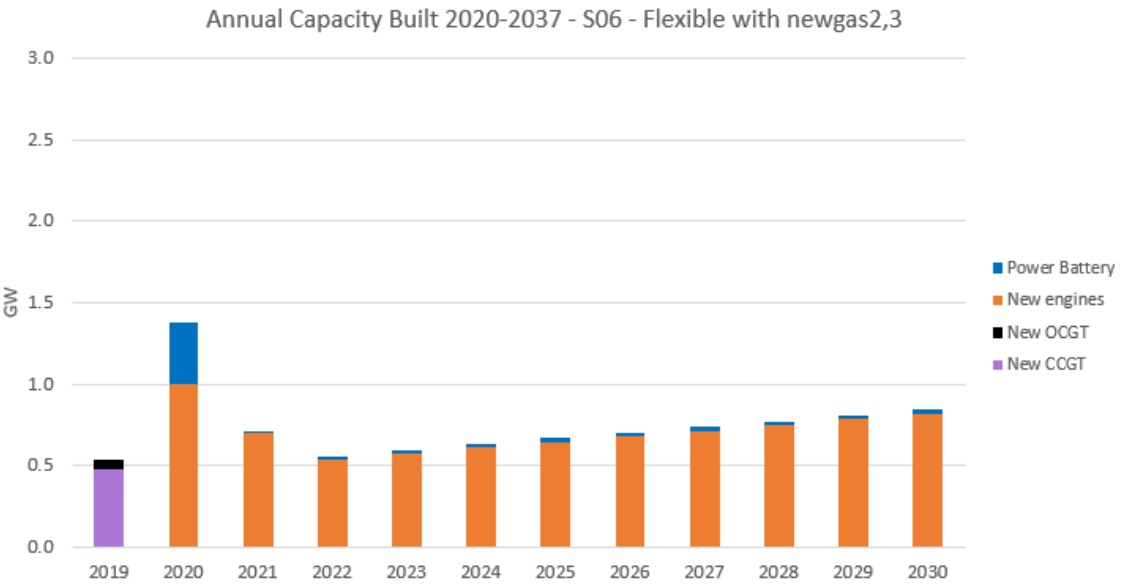


Figure 17. Annual capacity built with Flexible solution 2,3 USD/GJ in gas price

*Comparison between scenario three and four*

Figure 18 is about annual $C0_2$ comparison between scenarios of Flexible solution 0,8 USD/GJ and 2,3 USD/GJ in gas price. Both scenarios start at 29 Mton of $C0_2$ emission and end up in between 40-45 Mton of emission annually. Here the Flexible solution with 2,3 USD/GJ has less emission of these two comparisons.

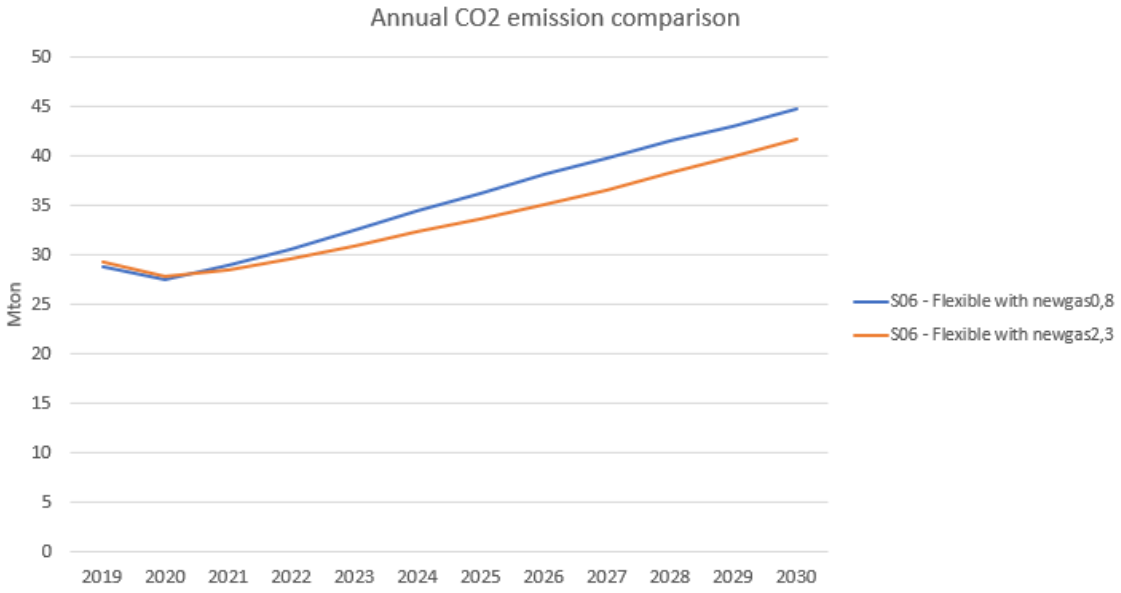


Figure 18. Annual $C0_2$ emission comparison between Flexible solutions of 0,8 USD/GJ and 2,3 USD/GJ of gas price

Figure 19 is about cost comparison between scenarios of Flexible solutions gas prices of 0,8 USD/GJ and 2,3 USD/GJ. We can see that the scenario with 0,8 USD/GJ is more cost efficient than the scenario with 2,3 USD/GJ the whole period of analysis. In the year 2030 the difference between these two scenarios costs are 1100 Million USD. Again, as the gas price difference between these two scenarios is 1,5 USD/GJ we can see that this has an effect of the total cost of the system.

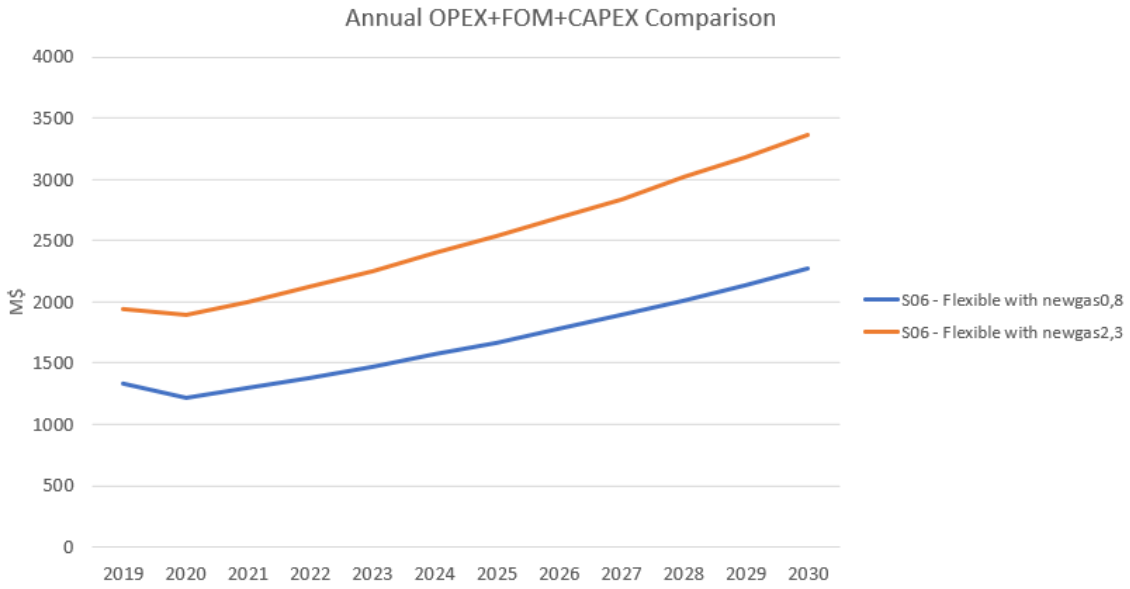


Figure 19. Cost comparison between Flexible solutions of 0,8 USD/GJ and 2,3 USD/GJ of gas price

**Second simulation**

In the second Plexos model for Uzbekistan we simulated a scenario where renewable energy plans were updated where by the end of 2030 Plexos could build up to 7000 MW of renewables, with the amount of 70% planned solar and 30% of planned wind. We chose the gas price to be 0,4 USD/GJ as it was the most realistic lowest gas price we could find. The lowest gas price would give Plexos a challenge to decide would it be more cost efficient to build renewables or rely on fossil fuels.

In Figure 20 Plexos could build up to 7000 MW of renewable power until the end of 2030 if it so desires taken into consideration cost effectiveness. The installed capacity of the years 2019 to 2030 was that Plexos increased the number of renewables and engines build as the need for energy is growing in the country of Uzbekistan. One interesting note is that Plexos did not abandon the fossil fuel installation as it stayed consistent around 10GW, but with an increasing rate of OCGT added. The implementation of 70% of solar production and 30% of wind production of renewables was considered to be successful. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 5.

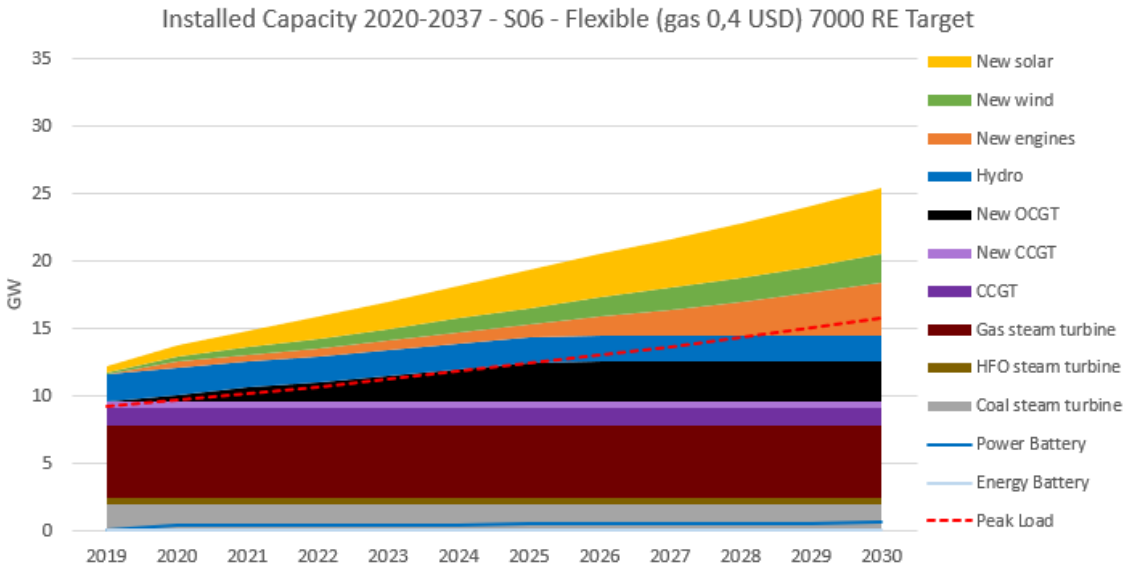


Figure 20. Installed capacity of Flexible solution with 0,4 USD/GJ of gas price and 7000 renewable targets

The annual capacity built from year 2020-2030 with 7000 MW of renewables target were built as following. Plexos stopped building fossil fuel based powerplants in year 2027, when it mostly focused on building engines, renewables and a small amount of power battery. Here the solar energy and wind energy amounts stayed consistent of 70% and 30% of renewable power. In this simulation Plexos decided similarly as in earlier cases to build nearly 2 GW of capacity build combination of fossil fuels and renewables. (Figure 21.) We can see that when the renewable target was set as high as 7000 MW, Plexos built every year solar and wind power same amount as previous years with the ratio of 70% and 30%.

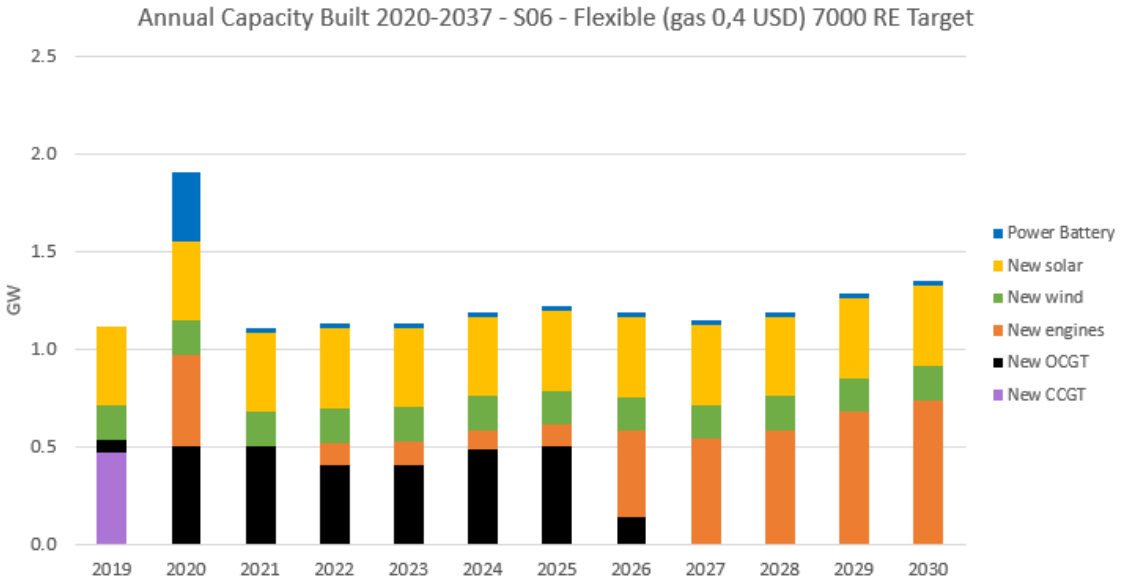


Figure 21. Annual capacity built with Flexible solution 0,4 USD of gas price and 7000 renewable targets

*$CO_2$ and Cost view of simulation two*

The annual $C0_2$ view of 7000 MW of RE targets started from 28 Mton in 2019 and reached in year 2030 with 38 Mton (Figure 22.) The surprising fact in the $C0_2$ of scenario two is that it is less environmentally friendly than traditional thermal solution (Figure 10), the reason for this is that Plexos utilizes in installed capacity still a lot of fossil fuels, but still is able to reach the 7000 MW of RES target.

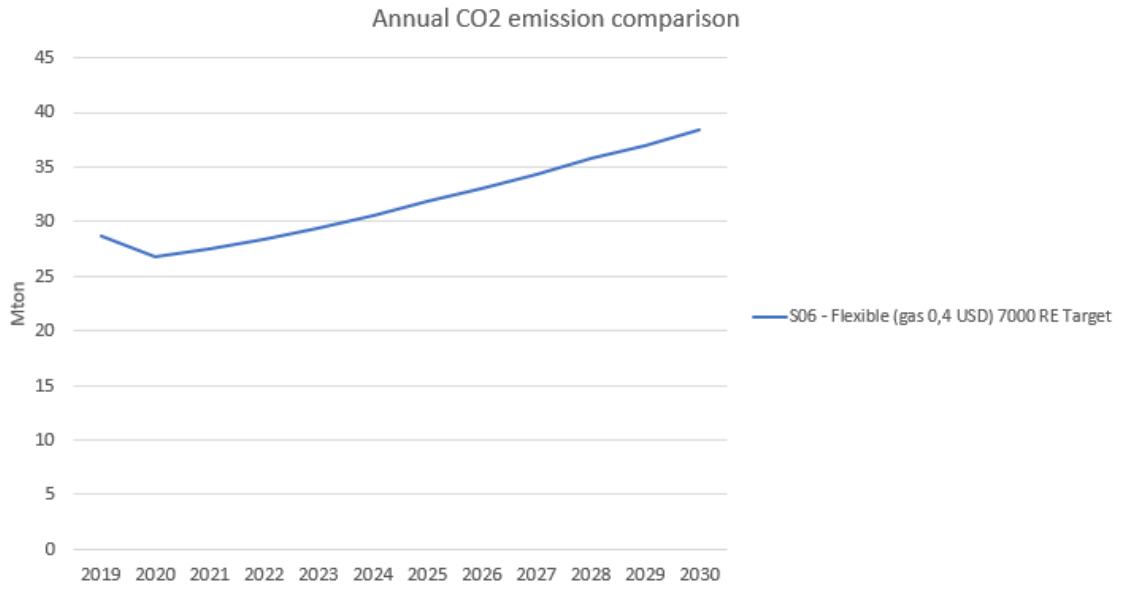


Figure 22. Annual $C0_2$ comparison of 7000 MW RE target

In Figure 23 the cost comparison of 7000 MW RE targets were viewed. Here the cost starts in 2019 with 1300 Million USD and in 2030 the cost is at 2500 Million USD. The costs of simulation two is much cheaper option than traditional thermal (Figure 11), this is mostly dependable of the low gas price and the cost effectiveness of renewable in the long term.

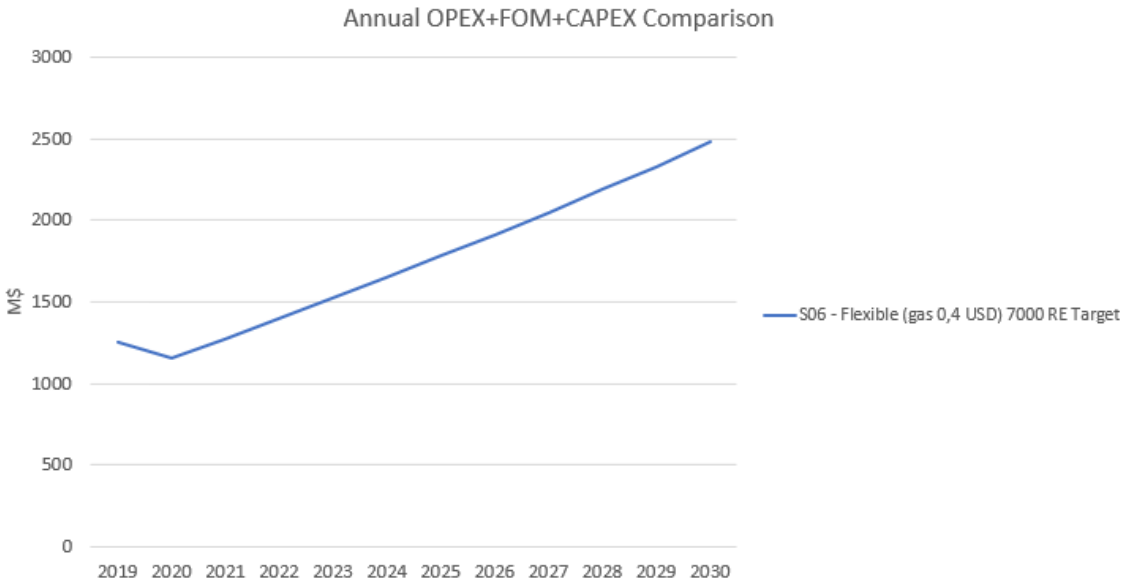


Figure 23. Annual cost view of 7000 MW RE target

**Scenario one of the third simulation**

The third simulation modelling was based on a scenario where capacity factor was set to be 25,11% with solar energy and the capacity factor for wind was set to 36,5%. A CF is according to Neill & Hashemi (2018) “the actual electricity production divided by the maximum possible electricity output of a power plant, over a period of time”. We were able to combine these two CF changes into one Plexos model, so that it was more time efficient and gave a holistic understanding of the results. The simulations using CF were compared against the first simulations made earlier with Plexos, just to see if the change in CF had a drastic change.

In the Figure 24 the new profiles with CF in solar and wind had a gas price of 4 USD/GJ. We can see that the model is similar to flexible solution with the gas price of 6 USD/GJ (Figure 6), the main difference is the needed installed capacity in this “new profiles” has been decreased under 30 GW. This is due to when the CF increases does it require less capacity from solar and wind power to match the demand. Also, when the gas prices in this scenario were 4 USD/GJ, it is lower than the flexible solution gas price of 6 USD/GJ, this means that it is cheaper to build more engines. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 6.

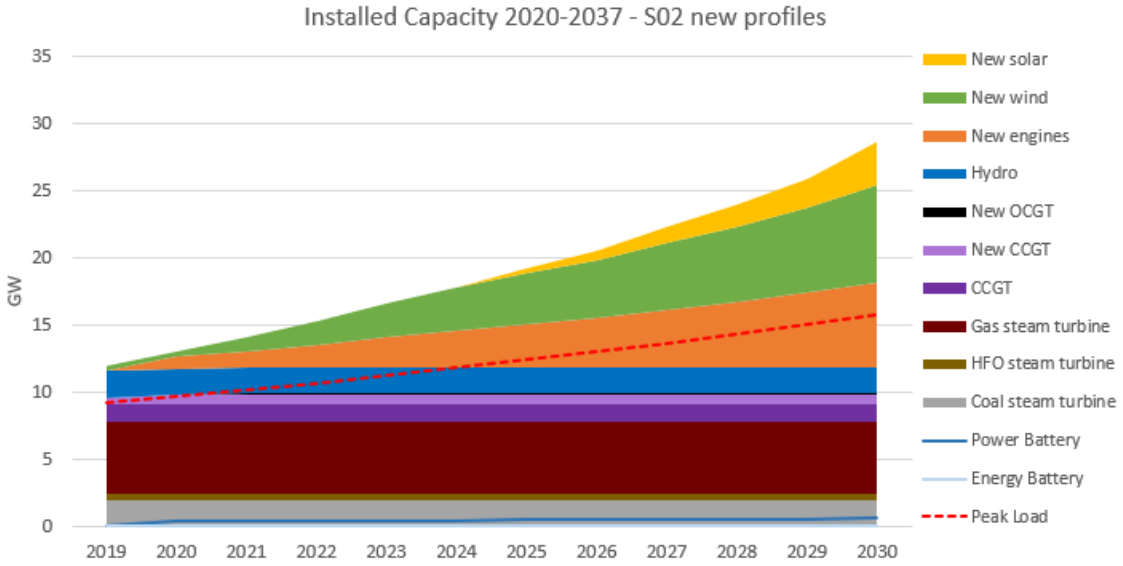


Figure 24. Installed capacity of Flexible solution with new profiles of CF 4 USD/GJ in gas price

The capacity factor changes affected the annual capacity built the following way that no coal steam turbines were built, and the solar power started to be built from the year 2025. The amount of engine powerplants and closed cycle gas turbines had increased in comparison with flexible solution 6 USD/GJ. (Figure 25.) As the capacity factor being set high, this means that Plexos optimized in capacity-built renewables and engines built.

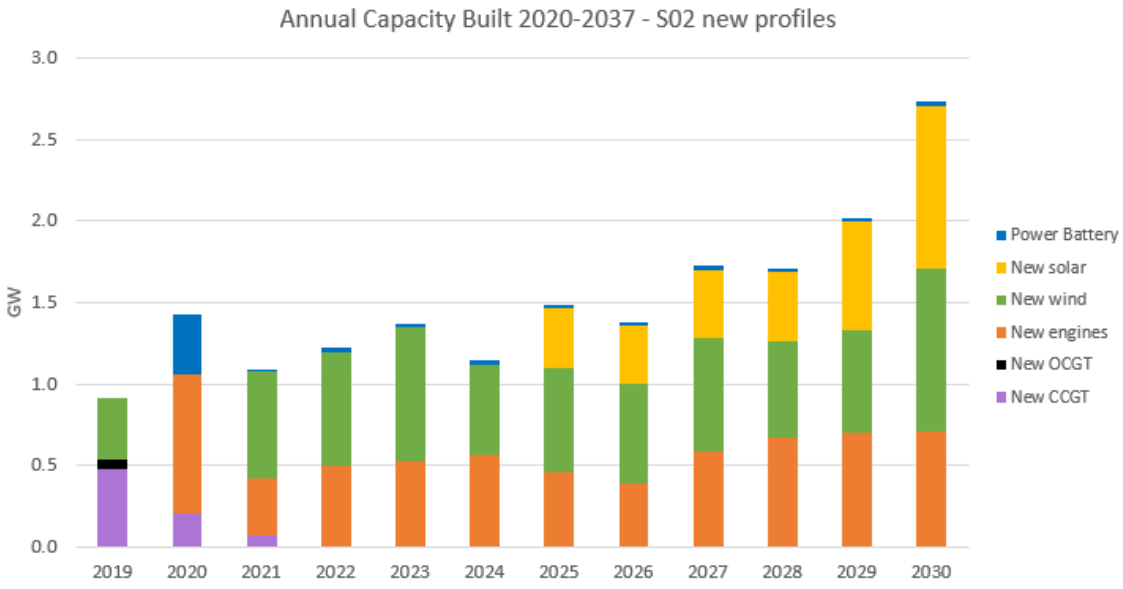


Figure 25. Annual capacity built with Flexible solution with new profiles of CF

**Scenario two of the third simulation**

The Figure of 26 is installed capacity with the gas price of 0,80 USD/GJ with updated CF, here as the gas is being cheap, the baseload consists of fossil fuels with a combination of hydro and engines. The CF change has not had a dramatically change in the Figure 26 if compared to 0,80 USD/GJ without the CF (Figure 12), this is because of the cheap gas price dominates the decision Plexos makes. Similarly, as in first simulation, here also the lack of renewable energy in installed capacity is dependable of the low gas price. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 7.

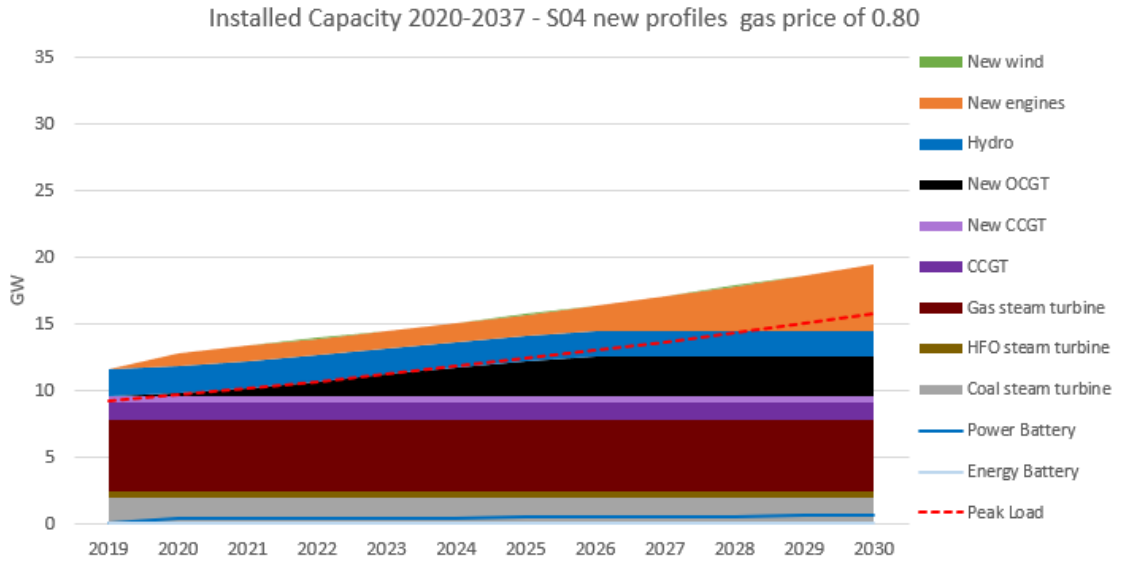


Figure 26. Installed capacity of Flexible solution with new profiles of CF 0,8 USD/GJ in gas price

The annual capacity built in Figure 27 was not affected of CF when comparing to flexible solution of 0,8 USD/GJ (Figure 13). The only change happened in Plexos modelling with 2019 build capacity, when wind power was built less than 0,1 GW. The main reason for this is the low gas price as Plexos optimizes OCGT. Engine and power battery built.

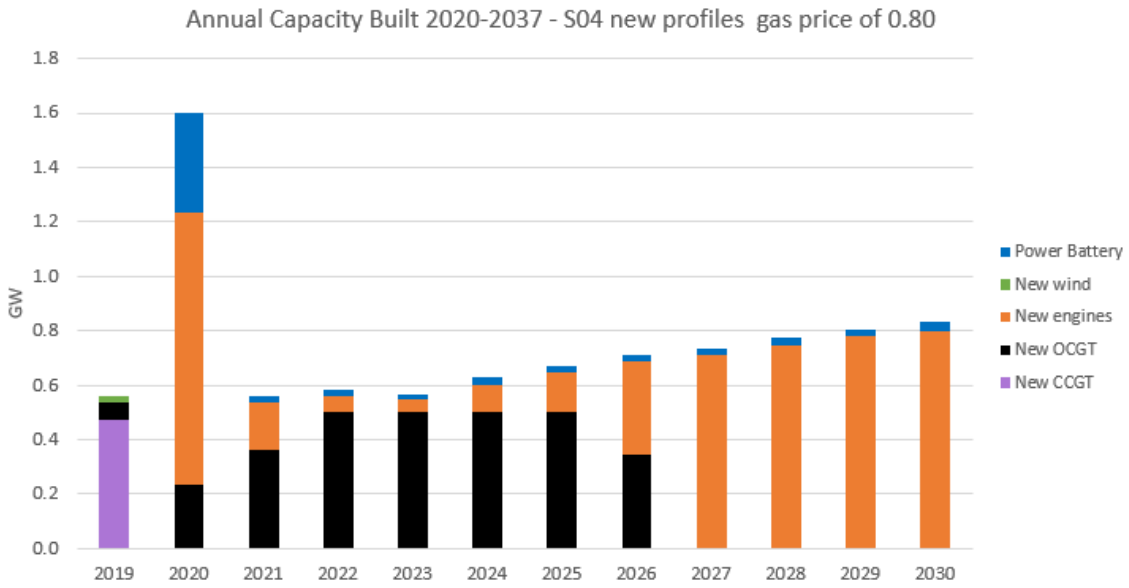


Figure 27. Annual capacity built with Flexible solution with new profiles of CF 0,8 USD/GJ

*Comparison between scenario one and two of third simulations*

Figure 28 is about annual $C0_2$ emission comparison between Flexible new profiles gas price of 4 USD/GJ and new profile of 0,8 USD/GJ in gas price. We can see the breaking point for Flexible new profile gas price of 4USD/GJ to be more environmentally friendly the turning point happens in year 2023, the reason for this is that with S02 Plexos optimizes renewables. S04 in Figure 28 is increasing year- by-year in $C0_2$ emission annually, except from year 2019 to 2020.

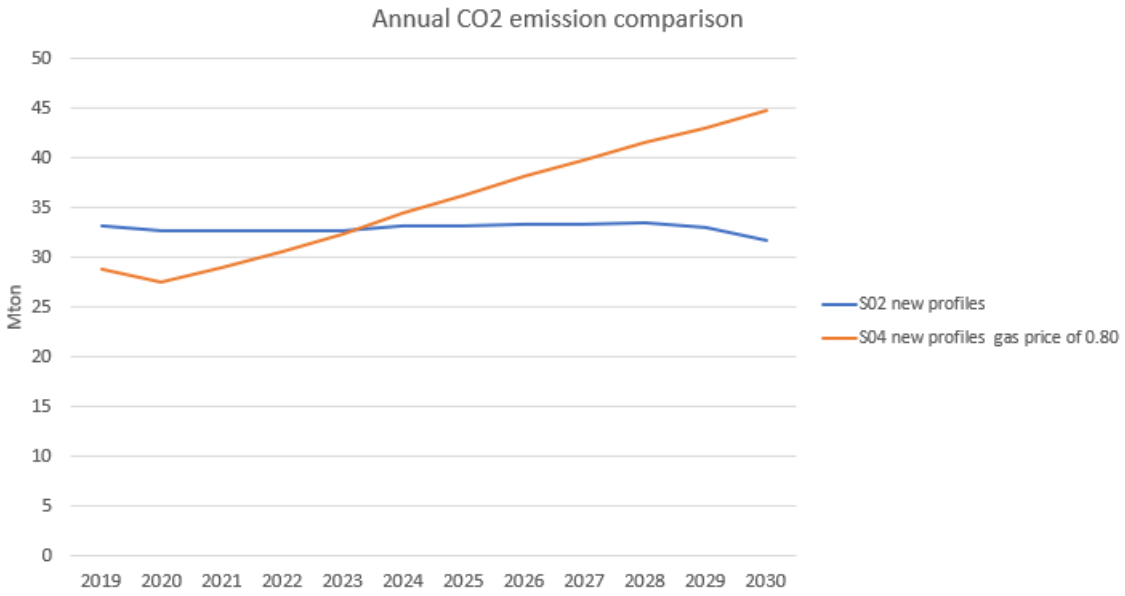


Figure 28. Annual $C0_2$ emission comparison between Flexible new profile gas price 4 USD/GJ and new profile of 0,80 USD/GJ in gas price

In annual cost comparison between the scenario S02 and S04 we can see that S02, which is the flexible new profile with a gas price of 4 USD/GJ is more expensive through the whole analysis period. This again is due to the gas price difference. (Figure 29.)

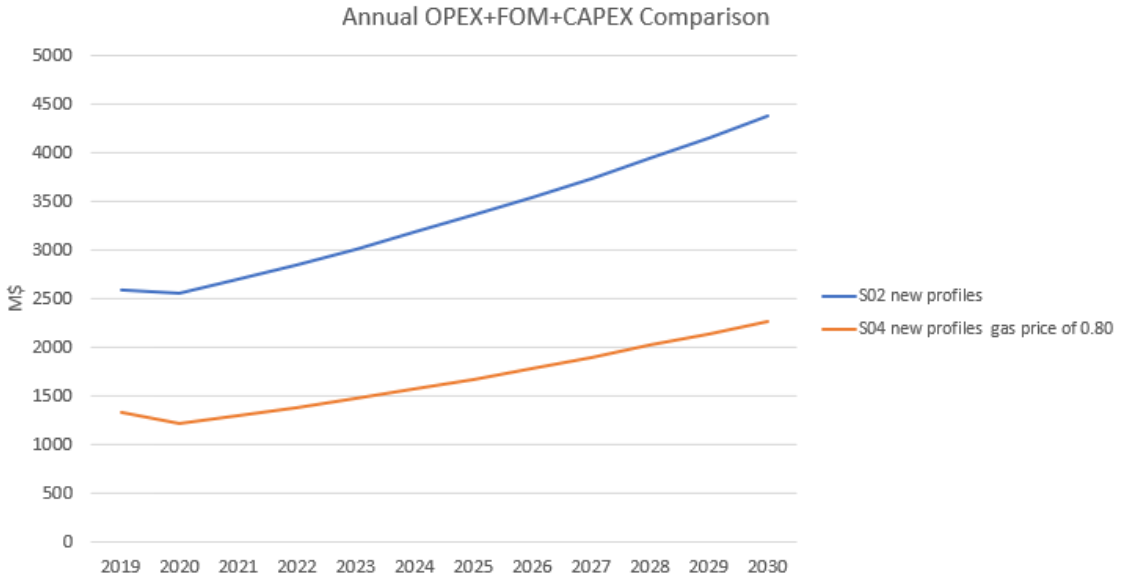


Figure 29. Annual cost comparison between Flexible new profile gas price 4 USD/GJ and new profile of 0,80 USD/GJ in gas price

**Scenario three of the third simulation**

In Figure 30 we can see that the only thing that has changed from the flexible solution 2,3 USD/GJ in gas price (Figure 16) is that from year 2029 there was an instalment of wind and solar powers. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 8.

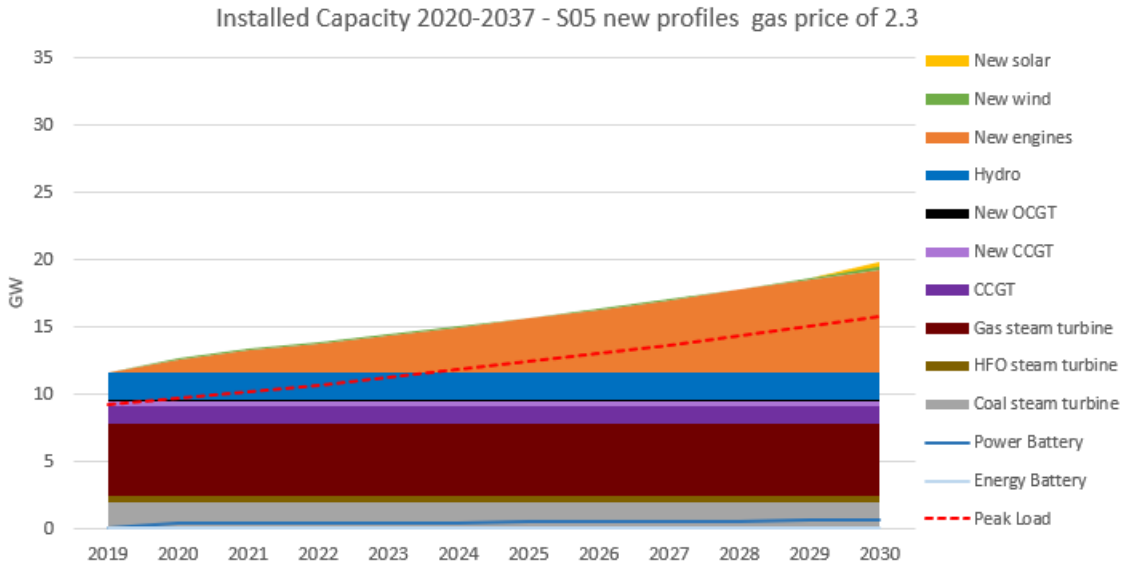


Figure 30. Installed capacity of Flexible solution with new profiles of CF 2,3 USD/GJ in gas price

As the CF was set, Plexos forces renewable built in the years 2019 and 2030, we can see this with wind power built in 2019 and in 2030 where Plexos built solar and wind. Otherwise with the gas price being at 2,3 USD/GJ, Plexos relies on engine power. (Figure 31).

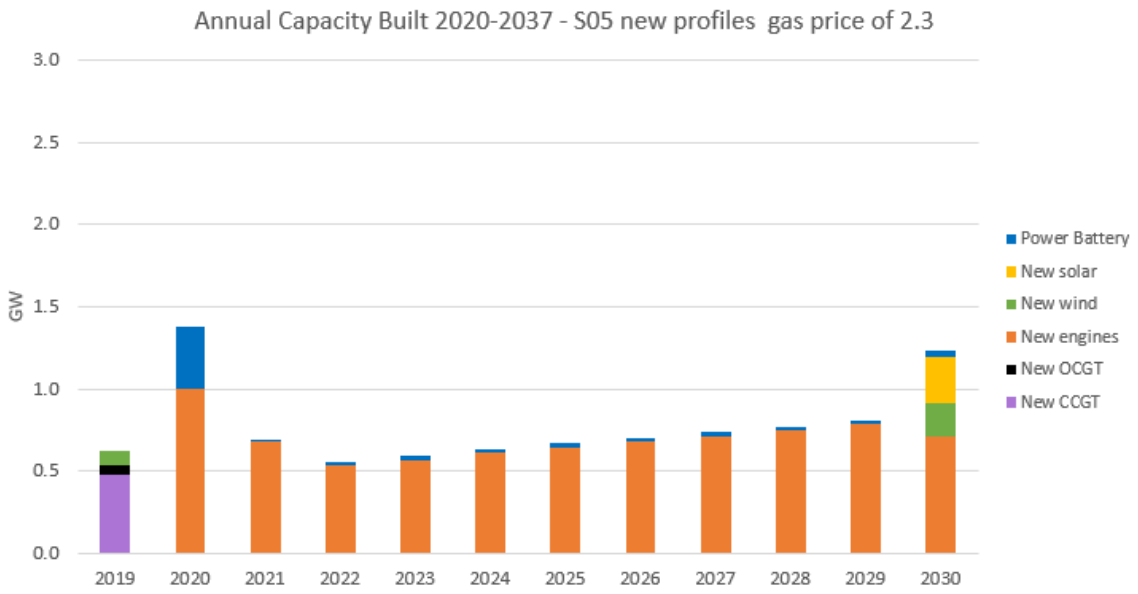


Figure 31. Annual capacity built with Flexible solution with new profiles of CF 2,3 USD/GJ

*Comparison between scenario two and three of the third simulation*

In Figure 32 the comparison of $C0_2$ emission starts similarly in both of the scenarios, but after 2020 the S04 scenario produces more $C0_2$ emission. The differentiation between these two scenarios is in the year 2030 4 Mton of emission. In Scenario four with a gas price of 0,8 USD/GJ Plexos has installed OCGT for capacity, which is less environmentally friendly than engines, which Scenario 5 in Plexos utilizes in installed capacity.

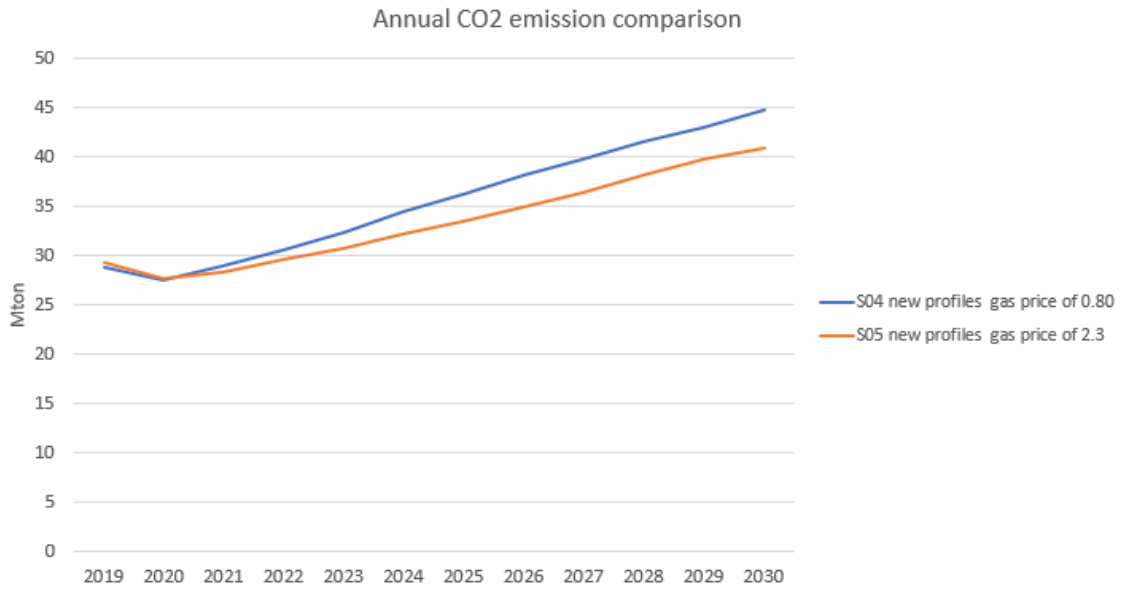


Figure 32. Annual $C0_2$ comparison between new profiles of 0,80 USD/GJ and 2,3 USD/GJ in gas price

In cost comparison between new profiles of 0,8 USD/GJ and 2,3 USD/GJ of gas price we can see that the scenario of S04 remains cheaper than S05. The price difference in year 2030 is 1100 Million USD. This again is due to gas price difference and engine power-plant utilization with scenario S05. (Figure 33.)

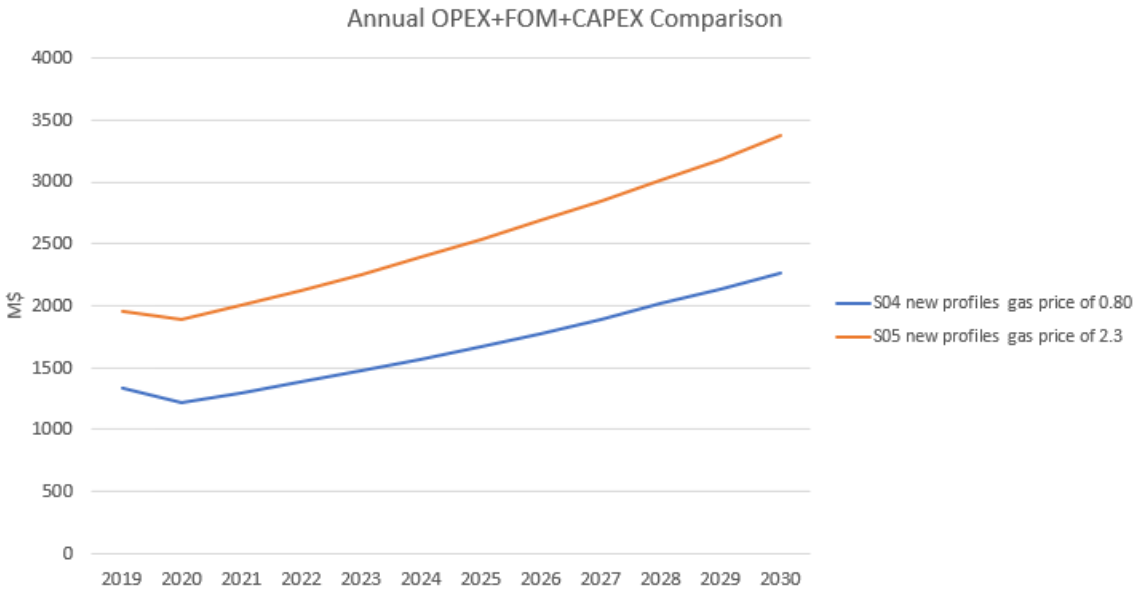


Figure 33. Cost comparison between new profiles of 0,80 USD/GJ and 2,3 USD/GJ in gas price

The results from these simulations gave us an understanding of different plausible scenarios and the effects they would have on the whole energy sector. Later in this thesis we will go through how these models could improve Wärtsilä's business in the countries studied.

### 4.5.2 Azerbaijan Plexos modelling

In Azerbaijan there had been an earlier made Plexos simulation of the county in the year 2018. The market situation has since then not changed dramatically, but new information had been gathered. We simulated the different scenarios using Chronological model, where also a dispatch model was simulated. In the Chronological dispatch model, we simulated for every model year 2019, 2025 and 2030 the models can be found in Appendix part. The difference between earlier done simulation and simulation made to this case study was the updated gas price. Other aspects such as renewable costs, heat rate update and RES forcing into the model to be over 8% were considered but we did not continue with these ideas as the data is owned by the Azerbaijan government and therefore not to be shared with third party members, which the case company is. Also, forcing RES to be over 8% will in this situation be an unrealistic input, maybe in the future research it could be implemented if the markets change to that direction.

The gas price update was decided to be 1,89 USD/GJ. The previously done simulation had gas prices of 1,6 USD/GJ and 5,6 USD/GJ. In the case study simulation with Plexos, there existed six different scenarios where three had a different gas price and three had forced 8% RES into their models. In half of the scenarios Plexos was informed to optimize the total costs of the system. The scenarios of one and two were made using fuel subsidiaries, which is a government action to lower the cost of fossil fuel energy production, the gas price for these two scenarios were 1,6 USD/GJ. Scenario three and four had a gas price of 5,6 USD/GJ and were without fuel subsidiaries. Scenario five and six were similar models as one and two, with the difference of gas price and fuel subsidiaries, the gas price was updated to 1,89 USD/GJ. For clarification we created a Table where the different scenarios can be viewed with their names, gas price and variables included. The table for Azerbaijan Plexos simulation can be seen from Table 4.

Table 4. Azerbaijan Plexos simulation Scenarios

| **Azerbaijan** | **Name of Scenario** | **Gas Price** | **Variables** |
|---|---|---|---|
| Scenario one (S01) | RES plan with fuel subs. | 1,6 USD/GJ | Fuel subs. |
| Scenario two (S02) | Optimal RES fuel subs. | 1,6 USD/GJ | Optimal solution and fuel subs. |
| Scenario three (S03) | RES plan | 5,6 USD/GJ | Updated gas price |
| Scenario four (S04) | Optimal RES plan | 5,6 USD/GJ | Updated gas price and optimal solution |
| Scenario five (S05) | RES Plan with 1,89 USD/GJ | 1,89 USD/GJ | Updated gas price |
| Scenario six (S06) | Optimal RES Plan with 1,89 USD/GJ | 1,89 USD/GJ | Updated gas price and optimal solution |

**Scenario one**

In Figure 34, which is scenario one with a gas price of 1,6 USD/GJ we can see installed capacity for the years 2019 to 2030 consist of a baseload of steam turbine and closed cycle gas turbine, where the amount of engine powerplant is increasing with the wind and solar power. The open cycle gas turbine and hydro stays consistent through the years. The Plexos model starts by installing 6 GW of energy, which increases to 7,5 GW by the beginning of 2030. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 9.

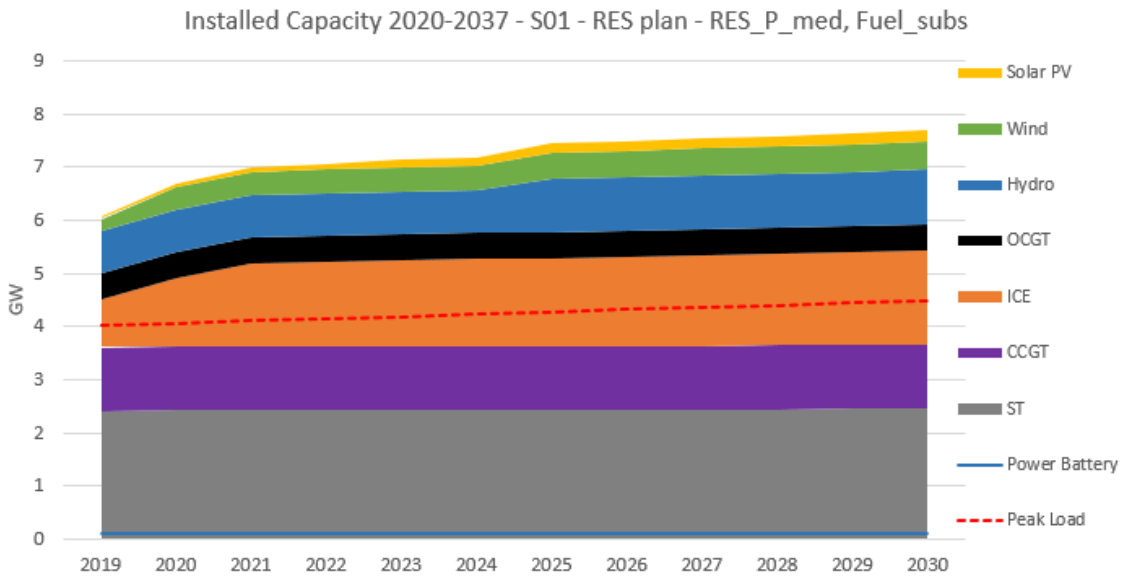


Figure 34. Installed capacity of scenario one in Azerbaijan with fuel subsidiaries and gas price of 1,6 USD/GJ

In Figure 35 we can see the annual capacity built from years 2019-2030, where in the year 2019 Plexos built engine powerplants, open cycle gas turbines, renewable and power battery. Plexos built in this scenario only in the year 2019 fossil fuels, where after engines and RES were only built. The capacity-built decreases rapidly from year 2021 as seen from Figure 35. The decrease of annual capacity built is due to the already exist power-plant production, which satisfies the energy consumption need.

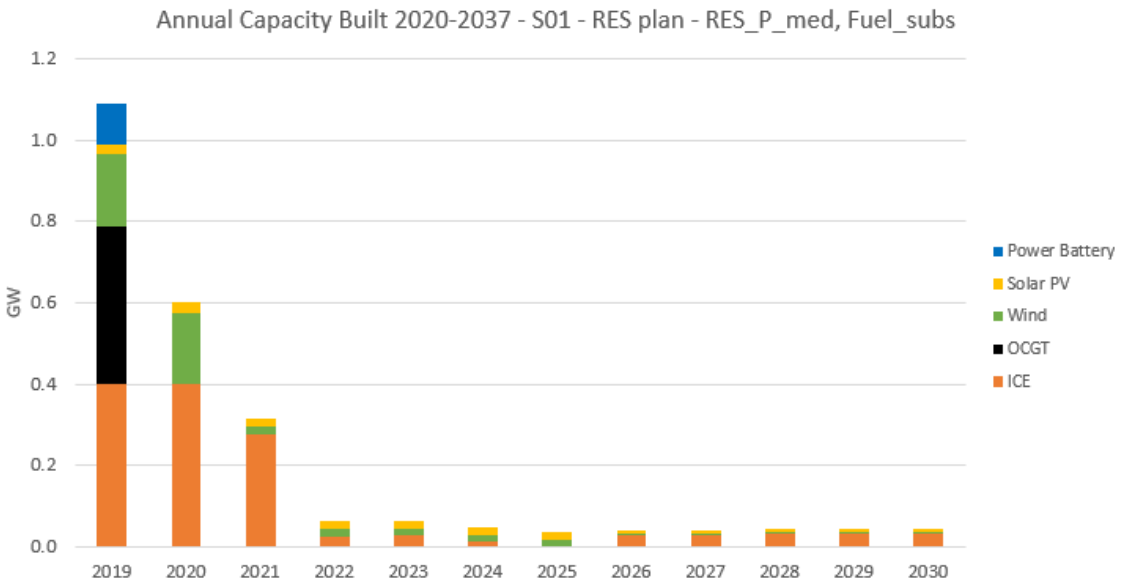


Figure 35. Annual capacity-built Azerbaijan with fuel subsidiaries

**Scenario two**

In Figure 36, scenario two, we let Plexos optimize the energy need to be as cost-efficient as possible given the similar values as in scenario one. In Figure 36 we can see installed capacity of the years 2019 to 2030, here we can see that the baseload consists of Steam turbine, Closed cycle gas turbine with an increased use of engine powerplant, open cycle gas turbine and hydro power. We can also see that the Plexos implemented a small amount of wind and solar power to the system. Plexos builds less renewable energy than in scenario one as it tends to be more costly solution, but on the other hand Plexos has put the capacity need towards engines. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 10.

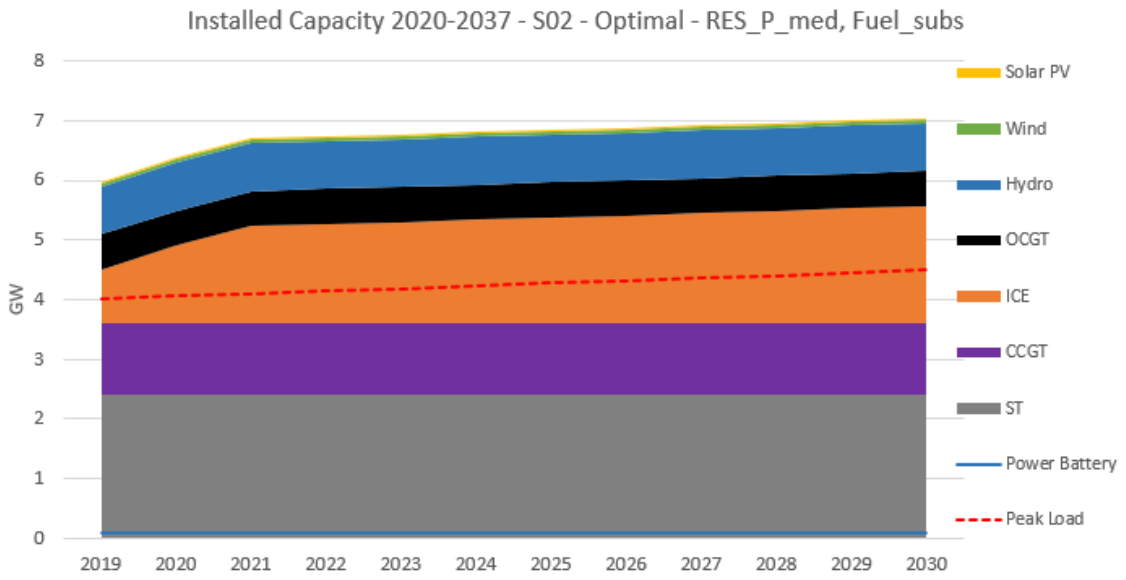


Figure 36. Installed capacity of scenario 2 in Azerbaijan with fuel subsidiaries

Figure 37 is about annual capacity built in Azerbaijan from year 2019 to 2030 with a gas price of 1,6 USD/GJ. Here we can see that in optimal situation Plexos builds in the year 2019 worth of one GW of power, which consist of engines, OCGT and power battery. Later Plexos builds only engine powerplants, with a decrease of built up from year 2021. Here again the energy need has already been satisfied with this kind of gas price and engines are the most cost optimal solution with given gas price.

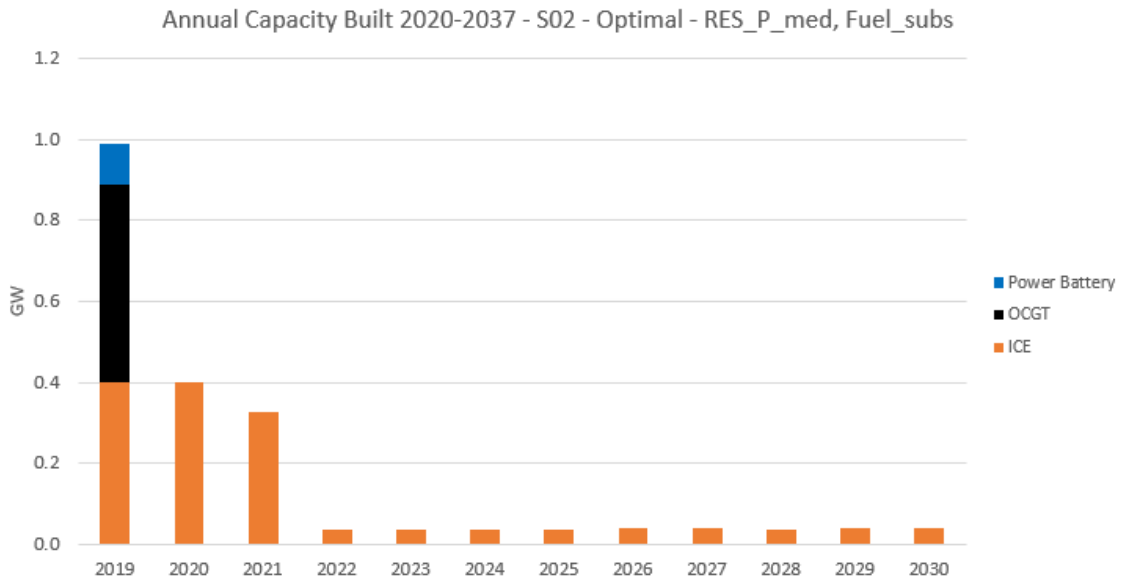


Figure 37. Annual capacity-built Azerbaijan optimal with fuel subsidiaries

*Comparison between scenario one and two*

In Figure 38 we can view the annual $C0_2$ comparison between scenarios S01 and S02. Scenario S01 has two Mtoe lower $C0_2$ emission rate than scenario S02, which is the optimal solution made by Plexos. Because both scenarios are fuel subsidiaries it means that they have higher $C0_2$ emission rates than the rest of the scenarios.

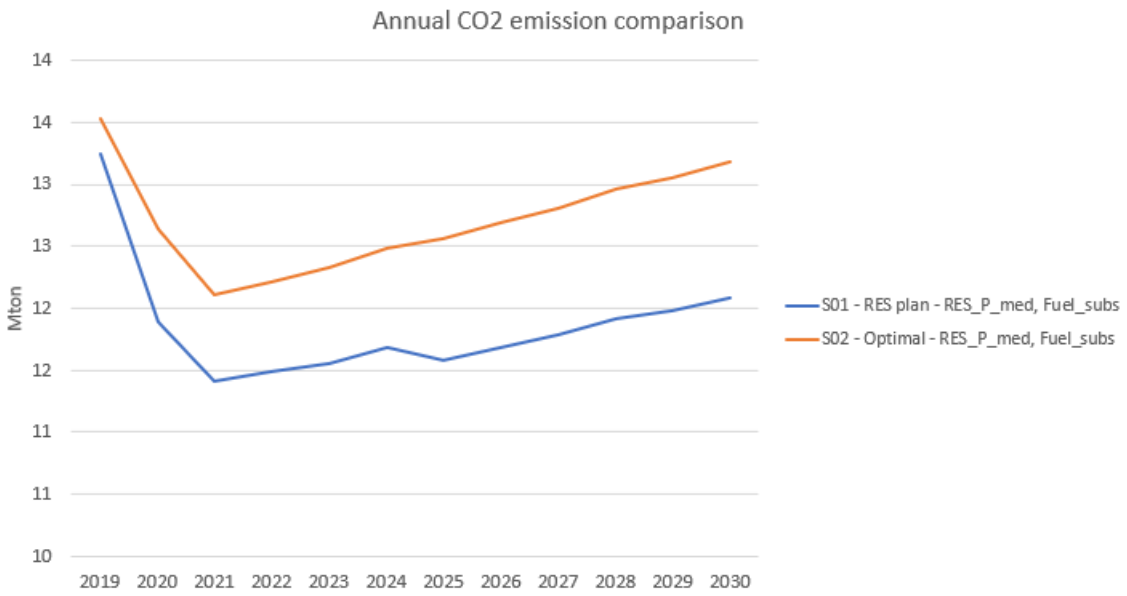


Figure 38. Scenarios S01 and S02 Annual $C0_2$ emission comparison in Azerbaijan

In annual cost comparison between scenarios S01 and S02 we can see that S02 is cheaper option with a price difference of 50 million USD in the 2030. Fuel subsidiary is the reason why $C0_2$ emissions are high, but the costs are low. (Figure 39.)

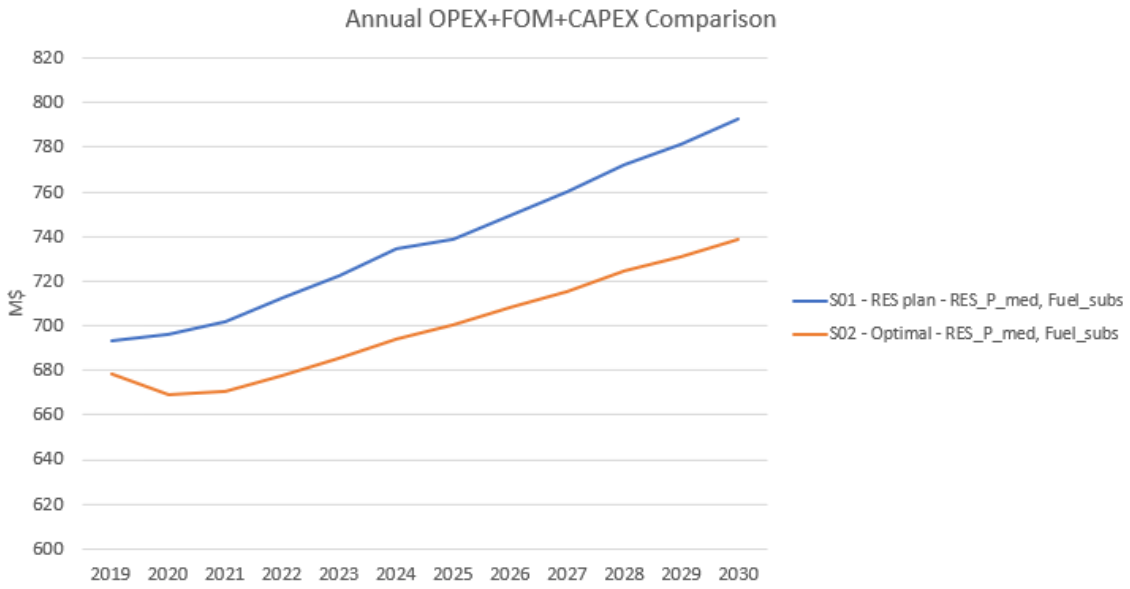


Figure 39. Price comparison between scenarios S01 and S02 in Azerbaijan

**Scenario three**

Scenario three, Figure 40 is based on a situation with a gas price being at 5,6 USD/GJ. Here the baseload consists of steam turbines, CCGT and increasing amount of engine power. Hydro power and OCGT remains the same but solar and wind power are increasing. The total installed capacity using scenario three starts with 6,5 GW in 2019 and in 2030 the GW is at 8,2. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 11.

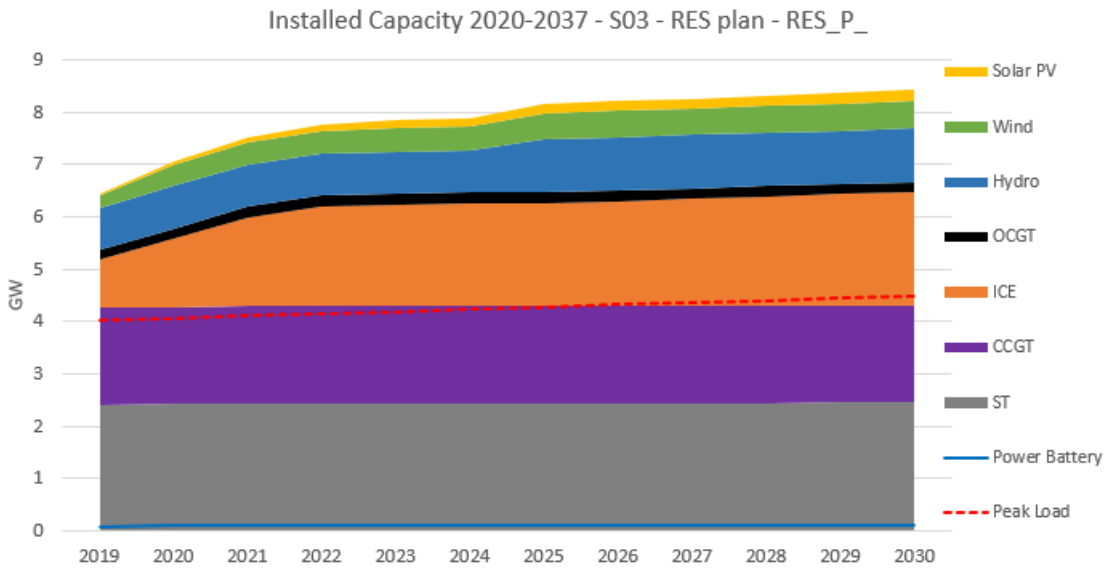


Figure 40. Installed capacity with a gas price of 5,6 USD/GJ Azerbaijan

Annual capacity- built in Azerbaijan Plexos scenario S03 made in 2019 consisted of mixed energy capacity. The amount of capacity-built decreases year-by-year where the Plexos only builds engines and renewable power. As the gas price is at 5,6 USD/GJ it is expensive to build and operate OCGT (Figure 41.)

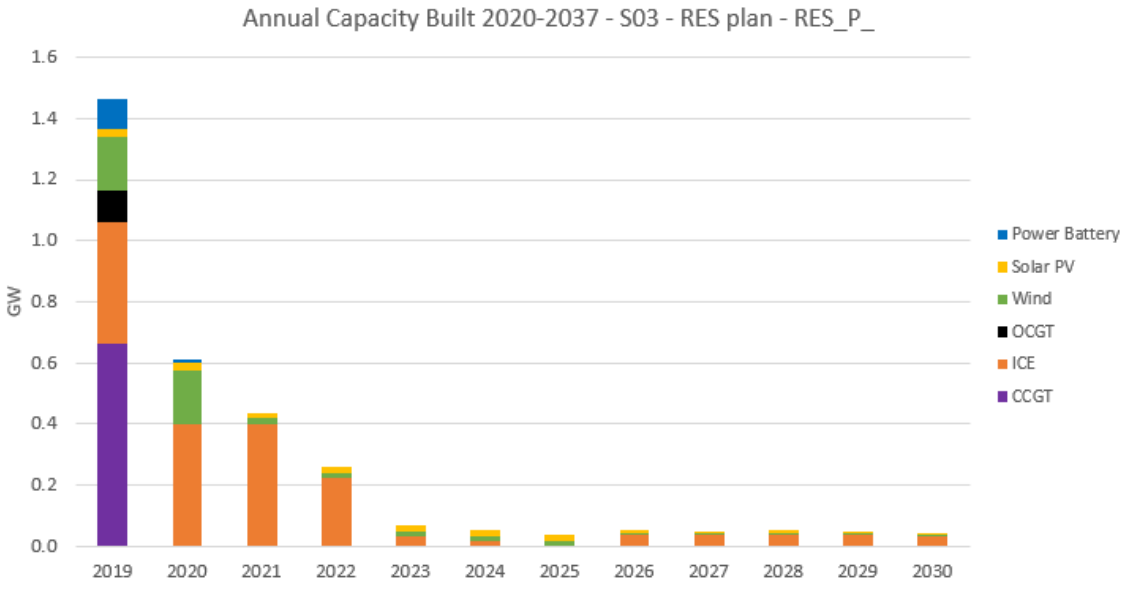


Figure 41. Annual capacity-built Azerbaijan with a gas price of 5,6 USD/GJ

**Scenario four**

In scenario four, Figure 42 Plexos created an optimal solution with a gas price of 5,6 USD/GJ, here the baseload consists of fossil fuels, with an increasing number of installed capacity of engines and wind power. The reason why Plexos built much more wind power than with scenario three Figure 40 was the cost- efficient optimization that Plexos utilizes, especially when gas prices are high, and Azerbaijan has wind potential to be utilized. The difference between scenarios S03 and S04 is also that the installed capacity is 2 GW higher in S04. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 12.

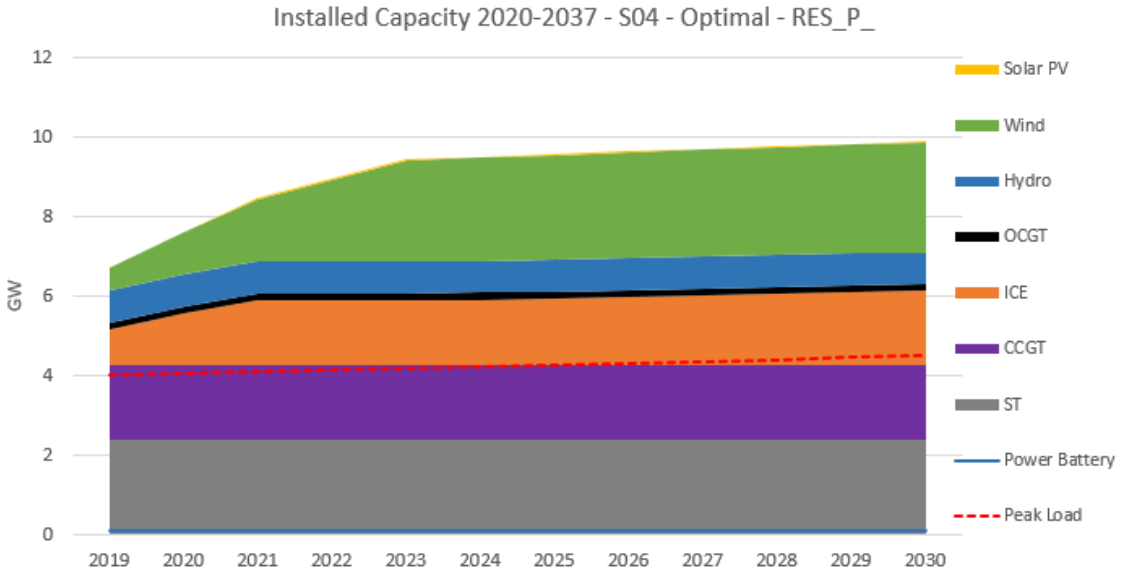


Figure 42. Installed capacity in Azerbaijan with a gas price of 5,6 USD/GJ Optimal

In the annual capacity built for Azerbaijan scenario S04 Plexos builds in 2019 CCGT, engines, OCGT, wind energy and power battery. The amount also built in 2019 is higher than in the comparison scenario S03 and Plexos does not built any solar power in this Figure 43. In scenario S04 Plexos relies on building wind power over 0,2 GW until year 2024, where after it builds under 0,1 GW of power which is generated through engines and wind (Figure 43.) With a gas price being at 5,6 USD/GJ Plexos relies on building wind power as it is the most cost-efficient way of producing energy.

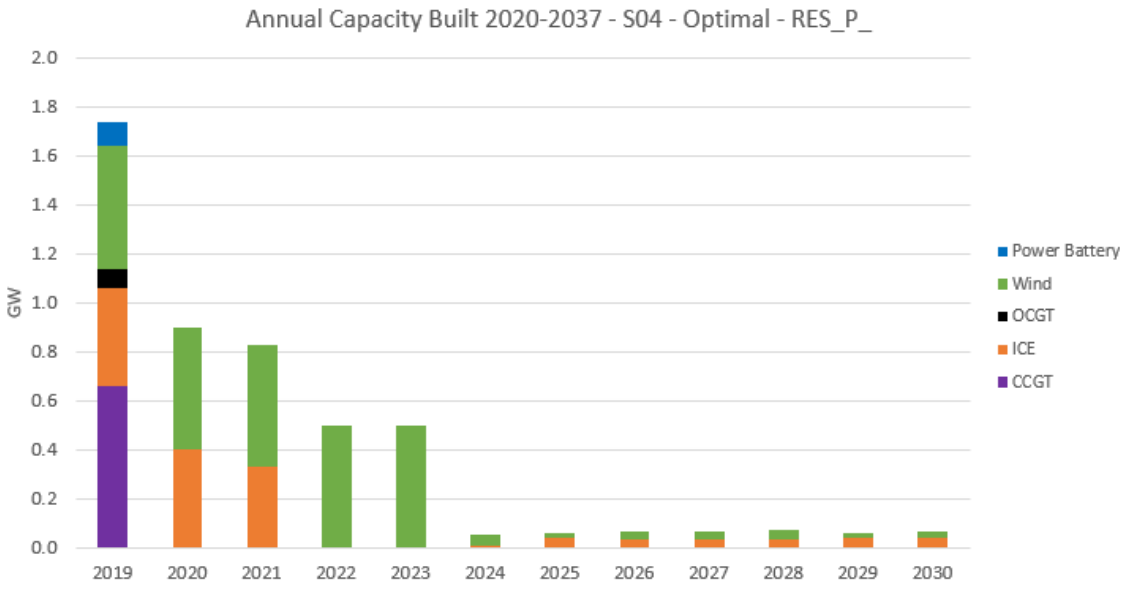


Figure 43. Annual capacity-built Azerbaijan with a gas price of 5,6 USD/GJ Optimal

*Comparison between scenario three and four*

In the annual $C0_2$ comparison we can see that the optimal solution scenario S04 is with two Mton more environmentally friendly solution than scenario S03. In scenario S04 there exist a steeper curve to reduce the $C0_2$ amount than with scenario S03, this phenom is due to the amount of wind power used in scenario S04. (Figure 44).

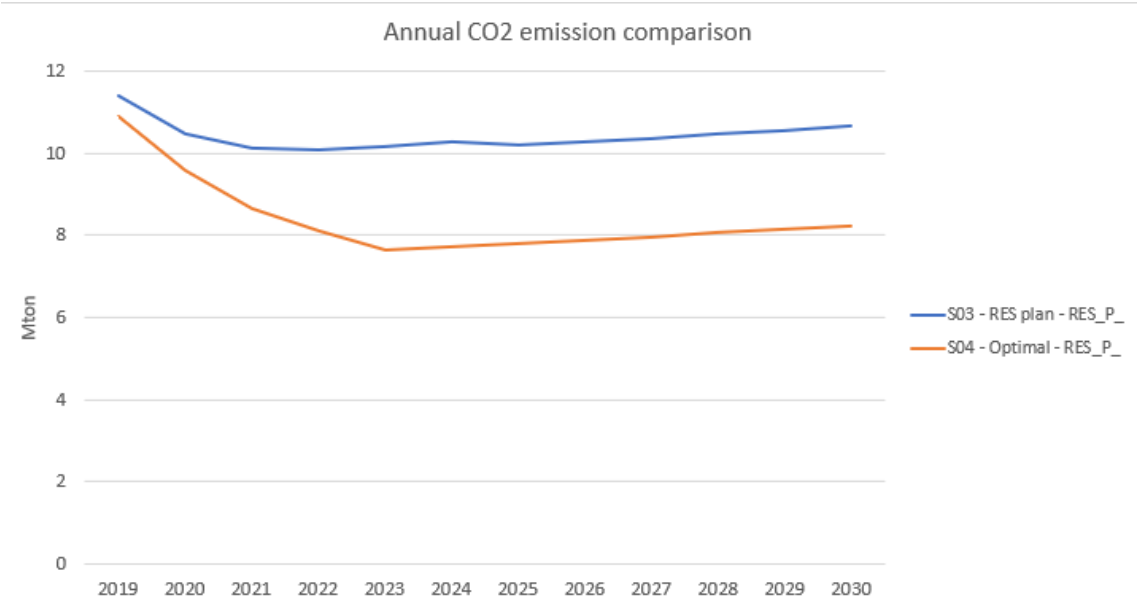


Figure 44. Scenarios S03 and S04 Annual $C0_2$ emission comparison in Azerbaijan

In Figure 45 where the cost comparison between scenarios S03 and S04 is set, we can see that scenario S04 is cheaper solution than scenario S03 to be implemented as the price difference in 2030 is 80 Million USD. This again is due to the fact that Plexos optimizes the cost-efficiency more than other parameters.

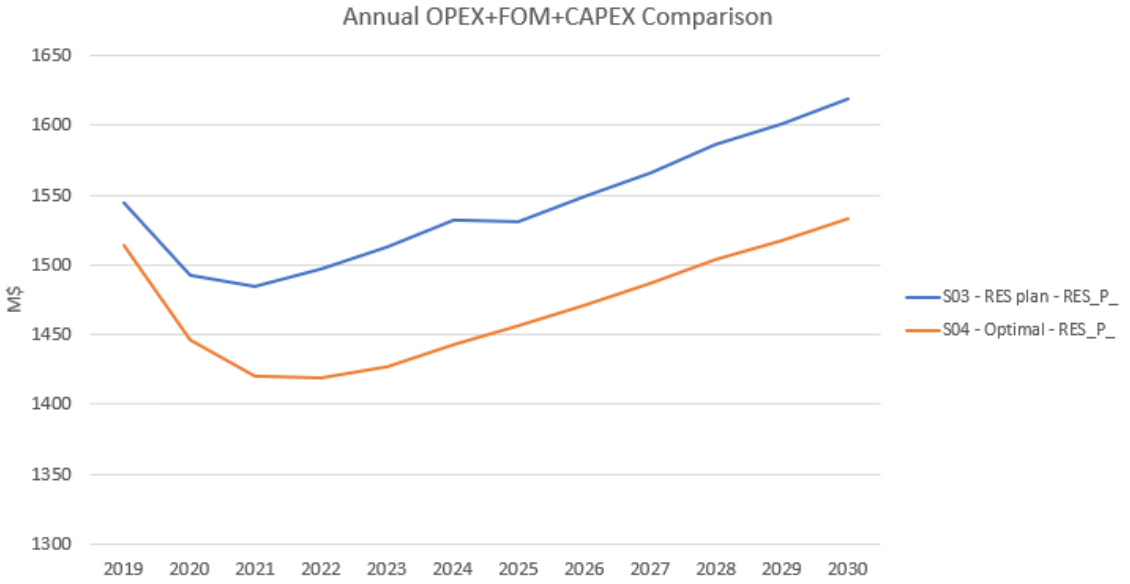


Figure 45. Price comparison between scenarios S03 and S04 in Azerbaijan

**Scenario five**

Scenario five, Figure 46 had an updated gas price of 1,89 USD/GJ. Figure 46 remains similar of installed capacity as with a gas price of 1,6 USD/GJ (Figure 34), this means that the increase of 0,2 USD/GJ did not meet the breaking point for installed energy market to provide changes. The difference is installed capacity increased with 0,5 GW with updated gas price. The baseload remains to be fossil fuels with a combination of increasing number of engines. Also, increase happened in renewables, where wind power was utilized more than solar power and hydro power remained the same. The installed capacity increased from year 2019 to 2030 by 2 GW. The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 13.

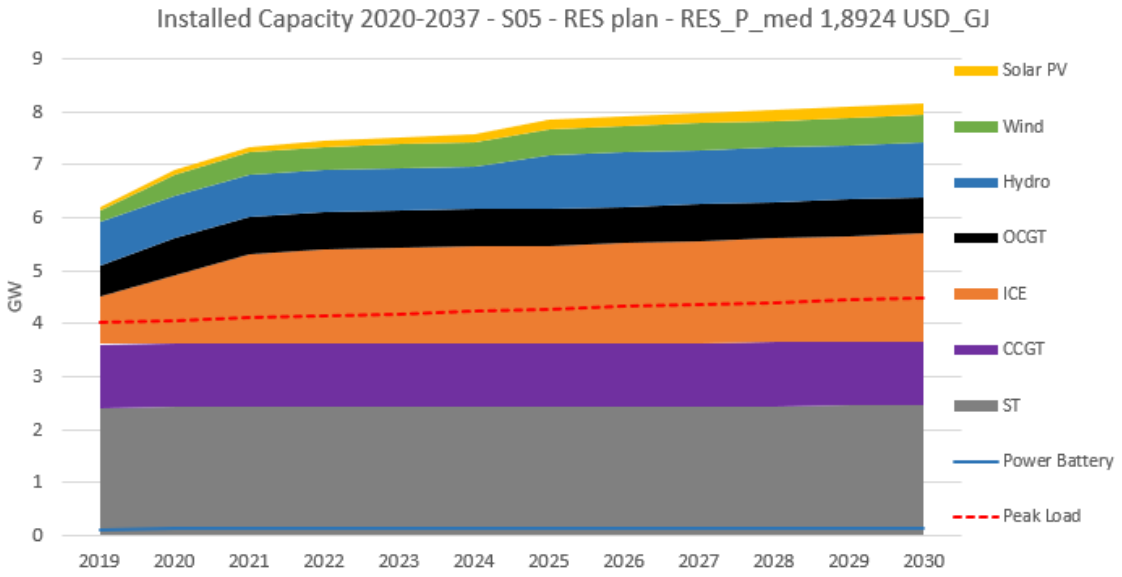


Figure 46. Installed capacity in Azerbaijan with a gas price of 1,89 USD/GJ

The difference between annual capacity built with scenario S01 (Figure 35) and scenario S05 was that with 1,89 USD/GJ of gas price Plexos built in 2019 0,1 GW more capacity and the amount stayed the same the capacity built were engines, OCGT, wind, solar and hydro power. Plexos also built in Figure 47 OCGT in 2020 and built overall more capacity than with a gas price of 1,6 USD/GJ. In Figure 47 the built capacity drops from year 2021 to less than 0,1 GW built capacity and the built capacity consist of renewables and engines. (Figure 47.)

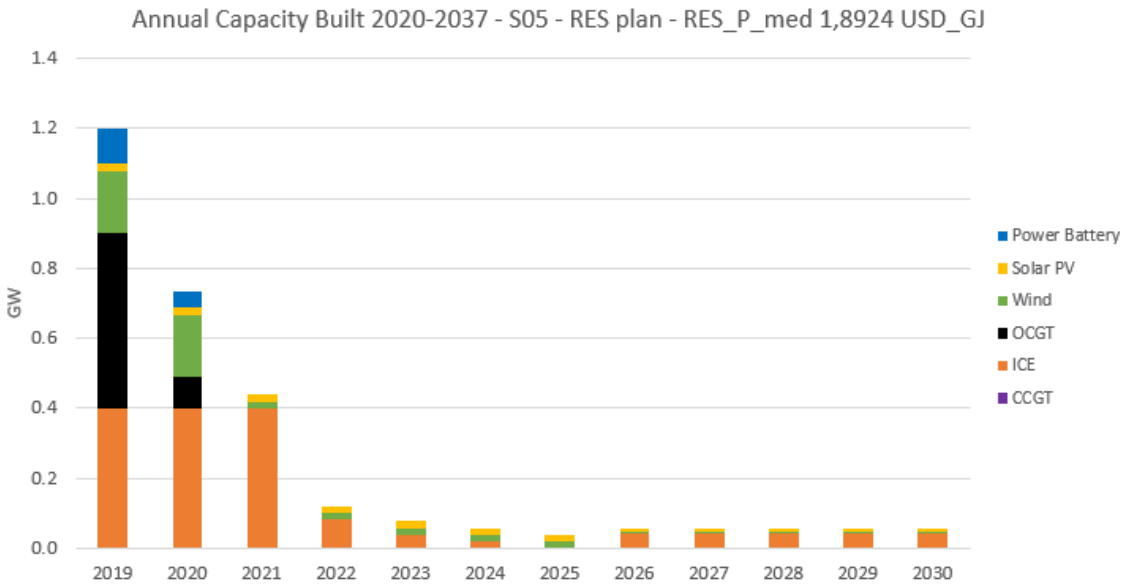


Figure 47. Annual capacity-built Azerbaijan with a gas price of 1,89 USD/GJ

**Scenario six**

We can see that Installed capacity in scenarios S01Figure 34 and S06 Figure 48 do not differentiate much, the only difference is installed capacity amount, the difference is less than one GW of energy. In Figure 48 we can see that the baseload consists of fossil fuels with an increasing number of engines. OCGT and hydropower remains the same with a minimal amount of renewable integrated. The optimal solution of Plexos installs less renewables than in scenario S05 (Figure 46). The Dispatch models for the simulation for the years 2019, 2025 and 2030 can be found in Appendix 14.

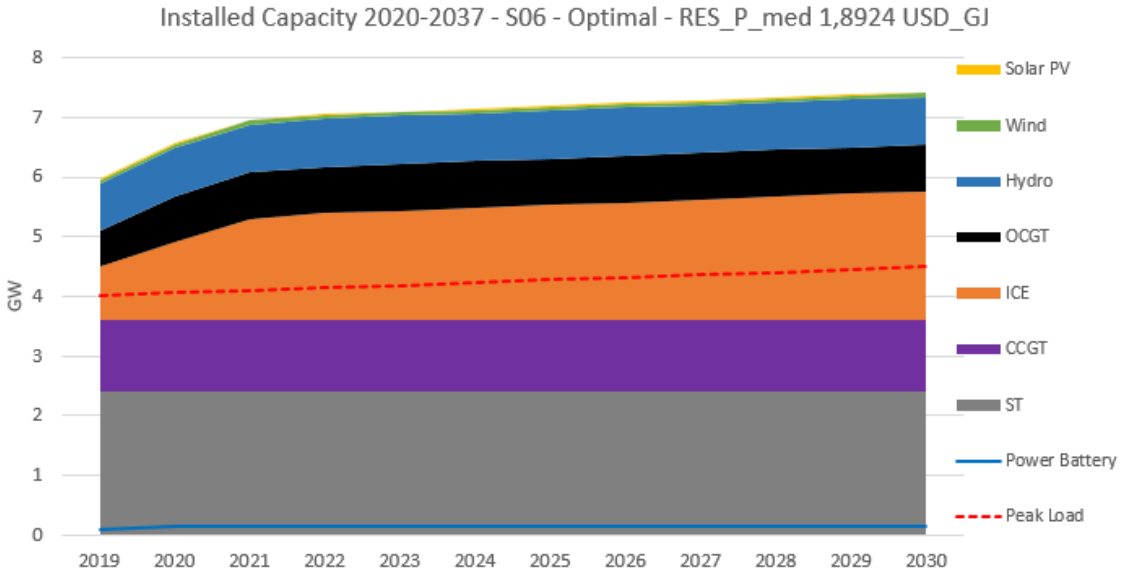


Figure 48. Installed capacity in Azerbaijan with a gas price of 1,89 USD/GJ Optimal

The difference between scenario S01 Figure 35 and scenario S06 Figure 49 in annual capacity build happens in year 2020, where in scenario S06 Plexos builds OCGT combined with engines and power battery. The amount built also varies with 0,2 GW from the year 2020 forward. (Figure 49.) In scenario S06 Plexos optimizes the engines built, this is because at gas price being at 1,89 USD/GJ it is costly to build renewable power or fossil fuels.

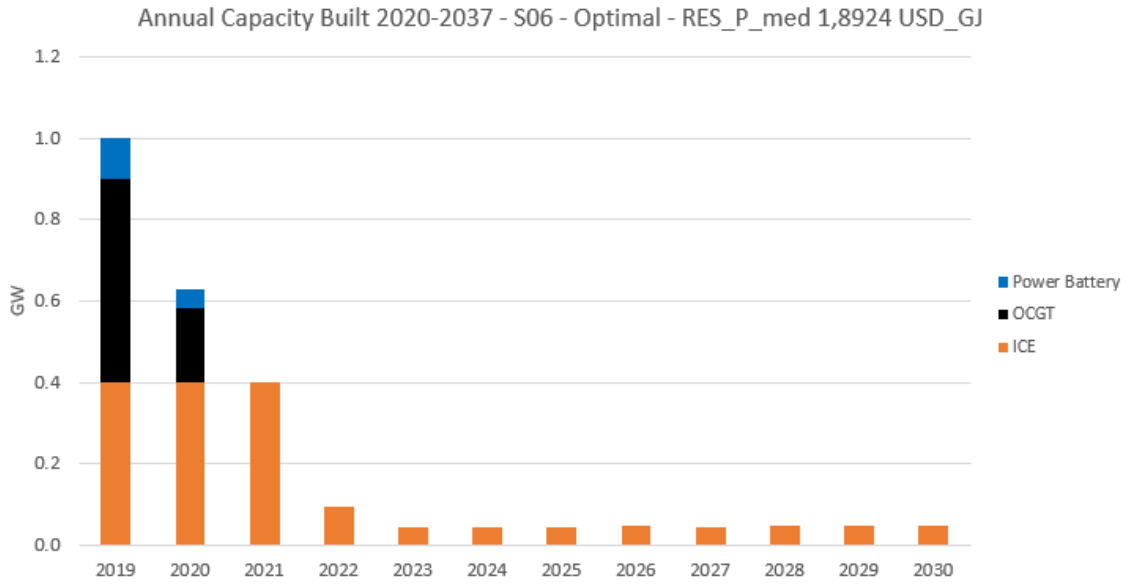


Figure 49. Annual capacity-built Azerbaijan with a gas price of 1,89 USD/GJ Optimal

*Comparison between scenario five and six*

Figure 50 is about comparing the annual $C0_2$ emissions between scenarios S05 and S06. Here we can see that as Plexos focuses on cost optimization, scenario S05 had lower Mton emission than scenario S06. Both curves act similarly as the $C0_2$ level drops the years 2019 to 2021 and then slightly increases the emission rate for the years to come.

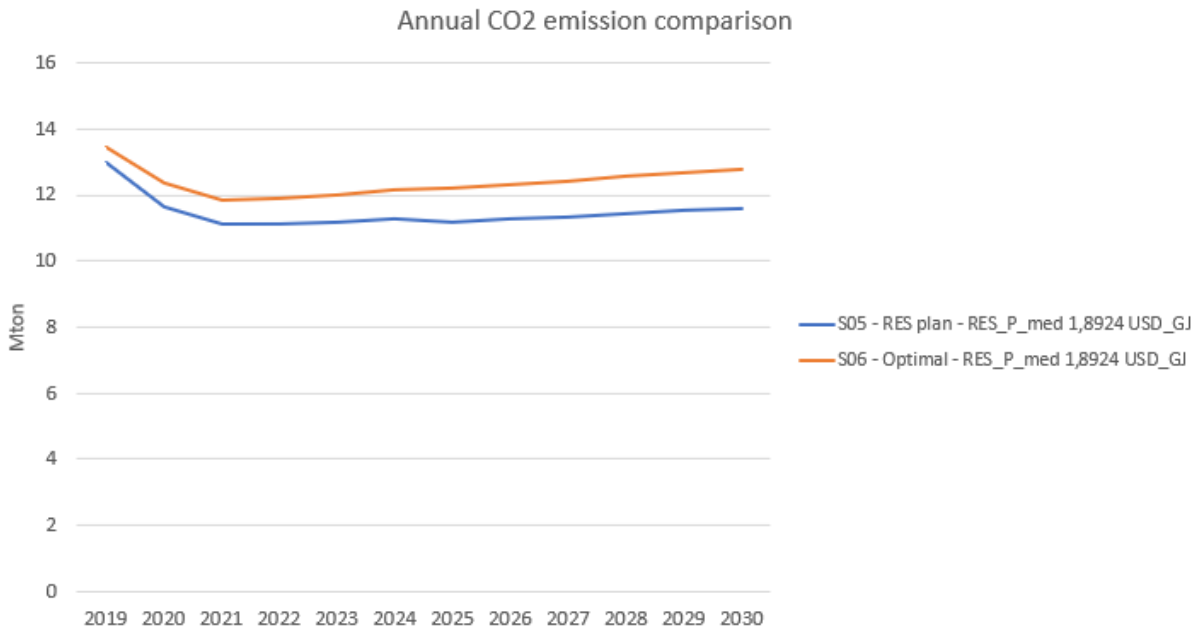


Figure 50. Scenarios S05 and S06 Annual $C0_2$ emission comparison in Azerbaijan

In cost comparison we can see that the optimal solution of these two is more cost efficient by 50 Million USD. The price difference starts to show in the year 2020 as scenario S06 keeps dropping in price more than scenario S05. (Figure 51.)

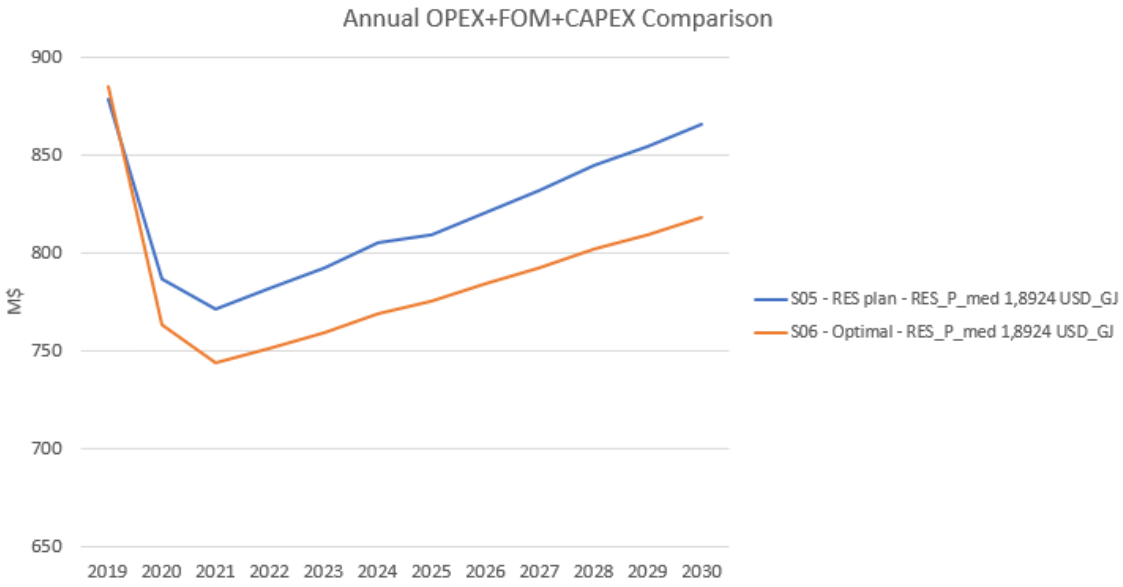


Figure 51. Cost comparison between S05 and S06 in Azerbaijan

# 5 ANALYSIS OF MARKET ENTRY STRATEGIES

In this chapter we conduct the case study and analyze which would be the best guidelines to be implemented for entry strategies in countries studied, also we consider what aspects to look for future development of sales for countries in central Asia. Here the results of previous chapters are being analyzed and set together for the strategic guideline of a sales strategy.

First, we go through the results that Plexos simulated for Uzbekistan and Azerbaijan energy markets. Then we introduce the Wärtsilä's new strategy set up in late 2018, where after political landscape and market liberalization are looked further into. We also look further into competition, financing and products of this case study. The last parts conclude the strategic focus that this case study should view and simplify the outcome using the strategic tools of Business Model Canvas and PESTEL models.

## 5.1 Results of Plexos

The outcome of the simulations provided us the knowledge that the energy systems in Central Asian countries are highly dependable of the gas price. The gas prices of the countries in Central Asia are heavily monitored by the government decision making. As we can see from the simulations, the used and built capacity varies of the gas price and different targets set up, such as renewable targets. The results of Plexos gave us hard data which to rely on when making a strategic viewpoint about the market and negotiating with the customer. In the results of Plexos there does not exist a right or wrong answer to move forwards with, the best results depend on the customers need and the political aspects of the country.

### 5.1.1 Results of Uzbekistan

The Plexos results in Uzbekistan rely heavily on the volatile of the gas prices. We can see from the simulations that if the gas prices are higher than 2,3 USD/GJ the whole energy system would be less environmentally friendly to maintain with the current energy system, but in some cases cheaper if the gas price remains as low as it has been in recent years. The results of Traditional thermal and Flexible system with a gas price of 6 USD/GJ is that they both are $C0_2$ friendlier than other simulations, but the overall cost is high. The reason why these two are more environmentally friendly than other simulations is that in traditional thermal the $C0_2$ emission dropped when the nuclear power was built and in the scenario with flexible 6 USD/GJ, Plexos forced RES to be installed through 2019 to 2030. The RES installed capacity is due to high gas price of 6 USD/GJ. The $C0_2$ levels between these two scenarios compared to others is not significant, but the total cost of these two are considered to be around 1000 Million USD more expensive than the rest of the simulations. Also, from the scenarios three and four, which were the scenarios with the gas prices of 0,8 USD/GJ and 2,3 USD/GJ, we can see that Plexos does not utilize renewable power simply because of the low gas price. Plexos rather relies on building and using fossil fuel-based power with a combination of engine power and hydro.

The results of CF from Plexos simulation three we noticed that the change towards the new CF had not dramatic changes if compared to the second simulation of new gas prices. One aspect that the Uzbekistan government should consider is to sell the produced gas forwards and use the engines and renewable energy in their own use. This move could potentially reduce the $C0_2$ emissions and create cost saving in the long run of the energy system.

An interesting aspect of the simulations is that Plexos does not build renewable power as much as one would have thought, as stated earlier Plexos optimizes cost-efficiency, which is with the gas prices of the simulations mainly gas power and engine power. We can see this scenario to be tested with the second simulation where the gas price was set to be 0,4 USD/GJ and 7000 MW of renewable target was set up in the simulation. For clarification we created a Table where the $C0_2$ levels and cost levels can be viewed (Table 5).

Table 5. Cost- and C0₂ scenario comparison between Uzbekistan Plexos simulations

| **Uzbekistan** | **$CO_2$ (2019) Mton** | **$CO_2$ (2030) Mton** | **Difference** | **Cost (2019) Million USD** | **Cost (2030) Million USD** | **Difference** |
|---|---|---|---|---|---|---|
| Traditional Thermal | 33,4 | 36,5 | 3,1 | 2600 | 5000 | 2400 |
| Flexible 6 USD /GJ | 34,8 | 38,2 | 3,4 | 3100 | 5100 | 2000 |
| Flexible 0,8 USD/GJ | 29 | 45 | 16 | 1400 | 2200 | 800 |
| Flexible 2,3 USD/GJ | 28 | 42 | 14 | 1950 | 3400 | 1450 |
| Flexible 0,4 USD/GJ 7000 MW RE Target | 28 | 38 | 10 | 1300 | 2500 | 1200 |
| New Profile 4 USD/GJ | 28 | 45 | 17 | 1300 | 2200 | 900 |
| New Profile 0,8 USD/GJ | 29 | 41 | 12 | 1900 | 3400 | 1500 |
| New Profile 2,3 USD/GJ | 28 | 45 | 17 | 2500 | 4400 | 1900 |

### 5.1.2 Results of Azerbaijan

The Plexos results in Azerbaijan rely also heavily on the volatile of the gas prices. We can see from the simulations that if the gas price is over 1,89 USD/GJ the Plexos suggest of building mostly engines in the long-run. Similarly, as in Uzbekistan simulations, the cheapest option tends to release the most $C0_2$ emissions. Azerbaijan as a country relies also heavily on fossil fuels as the rest of countries in Asia.

In scenario S03 and especially in scenario S04 we could see that Plexos optimizes the best cost-efficiency being with wind power when the gas price is at 5,6 USD/GJ. Similarly, as in Uzbekistan case, usually the cost efficiency and C02 emissions don't go hand in hand. The most environmentally friendly solutions would be to with scenarios S03 and S04, but they are around 700 Million USD more expensive. On the other hand, scenarios S01 and S02 are the cheapest ones, but they have a slight advantage in C02 emission, they produce two Mton of C02 emission more than the rest of the scenarios. That is why the scenario S05 or scenario S06 would be the best options to move forwards when trying to do business in Azerbaijan. Also, the scenarios of S05 and S06 have the most relevant gas price update. This of course is not only relying on Wärtsilä's decision making, the customer needs also to be involved in the decision making and show them what would be the best option and why. For clarification we created a Table where the C02 levels and cost levels can be viewed (Table 6).

Table 6. Cost- and $C0_2$ scenario comparison between Azerbaijan Plexos simulations

| **Azerbaijan** | **$CO_2$ (2019) Mton** | **$CO_2$ (2030) Mton** | **Differ-ence** | **Cost (2019) Million USD** | **Cost (2030) Million USD** | **Difference** |
|---|---|---|---|---|---|---|
| S01 | 13,5 | 12 | -1,5 | 690 | 790 | 100 |
| S02 | 14 | 13 | -1 | 675 | 740 | 65 |
| S03 | 11,5 | 10,5 | -1 | 1540 | 1620 | 80 |
| S04 | 11 | 8,2 | -2,8 | 1520 | 1530 | 10 |
| S05 | 13 | 11,5 | -1,5 | 870 | 860 | -10 |
| S06 | 13,5 | 13 | -0,5 | 880 | 820 | -60 |

## 5.2 Wärtsilä's new strategy

It is important for Wärtsilä to be able to explore new business opportunities which will create revenue and to be global leader in sustainable business. In the end of 2018 Wärtsilä launched a new strategy that is called "Smart Energy and Smart Marine" (Wärtsilä 2019). The strategy's goal is to provide smart technology for societies to be more sustainable. Wärtsilä's customers want to operate with more flexible and clean energy, this is the main reason for a strategy change in year 2018. The Smart Energy Strategy includes that Wärtsilä will lead the path towards 100% renewable energy. The new strategy is a roadmap that the whole company can follow, where the values, vision are set up.

The change towards Smart technology is established in a way which is service based, which means that Wärtsilä will in the future provide service for the whole product lifecycle with the help of artificial intelligence and data analytics. This means Wärtsilä will become more customer oriented and will together with the customer provide the needed value for their business. Wärtsilä's new values which was established in the beginning of 2019 are: Excellence, Energy and Excitement. In Excellence Wärtsilä aims to do things better than competitors, in Energy Wärtsilä's goals is to capture opportunities and make things happen. Excitement according to values in Wärtsilä is to foster openness and respect. (Wärtsilä 2019).

It is important for Wärtsilä how the customer sees the company and how it can be related to sustainability. As the global trend has gone to more sustainable way of thinking, Wärtsilä wants to be one of the top leading companies in this segment. Wärtsilä wants to be a recognized brand where the customers can think Wärtsilä as a service providing company.

## 5.3 Political landscape and market liberalization

The Central Asian energy sector relies heavily on turbine powerplant and have restricted knowledge about engine powerplants. The government steers heavily the power sector in both countries, this has an effect of how Wärtsilä will do business in these countries.

In Smart Energy Future Seminar, which was held 22nd May 2019 Wärtsilä together with Ambassador of Finland in Uzbekistan invited Uzbekistan's ministry together with other relevant stakeholders to participate in the event. In the event it was explained how the energy markets are changing rapidly. In the seminar Wärtsilä presented case studies from other countries of how the energy challenges had been managed. Also, in the seminar Wärtsilä's experts explained the features and difference in technologies and how they can be utilized using flexible engine power solution.

During the seminar Uzbekistan's deputy minister had an opening speech, where they thanked Wärtsilä for arranging the seminar and pointed out that they are highly interested in building a long-lasting relationship with Wärtsilä.

It is important for Wärtsilä to be able to provide previous case study success as it creates trust and the potential customers get a feeling that Wärtsilä is a partner that brings value and is able to solve problems. Geopolitical risk affects customers desire to invest, this can be seen in nearly every market. Wärtsilä need to be able to convince the customers especially in these countries that the flexible solution is in the long-term a sustainable and cost-efficient way of providing energy.

All in all, the Smart Energy Future Seminar 22nd of May 2019 was a success as Wärtsilä was able to implement a seed to potential customers minds and Wärtsilä was able to provide how the future energy challenges could be solved. There always exist some resistance when something new and unknown are about to happen, but Wärtsilä has taken first crucial step of educating the potential customer of Wärtsilä's way of working such as the information gathered from power system modelling using Plexos.

In Azerbaijan the energy sector is monitored strictly by the government where Azerenerji has a monopoly in energy production. The government decides how the energy sector in the future will look like and how the investments will be divided. Also, the gas prices rely how the government sets it up to be.

## 5.4 Competition

It is for the companies important to understand who the main competitors are, the environment they operate and how they can shape the markets in their favour. Companies often have failed in understanding of how competition affects their own market share and how they are being viewed by the customer. As Horn et al. (2005) endorses, a successful market entry fails because companies sometime underestimate the competition, where

they suffer from competitive blind spot. There is of course no need to be too secretly as customers and especially competitors know where your company does business and how.

Wärtsilä needs to be able to provide solutions which are unique value proposition, compared to competition, otherwise the competition of the services would be based on only price. The main competitors in central Asia markets are GE, Siemens and Mitsubishi, these competitor's main product to be sold is turbines. Vuorinen (2014:16) stated that the better a company can observe its environment, in other words competitors, the more efficient the company is and is able to provide solutions.

## 5.5 Financing

The projects in these countries could potentially receive financing, if they can be shown to be plausible to execute with competitive price. The potential financing institutes could be international banks and other international federations. Asian Development Bank has set up an agreement which is called "country partnership strategy", where they are trying to reduce Azerbaijan's dependable of oil exports, support the non-oil private sector and improve the access to finance. One potential financing power could come from China as the asset quality of banks in Central Asian countries remain poor, but here Wärtsilä would need clear rules and guidance of how these would go further with the financing aspect. The terms of payment's needs to be clearly set for every single project and to provide a bridge towards long-term service agreement terms.

## 5.6 Products

Wärtsilä could provide engine power generation solutions in an energy efficient way, as the Plexos models mainly suggest, which is both cost friendly and flexible for the countries in Central Asia. Wärtsilä could also provide for the engine powerplant projects support via energy storage. As Plexos models suggest, Uzbekistan and Azerbaijan would greatly benefit in the long term of using engine powerplants combined with RES.

The powerplant engine could potentially be a Wärtsilä 34 engine, which would later be upgraded to W31. The reason why we chose these engines for these case studies to move forward with Wärtsilä 34 engine is that it is easier to transport than Wärtsilä 50 and has a lower cost estimation than Wärtsilä 31. The desired engine powerplant type depends of course on customers need and what suits them best.

Existing thermal capacity could potentially be replaced with flexible generation. Also, Combined Heat and Power options in Central Asian countries should also be evaluated as it could potential benefit the rural areas around the main cities in these countries. The RE is becoming cheaper and the energy storage will in the future become more affordable, which increases use of RE.

Gas terminals with LNG combined with renewable energy is in the future a valid option to be included as well. Renewable energy consists most of PV power plants, wind power and energy storage solutions, these have the most potential to be utilized in Central Asian countries, but also other renewable aspects should be taken into consideration. The customer need is always important, that is why Wärtsilä tries in their new strategy to provide value for the customer sustainable way.

## 5.7 Strategic focus for the case study for Central Asia

The central Asia countries provide a huge market opportunity for Wärtsilä to explore, but it also carries some risks to be taken into consideration. Also, as the directives for reduction on $CO_2$ has tightened these target countries needs in the future to find different solutions than fossil fuels. In 2014 the country of Azerbaijan was hit with an oil price shock, this led to currency devaluation and increased the public debt. The oil price shock showed how a change in oil price can shake a country if the country is highly dependable on producing oil.

Wärtsilä could potentially be a wanted partner for the countries in Central Asia as Wärtsilä could provide a sustainable solution for the projects of updating the energy systems.

When making business abroad one of the most crucial aspects to take into consideration for Wärtsilä is to find a reliable partner in Central Asia, which have similar goals as Wärtsilä. The partnerships will mostly be State-Company based partnership (PPP), where later it can be evolved to IPP. Especially in Uzbekistan as the Ministry of Energy was formed, the focus of transforming Uzbekistan's energy sector is higher than ever.

One strategic focus suggestion would be in the future to build a local office or a CRM-team, which could co-work with the customer and know their needs and problems right away. CRM-team together with the customer could calculate for example return of investment for the customer. Also, one beneficial aspect to take into consideration would be to educate and provide knowledge to the customer about future energy sectors. CLV calculations would also provide for the company and to the customer knowledge what would be the most beneficial partnership to move forward with.

The two countries for this thesis was chosen with different evaluation criteria, the countries were Uzbekistan and Azerbaijan. The main focus of this thesis was on the country Uzbekistan, which is a country where Wärtsilä does not yet have had success. In Azerbaijan Wärtsilä has been successful and it is a great way of seeing what things to take into consideration when making business in other Central Asian countries, also it is good to evaluate how the markets have changed.

The main reason why Wärtsilä should make business in Uzbekistan is that Uzbekistan is the largest market in Central Asia, which grows the fastest in the countries in Central Asia. Uzbekistan has had previously successful joint ventures with international companies, mostly oil companies, such as BP, CNPC, Gazprom and Lukoil.

The most ideal way of entering the markets permanently is to be able to deliver a project successfully, this will provide positive word-of-mount within the customers of the countries. The main points in providing information about why Wärtsilä could be potential partner to Central Asian countries is that the countries in Central Asia need stability in their grid, this happens via improvement of efficiency, which will lead to the reduction of losses. Azerbaijan was chosen for this thesis because of the previous success to make

business. Also, Azerbaijan being a post society socialistic country provides a great opportunity to view how Uzbekistan could potentially be heading and if there exist something the case company could do better in Azerbaijan. One possible suggestion Wärtsilä could provide for the Central Asian countries is to sell the produced gas forward and utilize the engine powerplant with renewable energy.

### 5.7.1 Marketing and development strategic aspects

One efficient marketing strategy is based on expertise, where Wärtsilä would find reasons for the countries in Central Asia why Wärtsilä's solution is better than regular gas turbines, this can be done using Plexos modelling and local knowledge. As the customers in Central Asia countries are often not so easy to convince about 100% RES, it is crucial for Wärtsilä to be able to provide a plant, which could be operated in different modes.

One potential strategy in the future is to have a local office established in Central Asia countries. This could have benefits like local knowledge, more easily to access markets and be closer to the customers. Local offices would give for the potential customers a trust towards Wärtsilä as the natives in the country also work for Wärtsilä and understand the customers mindset and speak the same language. Wärtsilä need to be able to tell the potential customer that the company is a global operating firm and a trusted partner. To be able to convince the customer that Wärtsilä is a reliable partner that can bring value do not happen via one or few meetings, it takes many meeting and discussions for the trust to be able to build up. Wärtsilä's competitive strategy is based on the understanding not only in technology but the customer. Of course, one aspect to take into consideration is partnering up with a company that has already established business in the target country or other government sections such as Embassy.

## 5.8 Strategic Tools

Using strategic tools is a crucial step of implementing a successful strategy, using multiple tools to get different viewpoints usually provides the best results. In this part we have

implemented two strategic tools to be conducted into the most effective strategy in the case study, they are business model canvas and PESTEL model, which is made of a benchmarking interview with head of sales SECA area in the company Nokia Oyj.

### 5.8.1 Business Model Canvas

The first business model canvas is about Uzbekistan's market combined with Wärtsilä's business segment (Figure 52). There exist nine different blocks, where the first one is key partners, Wärtsilä needs to have key partners in the country of Uzbekistan as in the country there does not exist IPP guidelines and the local own office has not been set up. In this strategy tool for Uzbekistan the key partners for Wärtsilä was chosen to be Smart Asia Labs LLC and international financing institutes. Key activities block is about educating the potential customers about the technology, create networks, where trust can be utilized, educate local partners, defining the customer needs and be able to handle the logistics efficiently. In key resources there is three main points, which are local representative office establish, Wärtsilä 34 engine powerplant and the concept of Lifecycle services. Especially the local representative office in the country of Uzbekistan would be necessary for successful business breakthrough. Wärtsilä's value proposition in the business model canvas is to provide reliable, stable energy and to be able to support renewable targets set by the government of the country. Also, produce heat and power to areas that has not yet electricity available. As earlier stated, the country of Uzbekistan has a great need to reduce the transmission losses and provide energy efficiently to the whole country.

Customer relationships is about establishing high degree of local presence and to be able to build good relationships with key stakeholders in several organizational ladders. In the channels block there exists three main key points, they are partner's channels utilization, local presence and ability to speak Russia, this happens via colleagues who can speak Russia. In the customer segments it is defined who are the customers, they are Uzbekenergo that has already established a monopoly in the energy production sector. Second notable customer is Ministry of Energy where Wärtsilä will support the political targets

in energy modernization. The third customer would be private companies under a PPP structure. The cost structure is about low capex solution with known operational and maintenance costs, also Wärtsilä's main costs relate to the production of an engine and possible building of powerplant. The revenue stream in business model canvas for Uzbekistan was selected to be powerplant selling with the price level of the region, which can vary depending on the price of the investment and the lifecycle cost of a project. Wärtsilä is also aiming for 100% of long-term service agreements to guarantee revenue streams through the lifetime of the assets. (Figure 52).

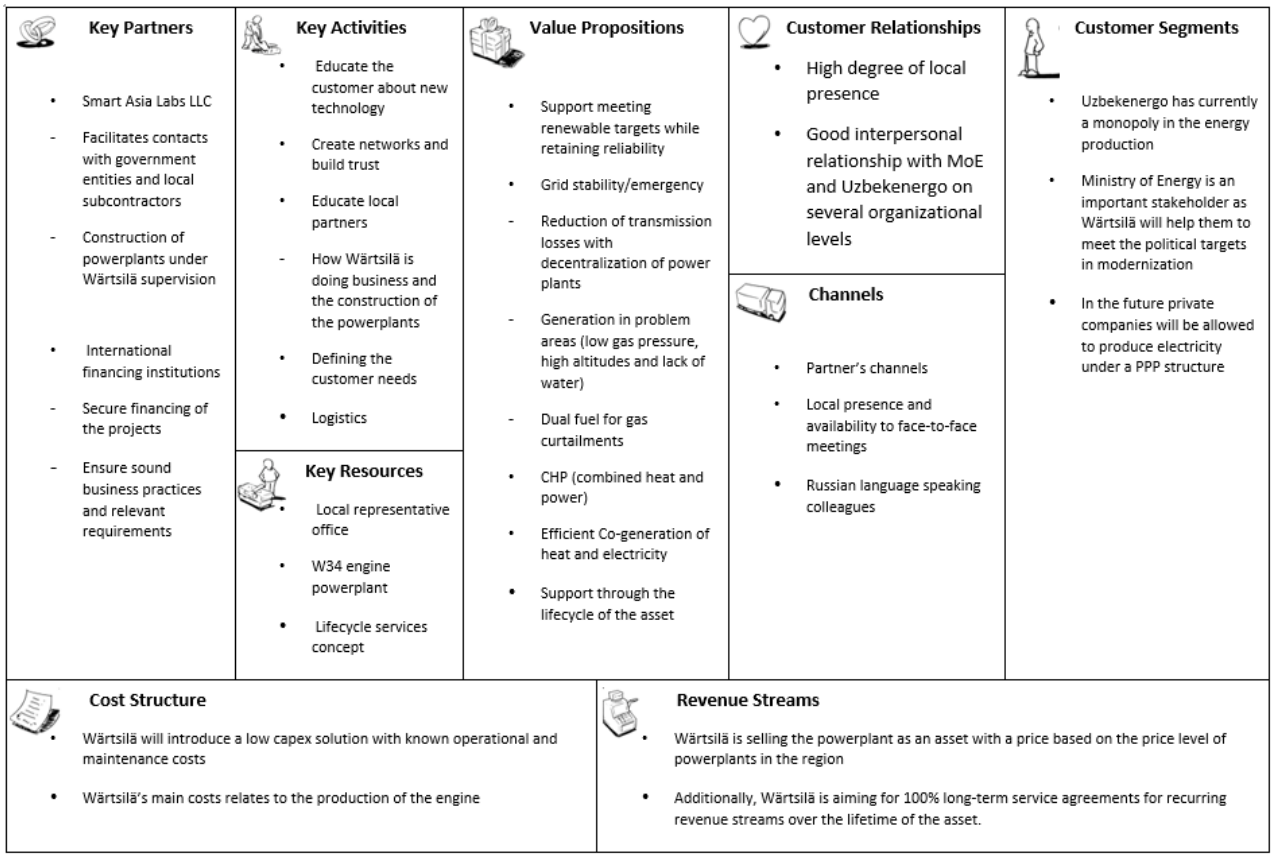


Figure 52. Business Model Canvas of Uzbekistan

The second business model canvas Figure 53 is about Azerbaijan's market and Wärtsilä's business segment in the country. The key partners in Azerbaijan is all connections within own local office of Azerbaijan, other partners are related to engines produced from Vaasa and Trieste factories. The key partners were chosen for this case study because Vaasa and Trieste factory produces engines and Wärtsilä Azerbaijan has the knowledge of making

business in this country. In key activities the promise is to improve asset management with maintenance agreement, ability to explain the concept of quality and maintenance importance. This concept will provide for Wärtsilä business in long-term with the country.

Also, the transference from Engineered equipment delivery towards Engineered Procurement Contract, the difference between these two are that EEQ is a contractual agreement between the customer and the contractor, where the customer or a subcontractor selected by the customer will build the powerplant. In EPC everything is sold, this means that the customer is straight away ready to use the powerplant, also called turn-key delivery. The reason why Wärtsilä would seek to change in the future from EEQ towards EPC is that in EPC Wärtsilä has a full control and knowledge of how to build an engine powerplant and in the long-run this option is a cheaper option. In key resources local office is one key factor, also Wärtsilä 34 engine powerplant and lifecycle service concept is important to take into consideration when making business the country of Azerbaijan. Value proposition for Azerbaijan is about grid stability, reduction of transmission losses, dual fuel gas curtailments, combined heat a power for greenhouses, support through asset lifecycle and energy flexibility in load variations between day and night. The key points in customer relationships are high degree of local presence and good relationships with Ministry of energy, finance and Azerenerji. Channels consists of local presence establishment and Russian/Azeri speaking colleagues. The main customers in Azerbaijan are according to business model canvas Azerenerji, Ministry of energy and Ministry of finance. The cost structure is about country specific capex solution with streamlined operational and maintenance costs where the main costs will be from moving to EPC from EEQ. Wärtsilä will create revenue streams from powerplant selling with the price level of the region and Wärtsilä is aiming for 100% of long-term service agreements to guarantee revenue streams through the lifetime of the assets.

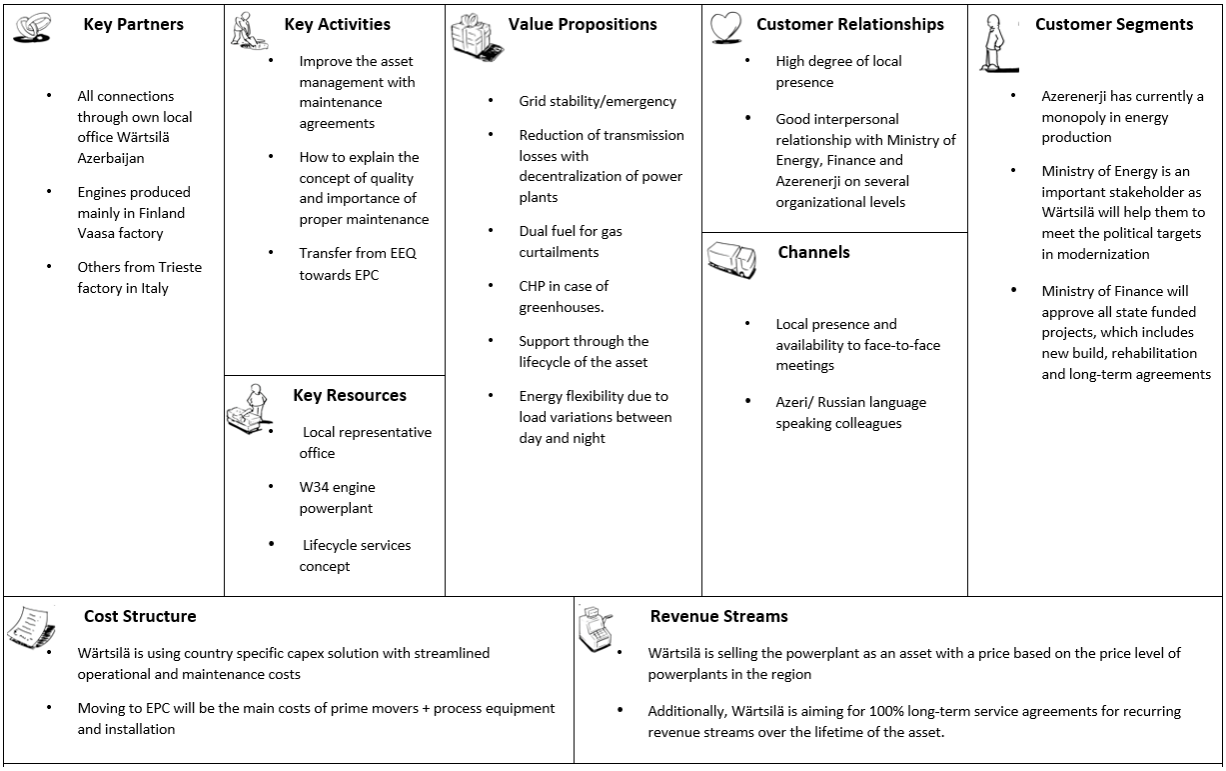


Figure 53. Business Model Canvas of Azerbaijan

### 5.8.2 PESTEL

The PESTEL model is done as a benchmarking practice of how Nokia is handling the markets in Central Asia. The PESTEL model was based on the interviews held on 17.6.2019 and 1.7.2019 with Head of Sales in Nokia for SECA area. The interview Q & A can be seen from Appendix 15 of this thesis. In Figure 54 we can see PESTEL model of Central Asia, which consists of Political, Economical, Social, Technological, Environmental and Legal point of views.

In the Political segment the key points to take into consideration when making business in Central Asia according to Nokia is that build connections with right people in various levels and balanced risk with neighbour countries, by this it means to know the competitors from these countries and how they can have an effect on Central Asian countries. Also, it is crucial for businesses to take action with corruption and be ethical as possible. In the Economical part there exist a competitive environment in Central Asia and one key factor is to find a partner or bank that can fund the business idea. Also, an important thing

to take into consideration is minimizing exchange rate risks and set clear functions to payment terms. Social segment what Nokia suggests is that the energy need is relevant in Central Asia, it needs to be reliable and cost efficient, also Finnish companies are seen as a neutral partner, which is a positive sign.

Technological part consists of comparing the Central Asia technology sector to Europe and that there exists a demand to change the mindset. In the environmental segment the environmental awareness in Central Asia is high, but there exist Soviet Union time problems with old waste. The Legal part concluded that corruption is an issue in these countries and deeply integrated in the culture. It is crucial for companies to be able to negotiate the contracts ethical, customers best interest in mind and in a way that government accepts the deal.

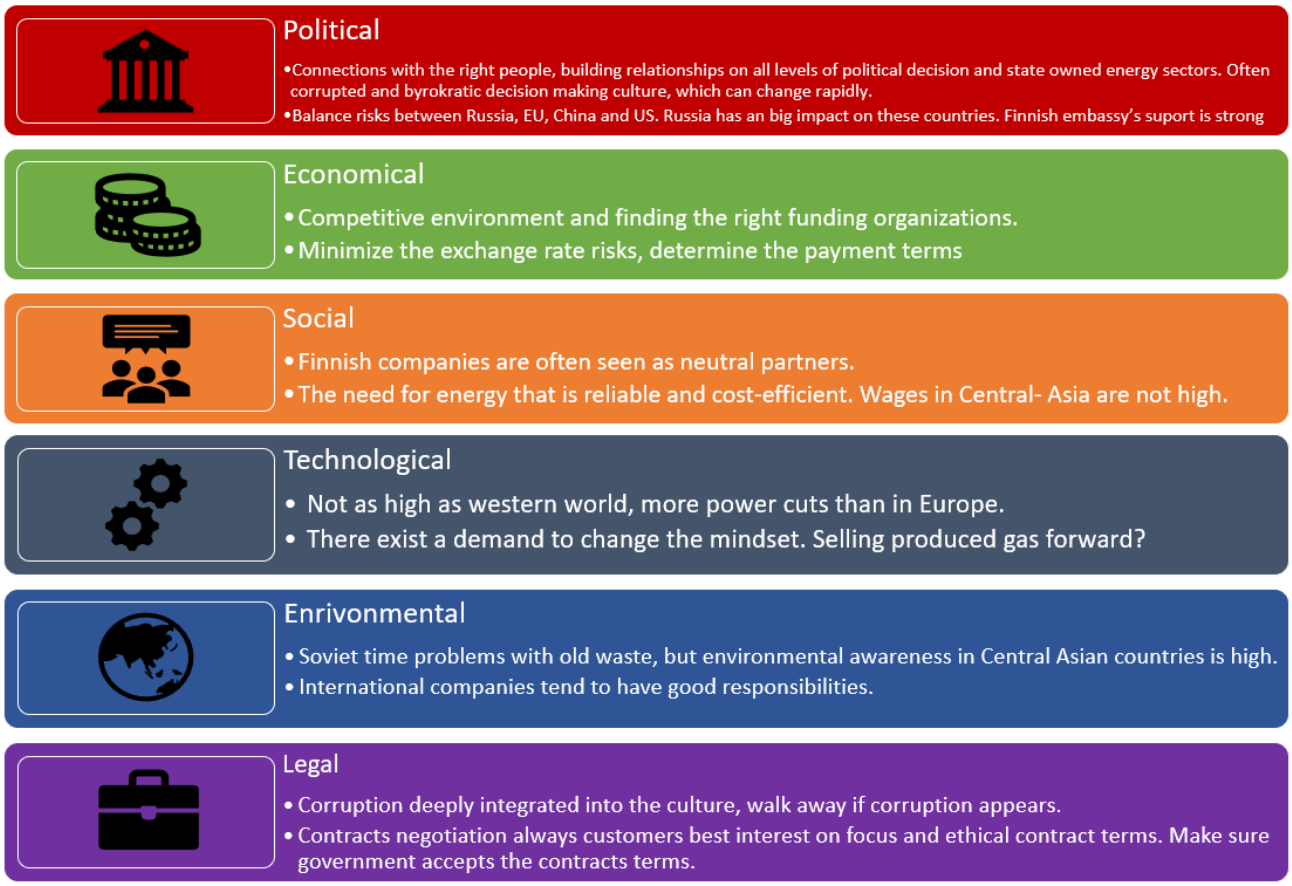


Figure 54. PESTEL analysis on Central Asia based on benchmarking from Nokia

## 5.9 Summary

In this chapter we analyzed what things to take into consideration when making business in Central Asian countries. The main need for these countries is to transform the energy sector to provide stable energy production and to cut the power shortages to minimum, with a cheap price.

The change towards 100% RES energy in the countries of Central Asia won't happen overnight as energy sector is so different if compared to Europe. Also, the mindset of the customer needs to change away from turbine only thinking for the successful implementation of renewable energy. As seen from Plexos simulations Wärtsilä's strong side would be to first offer engine powerplants combined with flexible solution to the customers in these two countries. The energy sector in these countries depends heavily on the gas price of the country, which is set up by the demand and the governments. Also, the energy segment production portfolio steers heavily the energy sector where the biggest energy production is from fossil fuels.

For a successful market breakthrough Wärtsilä needs to take into consideration competition, financing options and what products to offer to the customer. The strategic tools of Business Model Canvas and PESTEL gave us an all-around understanding of both markets cultures, mindsets and energy sectors. The analyses gave us an understanding to build in the future a local office or CRM-team, which could co-work with the customer and know their needs and problems right away. CRM-team together with the customer could calculate for example return of investment for the customer. Also, one beneficial aspect to take into consideration would be to educate and provide knowledge to the customer about future energy sectors. CLV calculations would also provide for the company and to the customer knowledge what would be the most beneficial partnership to move forward with. The aspects of building the right relationships with the right people and avoiding corruption in these countries is the key terms of successful market breakthrough. This was one potential answer to the first research question stated earlier: How can Wärtsilä improve their sales strategy for a successful breakthrough in Central Asian markets?

The second one was How will Wärtsilä's new strategy set up in 2019 beginning be effective in Central Asian countries? The answer is that first Wärtsilä needs to build relationship with the customer and have couple of successful projects, before trying to convince the customer to move forwards with 100% renewable strategy in their energy sector.

# 6 CONCLUSION

This thesis investigated the market potential and a strategic aspect to taken into consideration in the sales for the countries in Central Asia. The thesis was made as a case study for Wärtsilä Sales East Europe. The goal of this thesis was to gain in-depth knowledge of the market situation, the energy sectors in these two Central Asian countries, best way to gain market access and set up strategic viewpoints to stay competitive. The two countries studied for this thesis was Azerbaijan and Uzbekistan, these countries provide a great opportunity for Wärtsilä to make business, but as they are 0-IPP countries an all-around strategic viewpoint must be set up.

The literature review gave us an understanding of what is a strategy, why it is important, what is value-based selling, what is CRM, the theory of strategic tools used and risk management. The methodology used in this thesis was a mixed-method study, which consisted of qualitative and quantitative data. The qualitative approach consisted of an interview where it was used to create a benchmarking process and later a strategic tool called PESTEL. The energy sector simulations were done using a simulating program called Plexos, where the data gathered were considered as quantitative approach. Also, a business model canvas was made for easier understand the strategic viewpoints to taken into further consideration.

The findings of this study suggest that as the countries in Central Asia are committed to increase their energy stability, they are not yet committed to use 100% renewable solution. Wärtsilä needs to build relationship with the customer and have couple of successful projects, before moving forward in Central Asian countries with the new strategy set up in the beginning of 2019. This answers to the second research question… How will Wärtsilä's new strategy set up in 2019 beginning be effective in Central Asian countries? The gas storages in the world are declining and new solutions needs to be evaluated. Wärtsilä needs to be able to provide for the target countries in Central Asia solutions which provide customer value and create revenue at the same time. These kinds of solutions for the countries in Central Asia could potentially be to offer first a flexible engine powerplant

solution and later when the mutual goals and trust has been established renewables for combination. Influence and educate the stakeholders and trying to convince them with facts using tools such as Plexos where the Wärtsilä engines combined with flexibility would be a plausible solution for these countries. Changing the market perspective takes time, that is why Wärtsilä needs to be persistent about how we can best help the customers in these countries. Customers will buy when they have a problem they want to solve and when they see that Wärtsilä's solution are the best solution for their problems. One interesting key point of this thesis would be to be able to convince the potential customers in Central Asia countries to sell their gas forward and invest into engines and renewables. This change would create more profit to the customer than using the gas themselves. In the Plexos model we saw that the models rely heavily on updating on the gas price, which is managed by the government of the country. In both countries there does not exist any "best way of working" in Plexos model, the key thing is to find a balance between $C0_2$ emission and total cost of the system.

One of the key findings was to create a CRM team, which would be able to focus purely on the customer needs and to support business development managers in their daily tasks. A CRM team would need to consist of locals, or people who can the same language and knows the culture very well. A CRM team could also be established with local office and Wärtsilä as a company would know the customers mindset and understand the culture even better. Also, one possible outcome is to implement a future scenario analysis of customer lifetime value. With the help of CLV Wärtsilä could see the potential customers and measure if it would be beneficial to suggest for the customer what kind of solution. The recent market situations have delayed customer's decision making, that is why a crucial thing to do is to work even more closely with the customers. These findings with the PESTEL analysis provided an answer for the research question one: How can Wärtsilä improve their sales strategy for a successful breakthrough in Central Asian markets?

PESTEL model gave this thesis an understanding how the political, economic, social, technological, environmental and law factors play a role in these countries. The PESTEL model were made using benchmarking from a company that has already established success in the central Asia countries. The benchmarking process were done with interview

with a marketing unit head of SECA from a company called Nokia. The PESTEL model suggest that the key points were building the connections with the right people, balance risk with neighbour countries to know the competitors and how these neighbour countries affect Central Asian countries. PESTEL also suggest that key interest is to avoid corruption, find the right funding partner, set clear payment terms and minimize exchange rate risks.

The goal of this thesis was achieved as it created clear guidelines to taken into consideration when making a strategy in Central Asian countries, it also provided necessary data for a clear decision making and improvement suggestions.

## 6.1 Limitations

As this thesis being an empirical study done with a case study format, brought it limitations to generalizability. The goal of this thesis was not to generalize, but it was to find and improve strategical decisions that could later be used in similar market situations or work as a case study by itself in the future. Second limitation is that the market data is very volatile, which means that the Plexos modelling assumes only how in the future the markets could potentially look like. Especially countries in Central Asia tends to not share their energy information to third parties. Also, as the thesis went further we needed to reduce the scope as it was a few times too broad, especially the number of scenarios done for Uzbekistan case and the numbering of scenarios could have been done in more logical order. The third limitation is the writer's own knowledge of the topic, it grew step by step as the thesis was written and will grow even further.

## 6.2 Further research

Based on this research one interesting topic to study even further would be to develop the Plexos models even further and count the CLV and return of investments in a logical way.

In the future SWOT analysis could be utilized because it is a great strategy tool but requires even deeper analysis of the markets and other tools.

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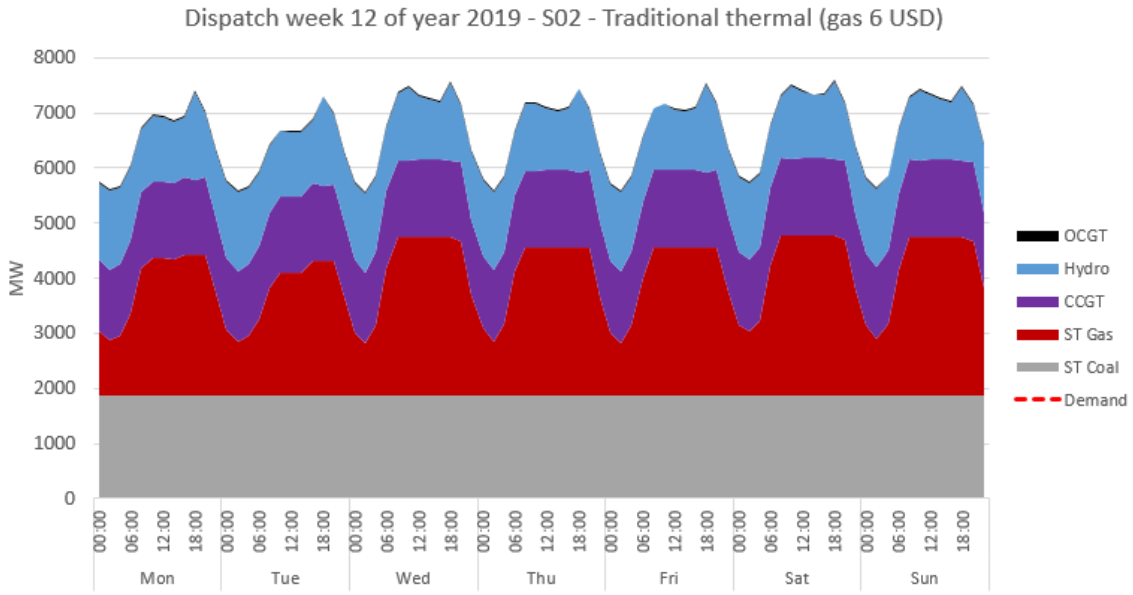
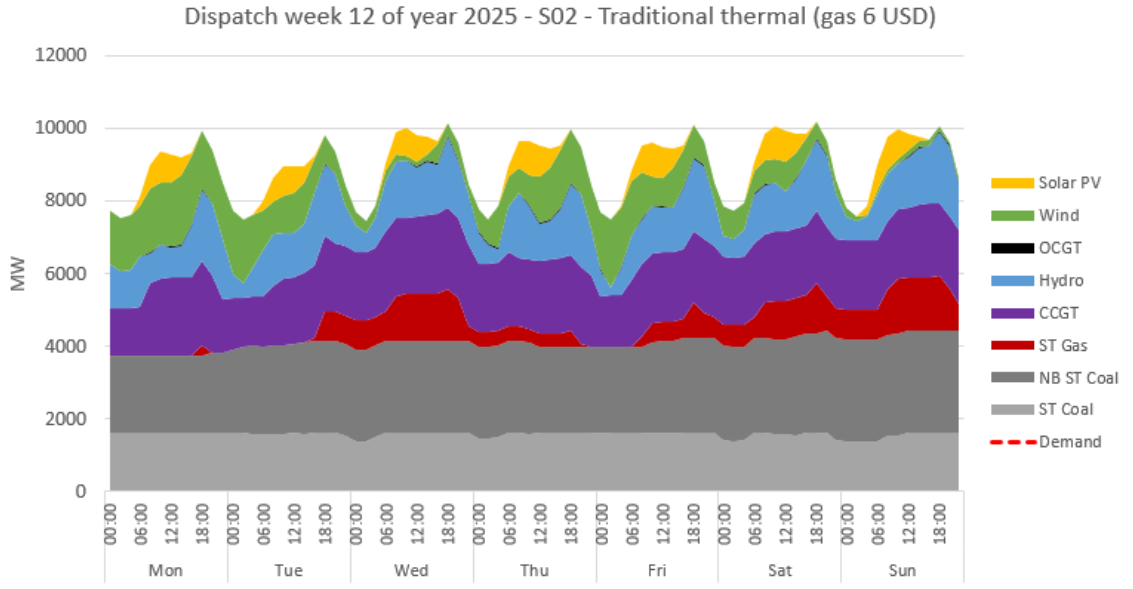
APPENDIX

**Appendix 1** Uzbekistan Plexos Simulation Traditional thermal


Dispatch week 12 of year 2019 - S02 - Traditional thermal (gas 6 USD)
MW
8000
7000
6000
5000
4000
3000
2000
1000
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
OCGT
Hydro
CCGT
ST Gas
ST Coal
Demand


Dispatch week 12 of year 2025 - S02 - Traditional thermal (gas 6 USD)
MW
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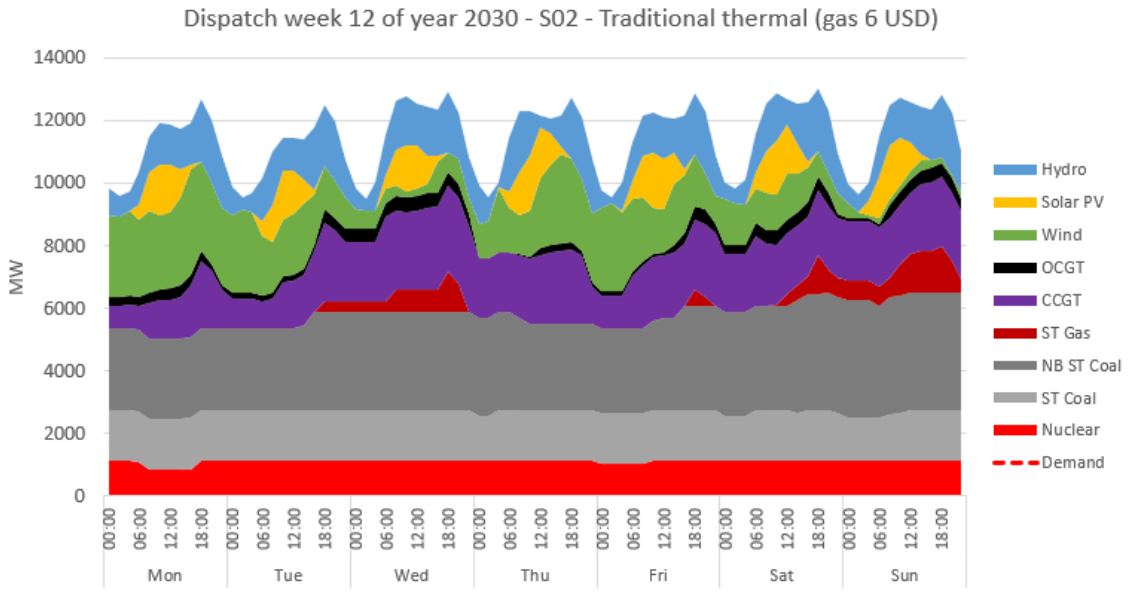
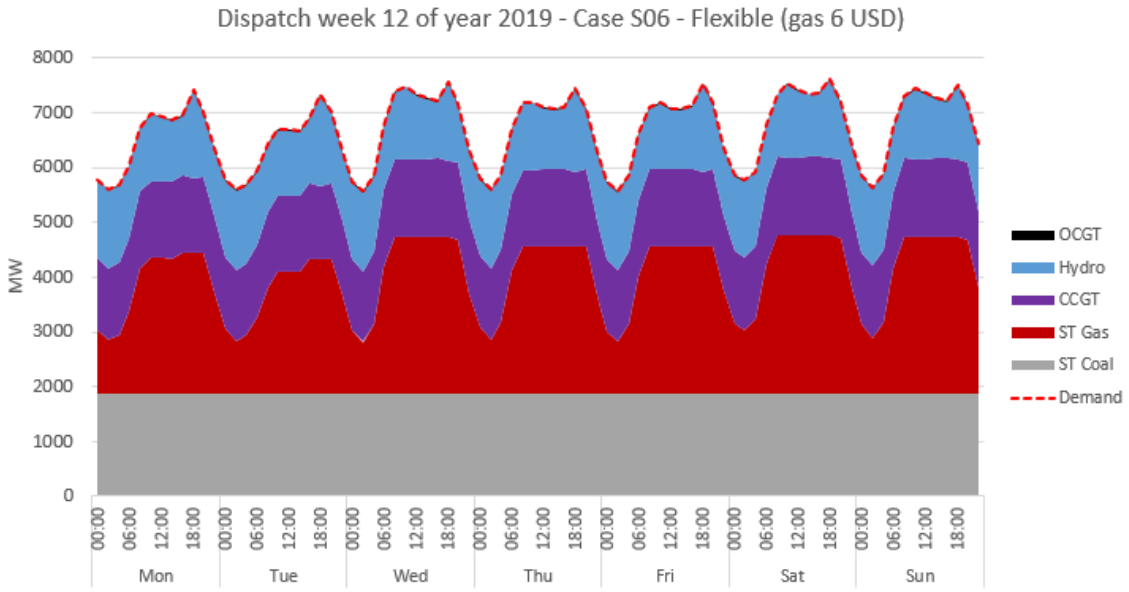
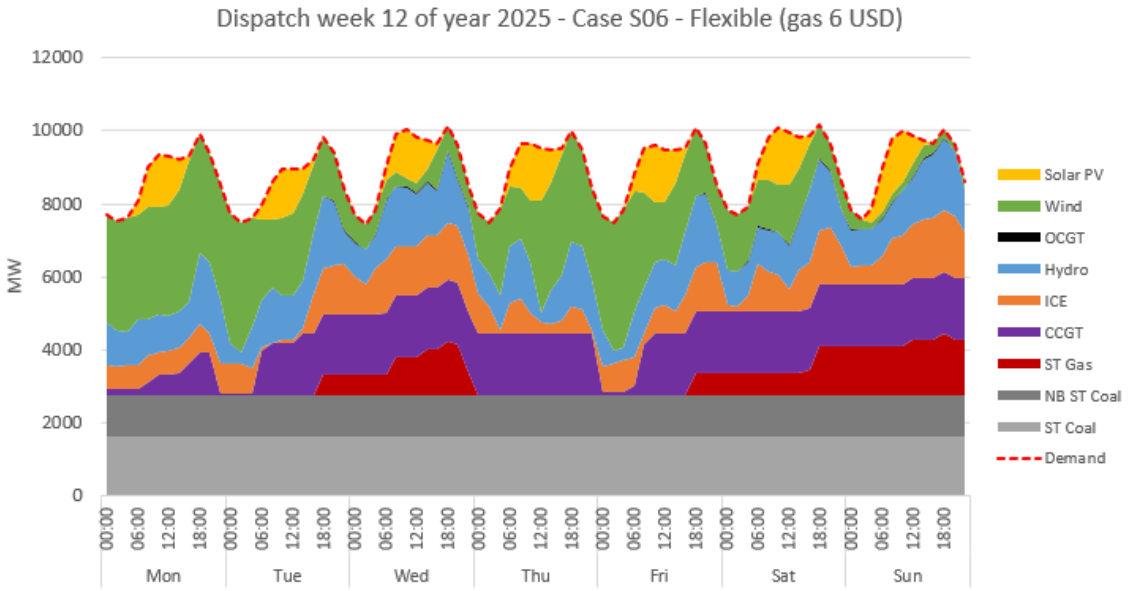
10000
8000
6000
4000
2000
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Solar PV
Wind
OCGT
Hydro
CCGT
ST Gas
NB ST Coal
ST Coal
Demand




**Appendix 2** Uzbekistan Plexos Simulation Flexible gas 6 USD/GJ




Dispatch week 12 of year 2025 - Case S06 - Flexible (gas 6 USD)
MW
12000
10000
8000
6000
4000
2000
0
00:00
06:00
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18:00
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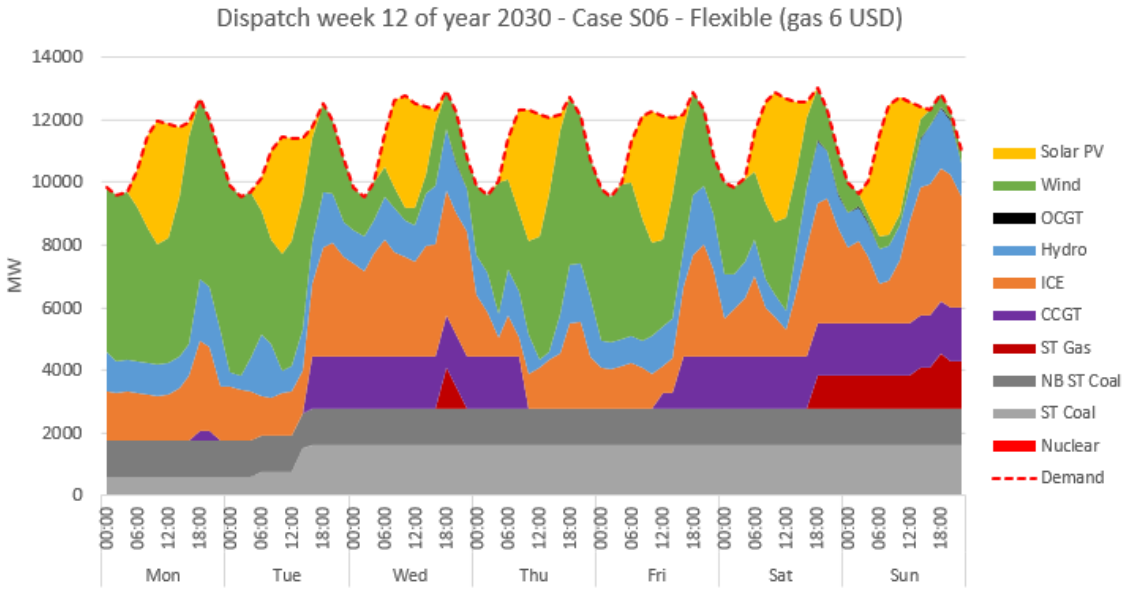
Fri
Sat
Sun
Solar PV
Wind
OCGT
Hydro
ICE
CCGT
ST Gas
NB ST Coal
ST Coal
Demand


Dispatch week 12 of year 2030 - Case S06 - Flexible (gas 6 USD)
MW
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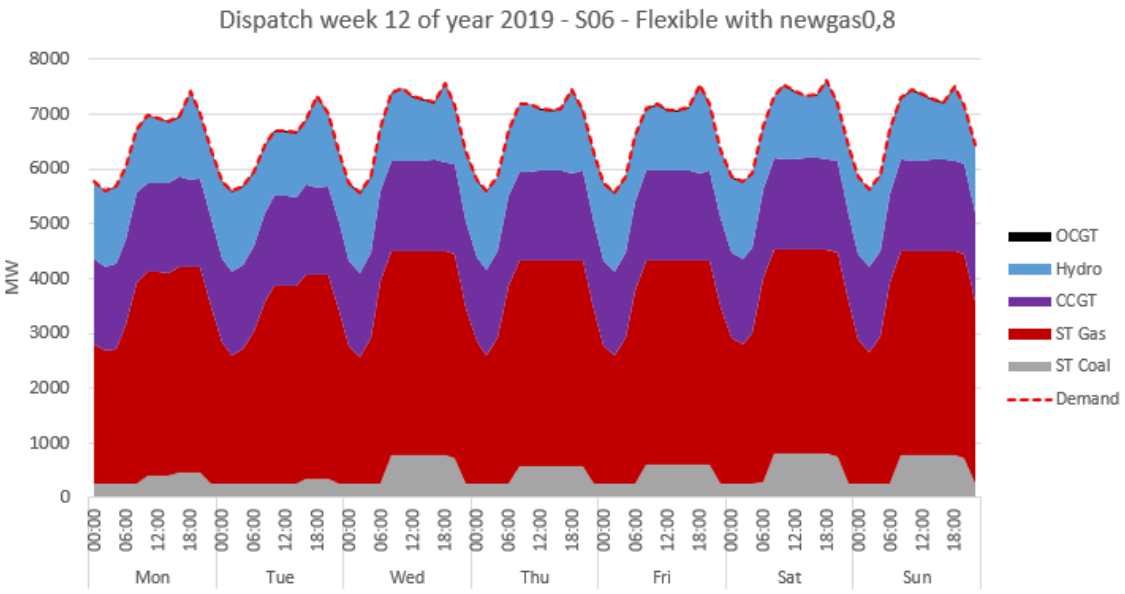
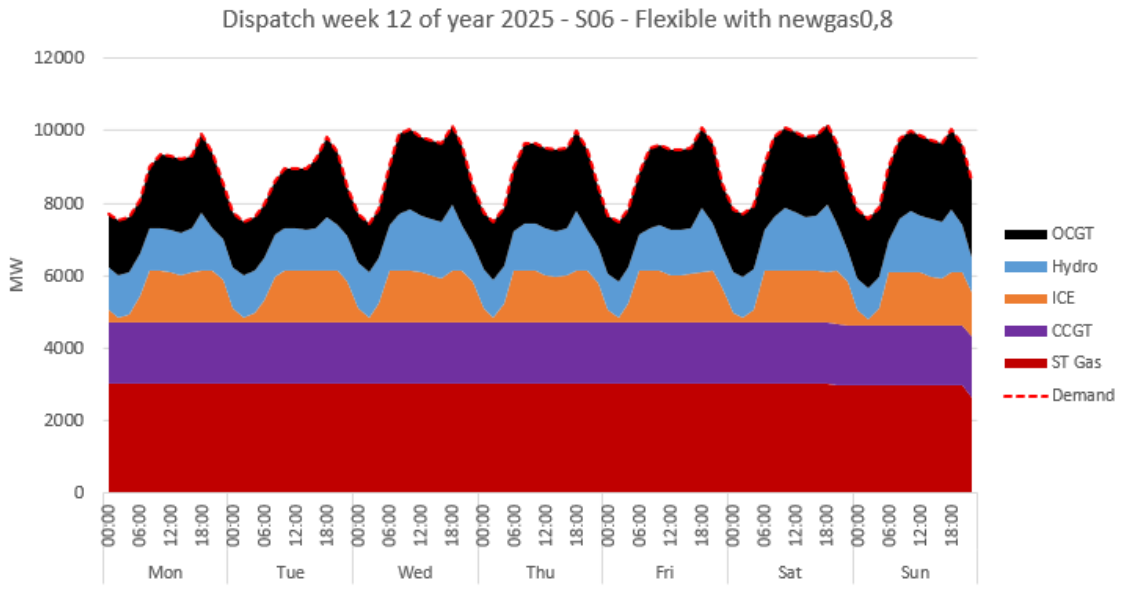
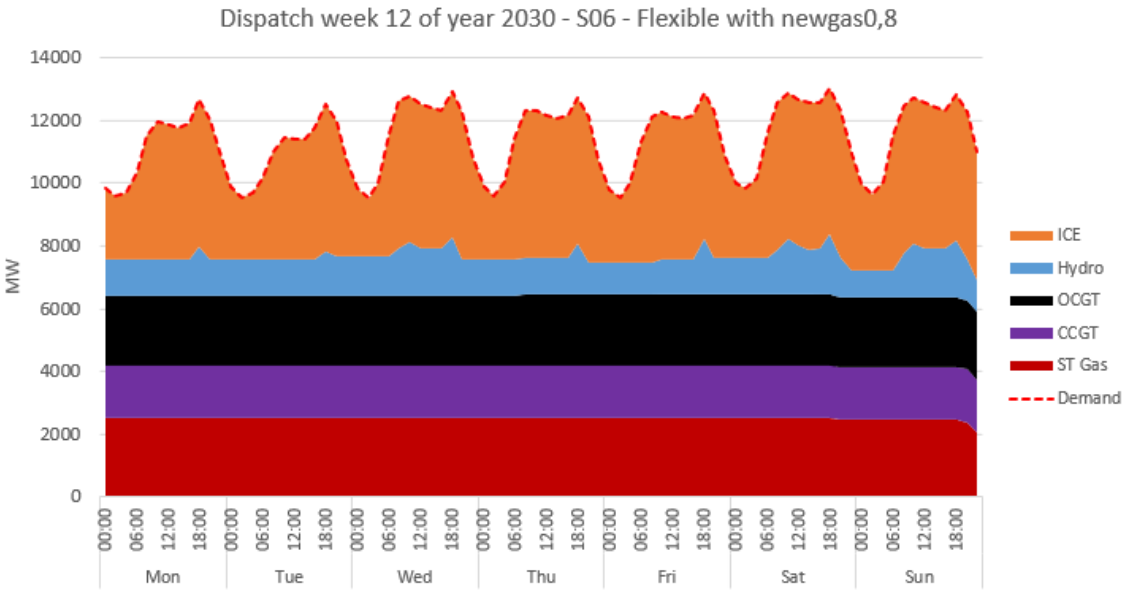
12000
10000
8000
6000
4000
2000
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Solar PV
Wind
OCGT
Hydro
ICE
CCGT
ST Gas
NB ST Coal
ST Coal
Nuclear
Demand

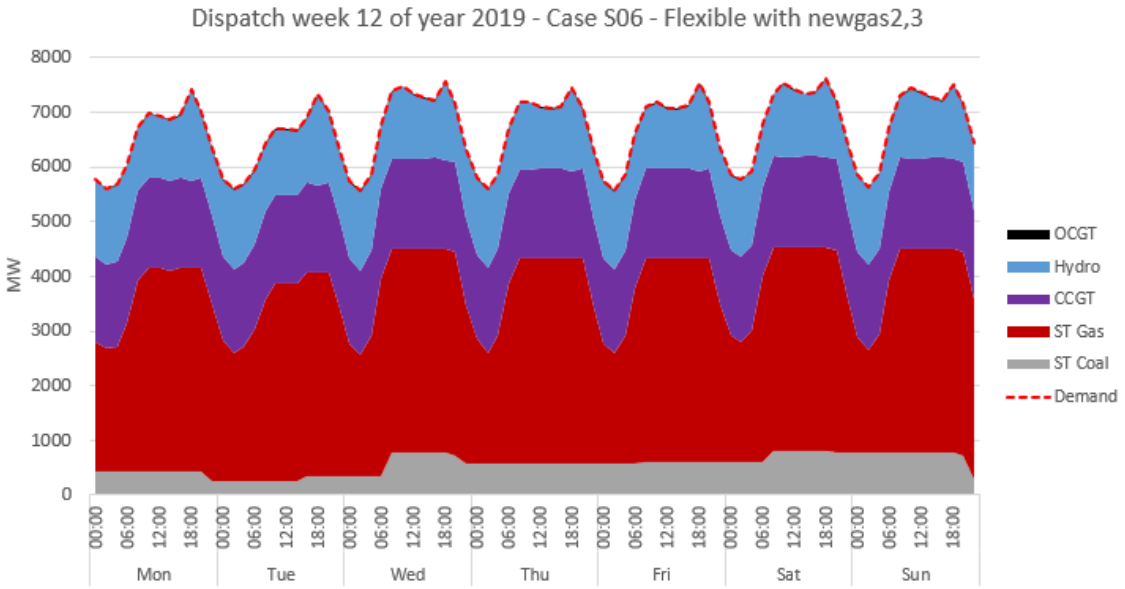
**Appendix 3** Uzbekistan Plexos Simulation Flexible gas 0,8 USD/GJ

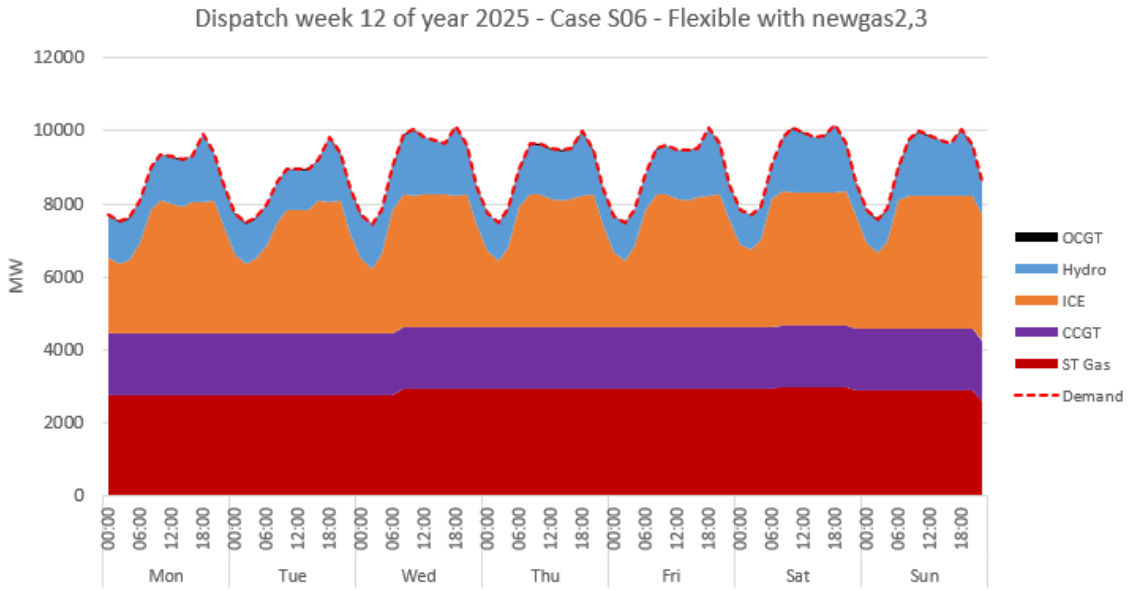


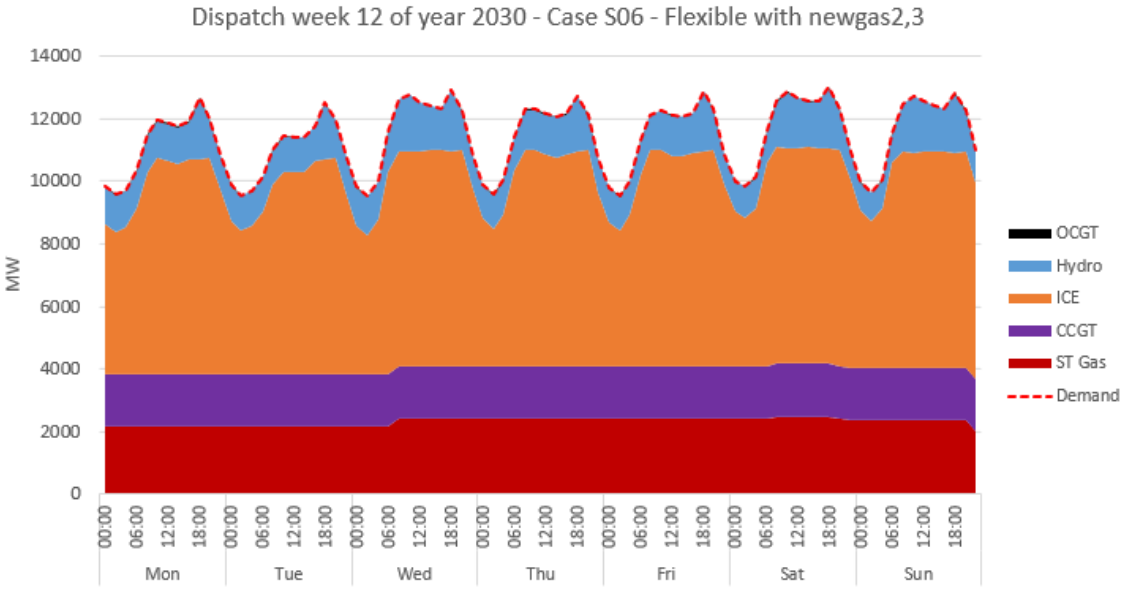





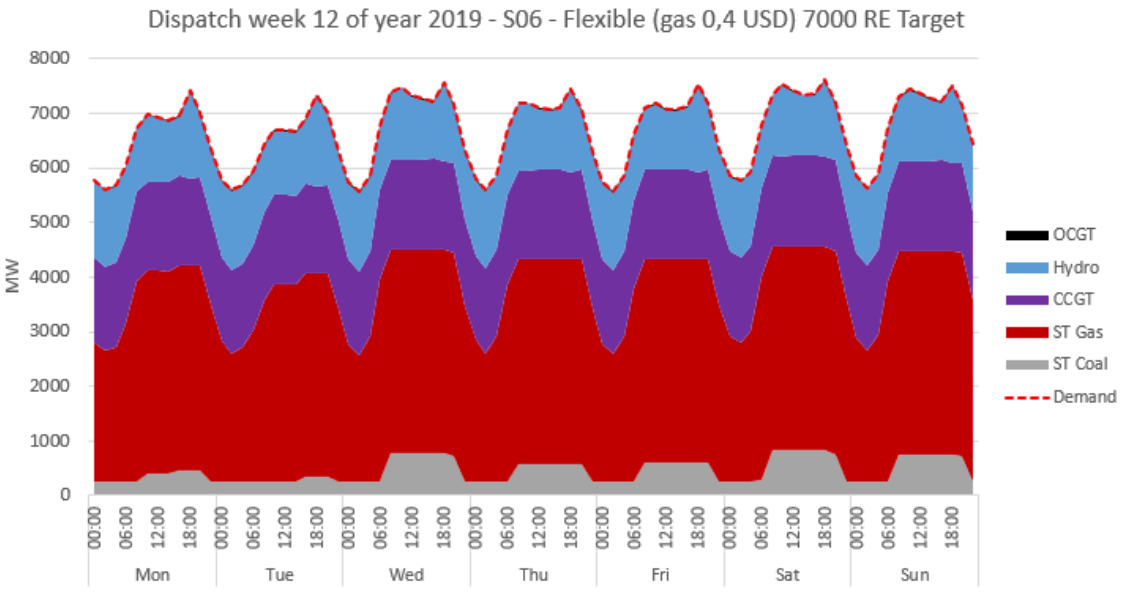

**Appendix 4** Uzbekistan Plexos Simulation Flexible gas 2,3 USD/GJ

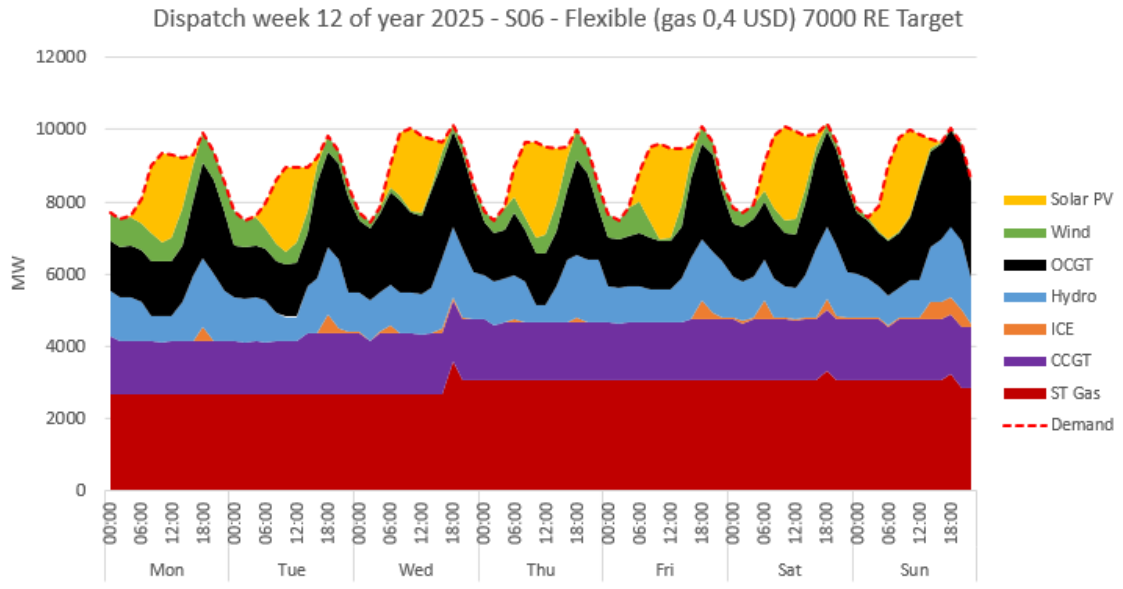


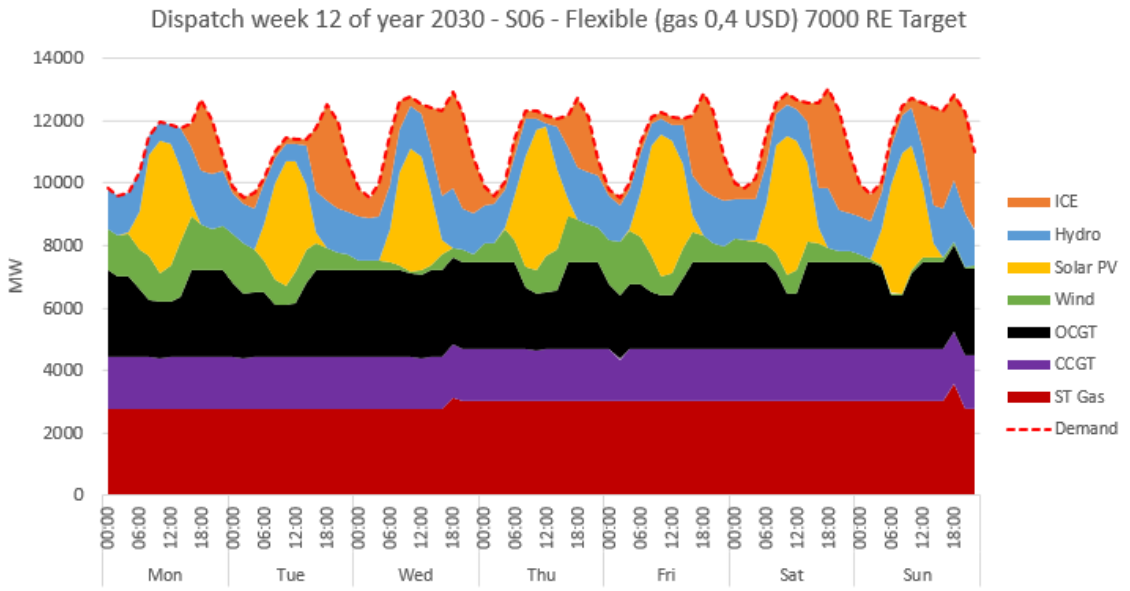

Dispatch week 12 of year 2025 - Case S06 - Flexible with newgas2,3
MW
12000
10000
8000
6000
4000
2000
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
OCGT
Hydro
ICE
CCGT
ST Gas
Demand


Dispatch week 12 of year 2030 - Case S06 - Flexible with newgas2,3
MW
14000
12000
10000
8000
6000
4000
2000
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
OCGT
Hydro
ICE
CCGT
ST Gas
Demand

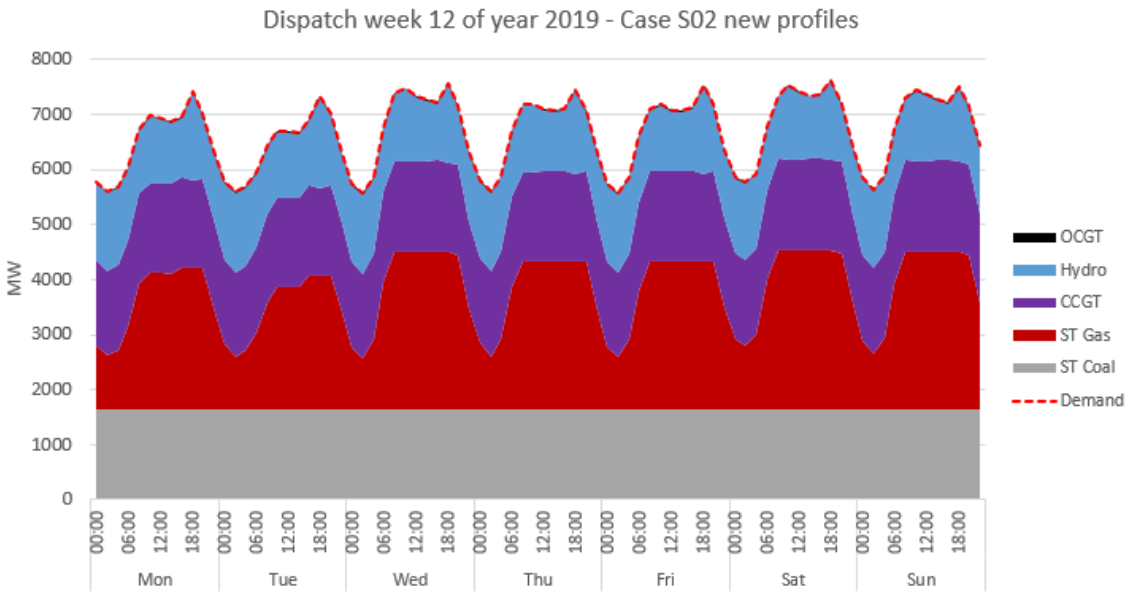
**Appendix 5** Uzbekistan Plexos Simulation Flexible gas 0,4 USD/GJ Renewable target

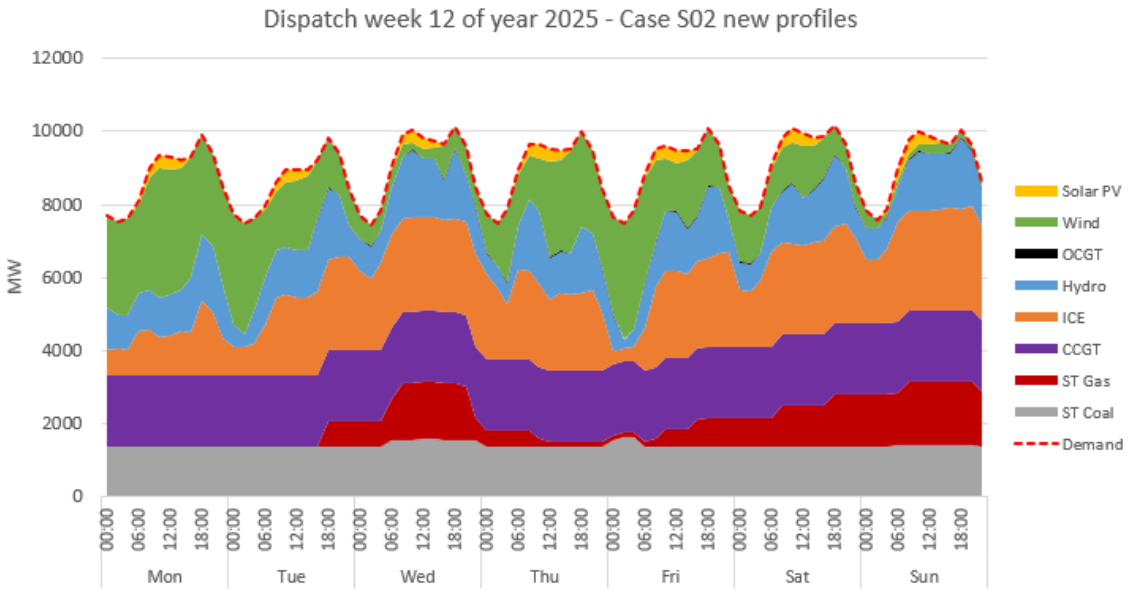





**Appendix 6** Uzbekistan Plexos Simulation Flexible new profile gas 4 USD/GJ




Dispatch week 12 of year 2025 - Case S02 new profiles
MW
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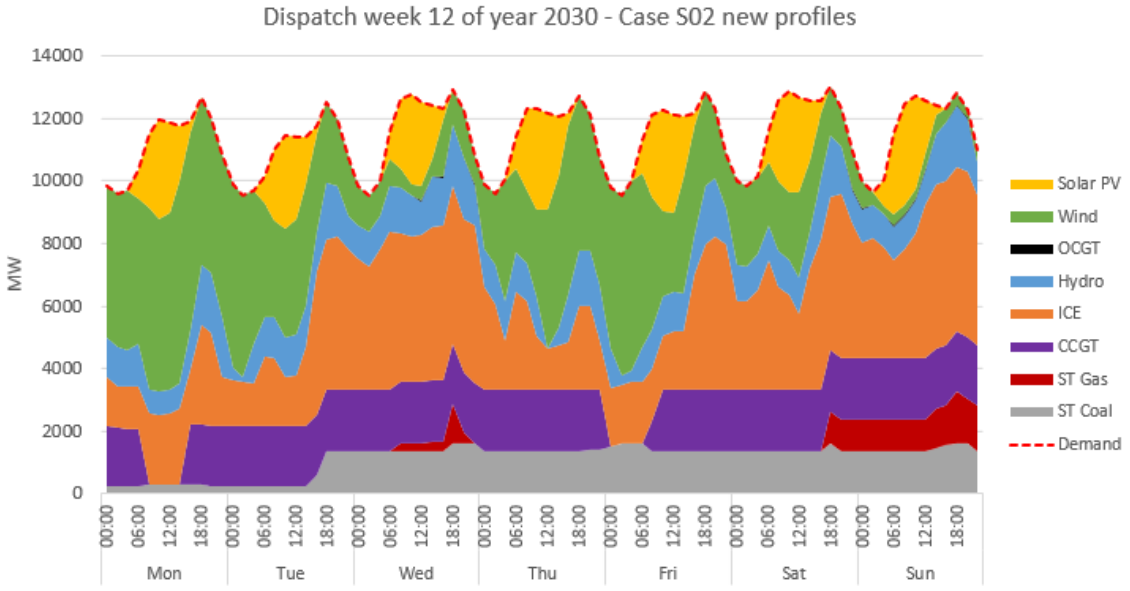
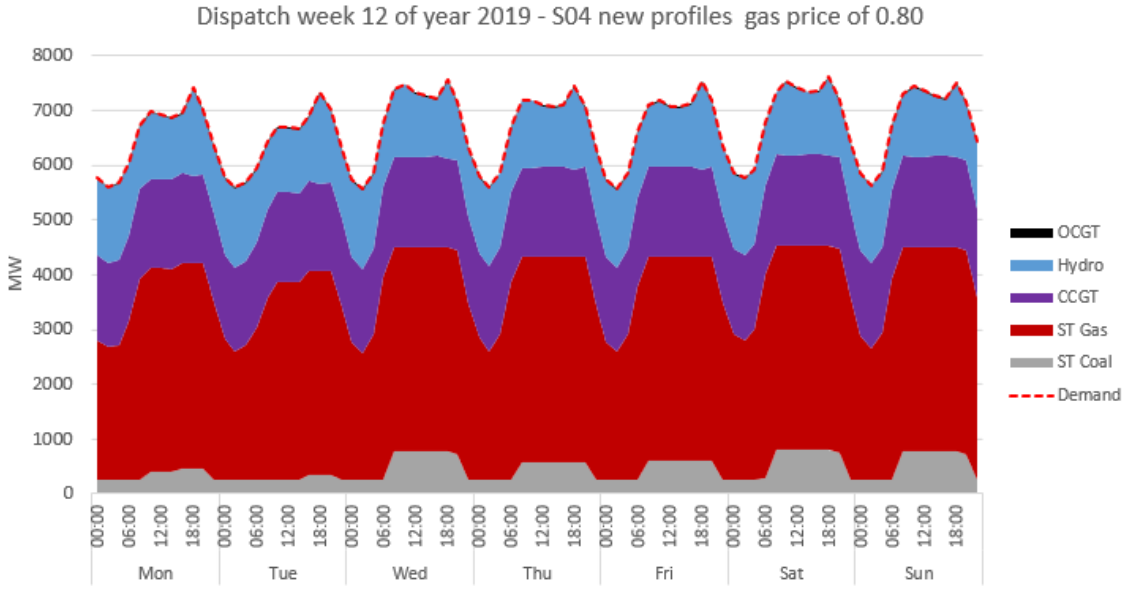
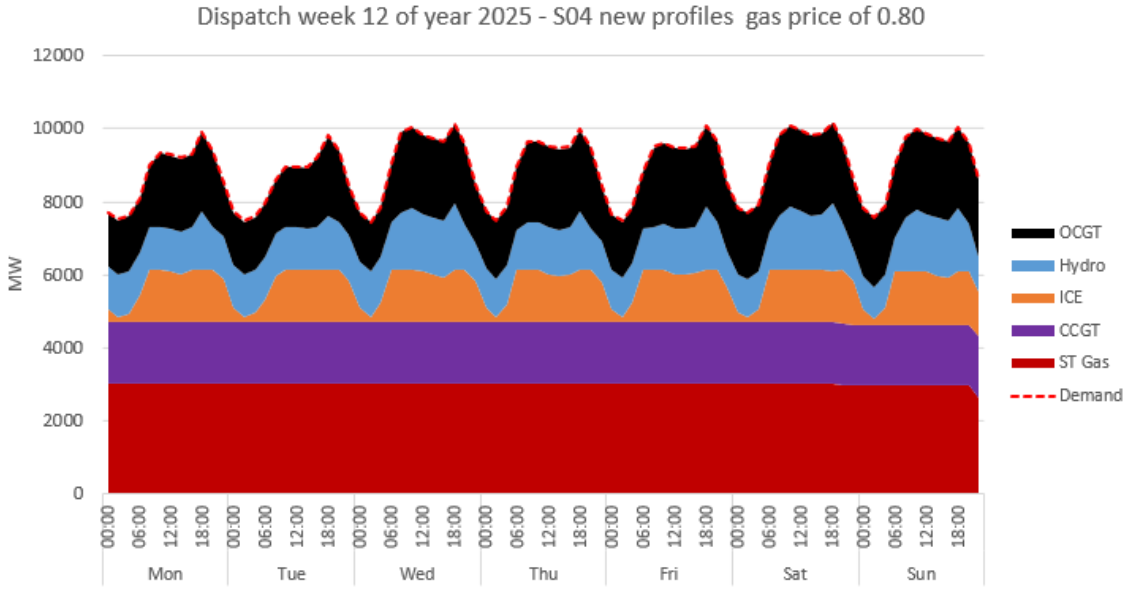
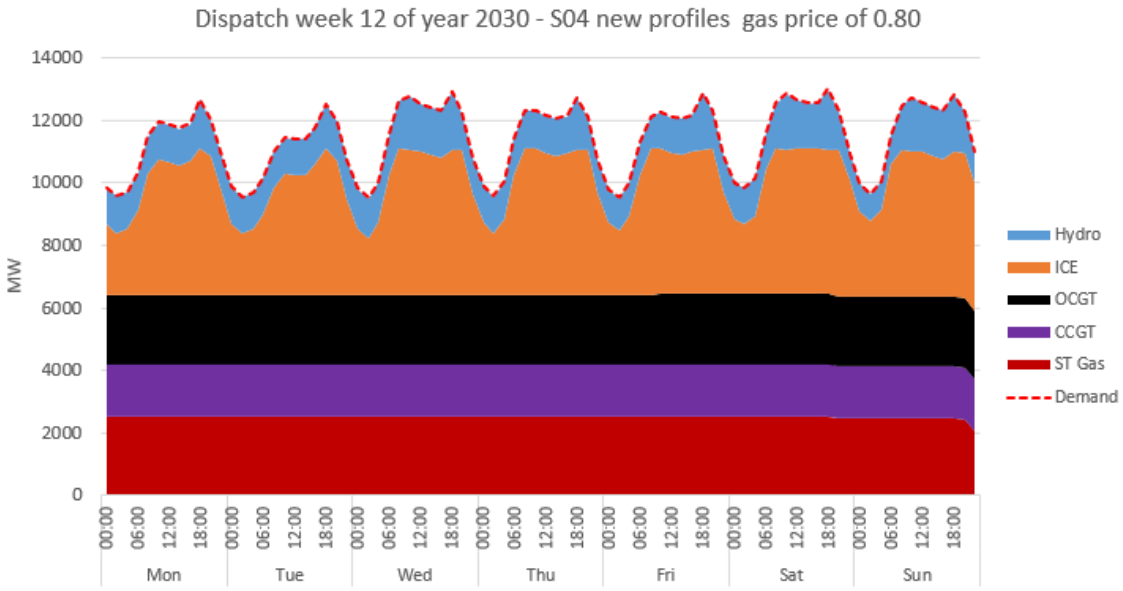
10000
8000
6000
4000
2000
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Solar PV
Wind
OCGT
Hydro
ICE
CCGT
ST Gas
ST Coal
Demand


Dispatch week 12 of year 2030 - Case S02 new profiles
MW
14000
12000
10000
8000
6000
4000
2000
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Solar PV
Wind
OCGT
Hydro
ICE
CCGT
ST Gas
ST Coal
Demand

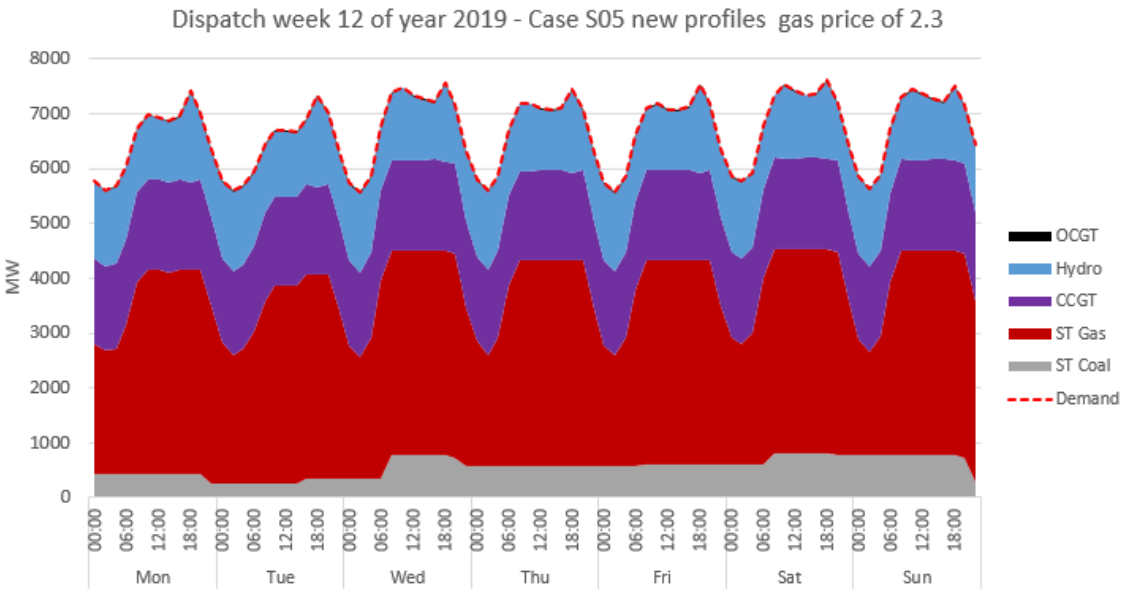
**Appendix 7** Uzbekistan Plexos Simulation Flexible new profile gas 0,8 USD/GJ

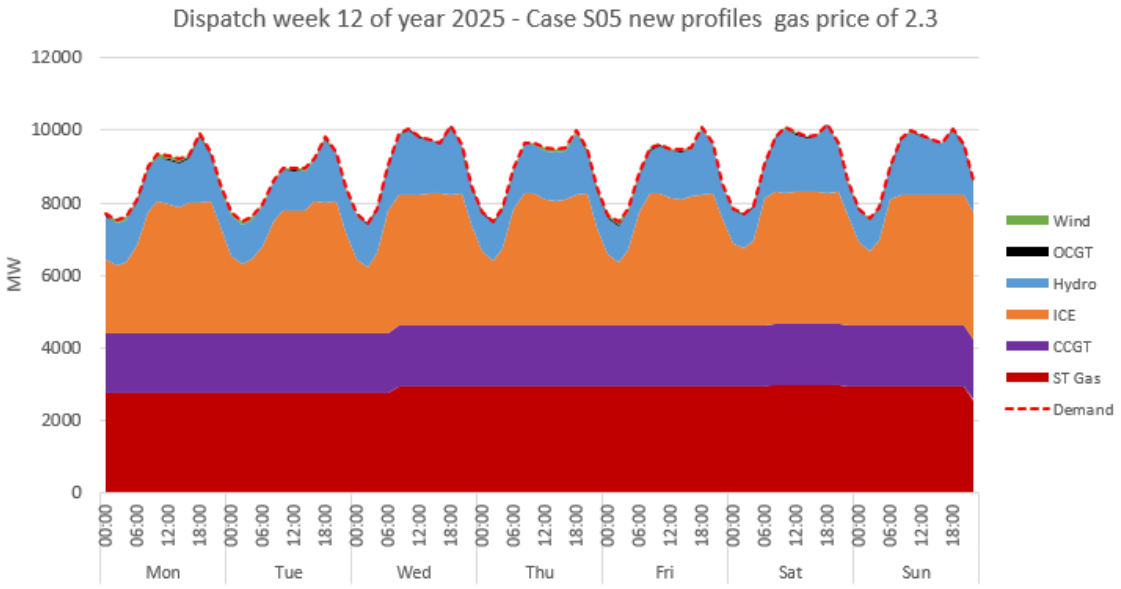


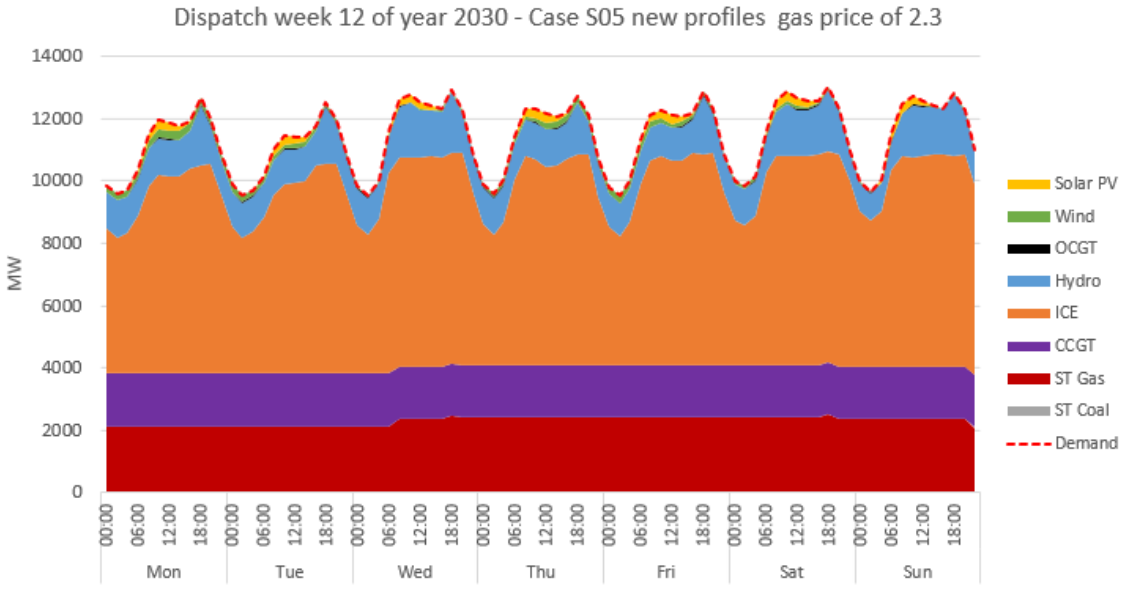





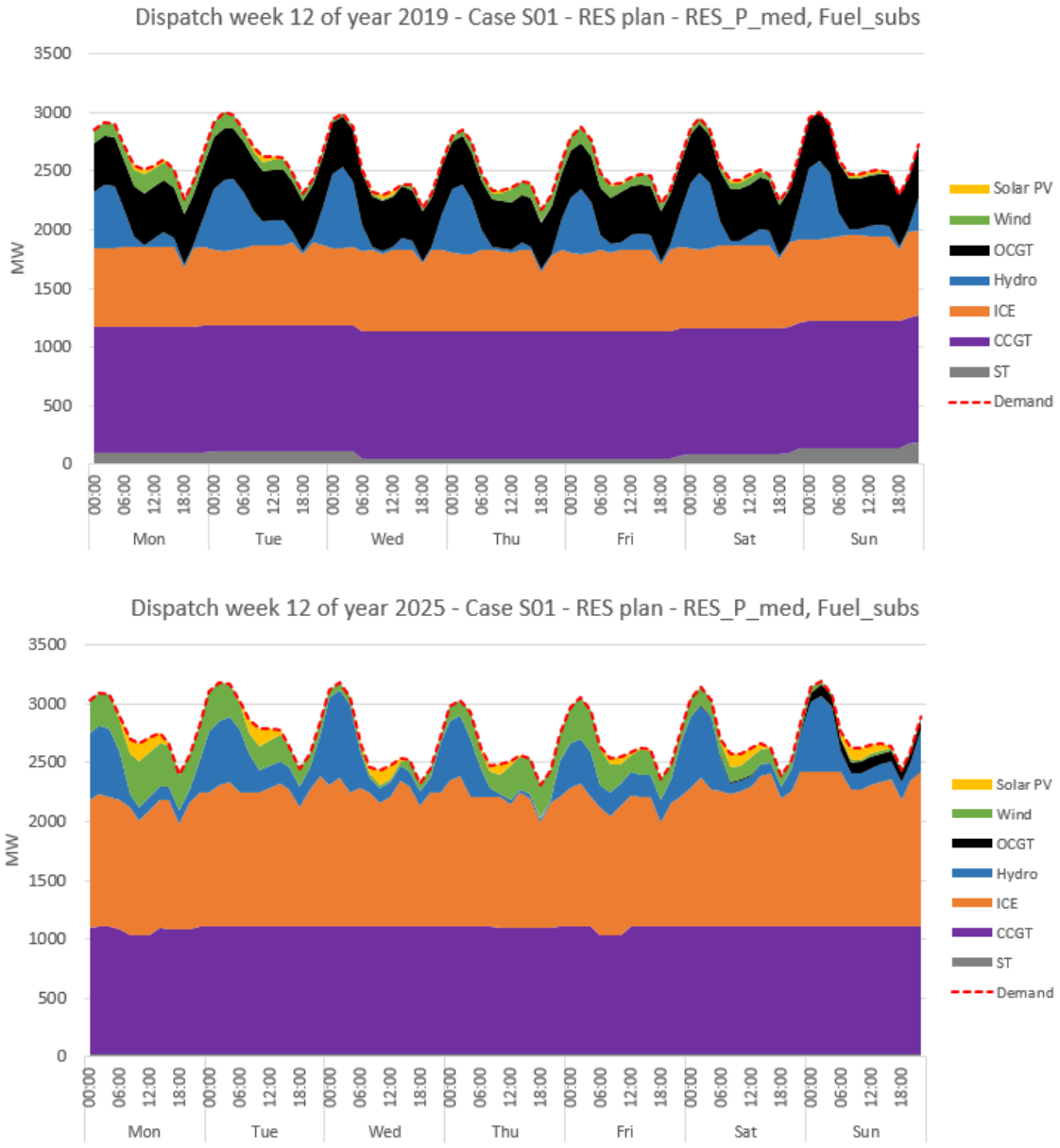

**Appendix 8** Uzbekistan Plexos Simulation Flexible new profile gas 2,3 USD/GJ

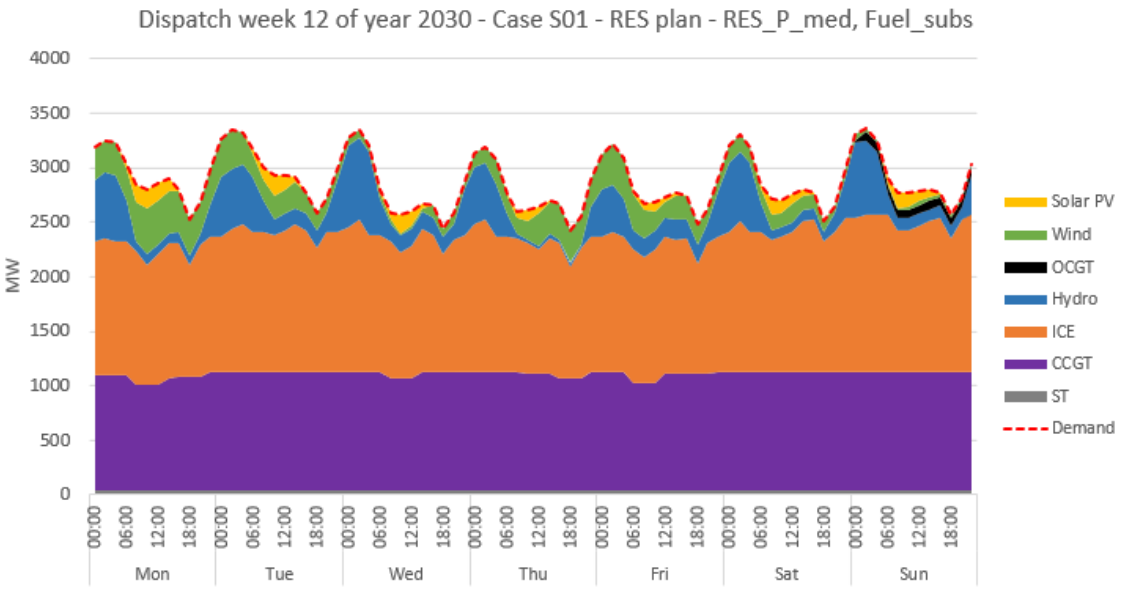



Dispatch week 12 of year 2025 - Case S05 new profiles gas price of 2.3
MW
12000
10000
8000
6000
4000
2000
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Wind
OCGT
Hydro
ICE
CCGT
ST Gas
Demand

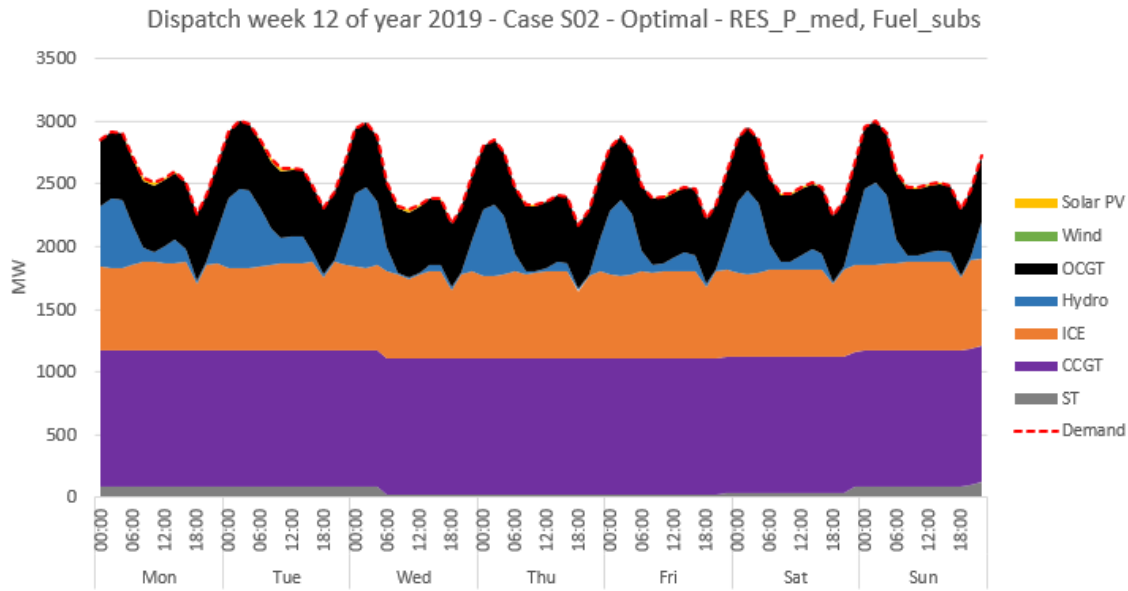

Dispatch week 12 of year 2030 - Case S05 new profiles gas price of 2.3
MW
14000
12000
10000
8000
6000
4000
2000
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Solar PV
Wind
OCGT
Hydro
ICE
CCGT
ST Gas
ST Coal
Demand

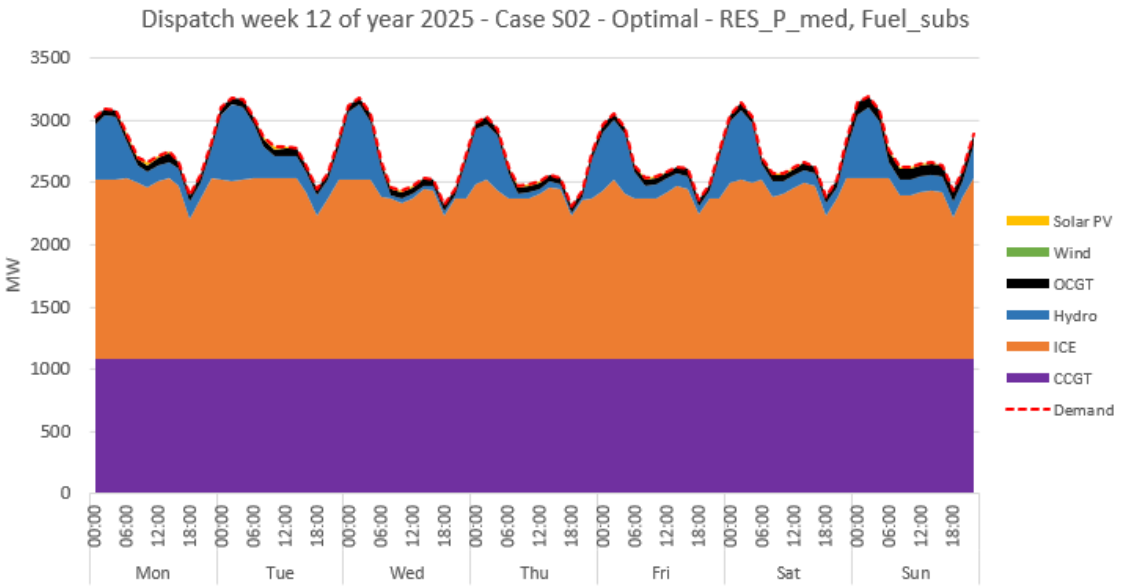
**Appendix 9** Azerbaijan Plexos Simulation RES plan with fuel subs

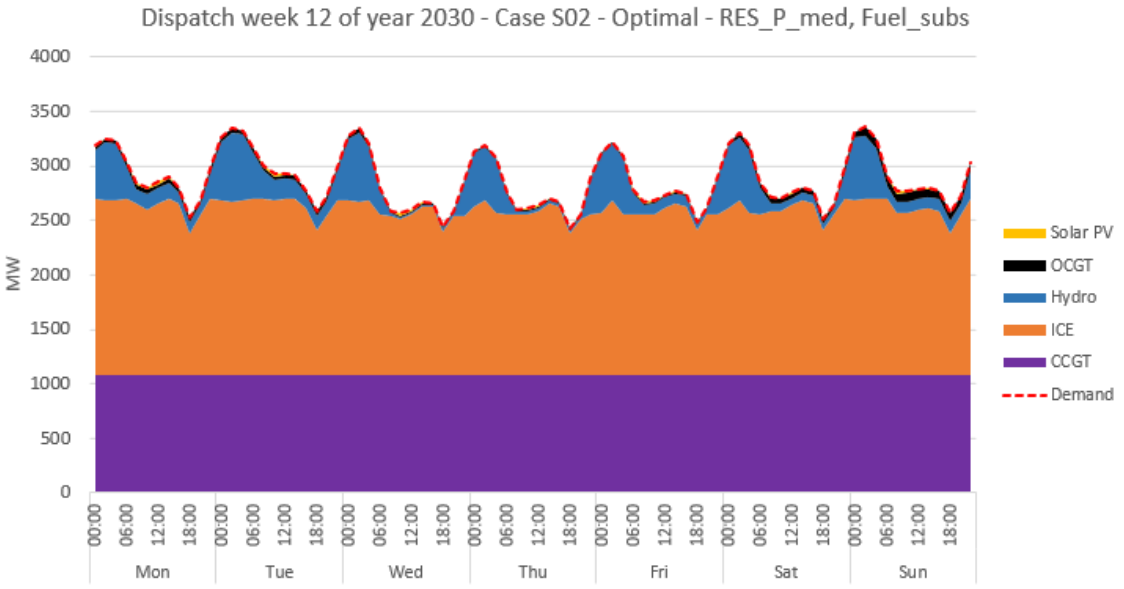




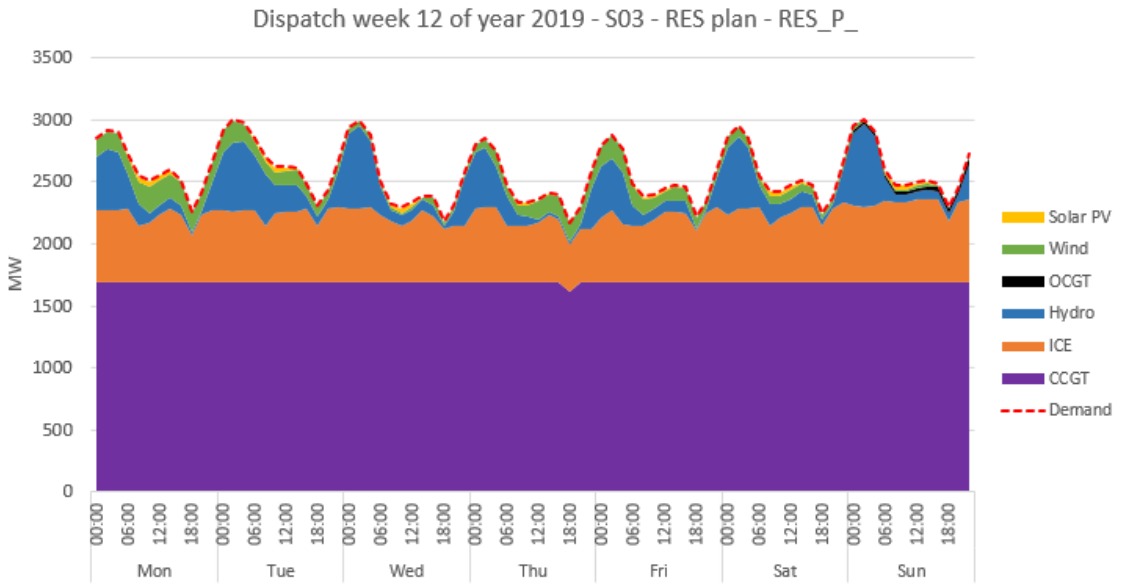

**Appendix 10** Azerbaijan Plexos Simulation Optimal RES plan with fuel subs

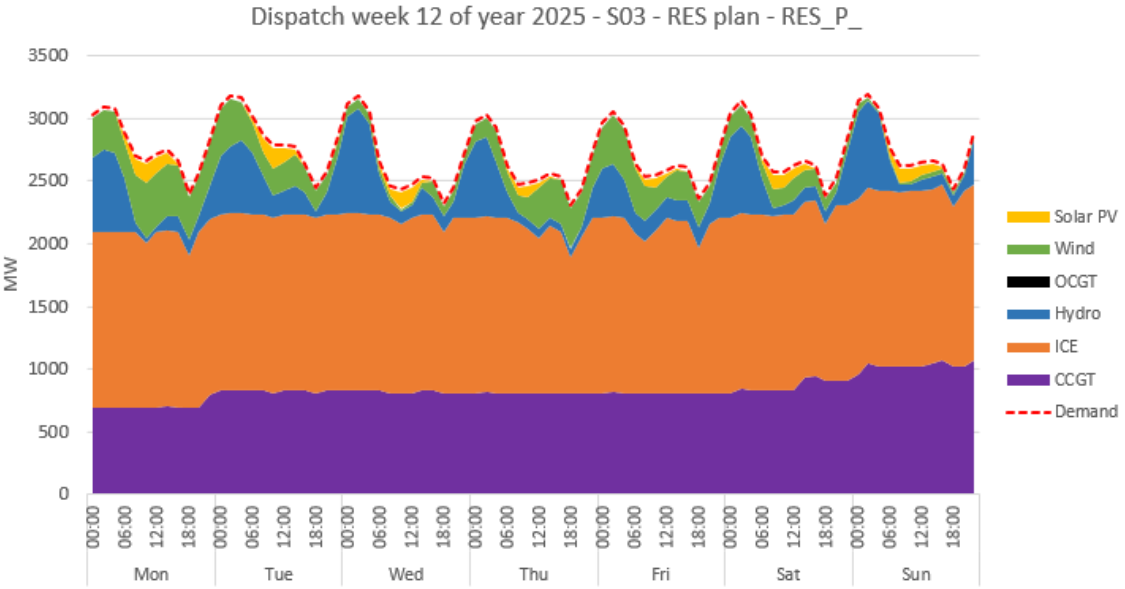


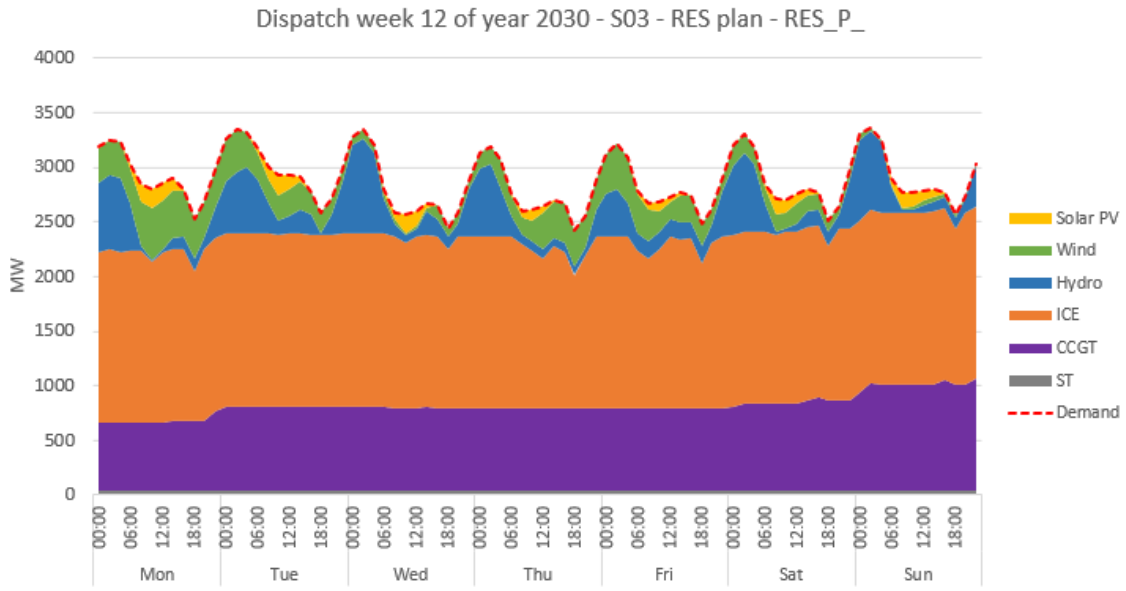

Dispatch week 12 of year 2025 - Case S02 - Optimal - RES_P_med, Fuel_subs
MW
3500
3000
2500
2000
1500
1000
500
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Solar PV
Wind
OCGT
Hydro
ICE
CCGT
Demand


Dispatch week 12 of year 2030 - Case S02 - Optimal - RES_P_med, Fuel_subs
MW
4000
3500
3000
2500
2000
1500
1000
500
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Solar PV
OCGT
Hydro
ICE
CCGT
Demand

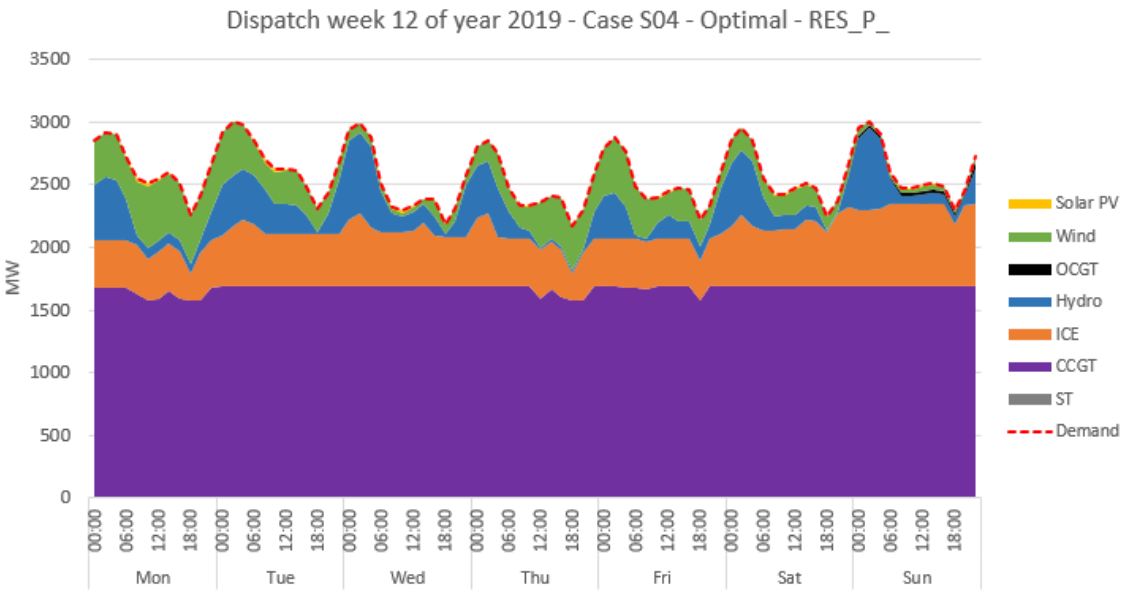
**Appendix 11** Azerbaijan Plexos Simulation RES plan

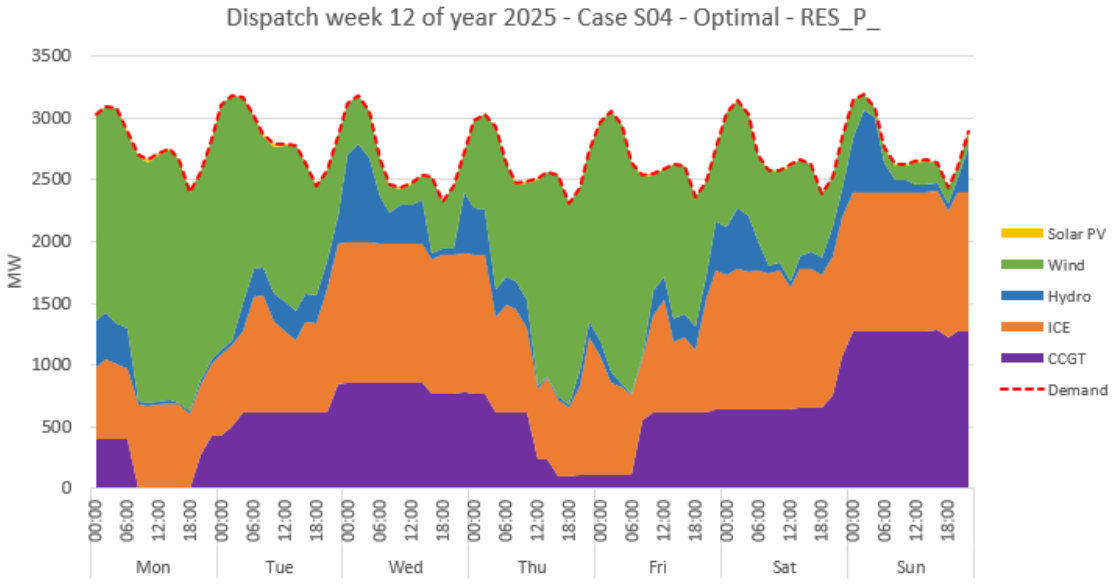





**Appendix 12** Azerbaijan Plexos Simulation Optimal RES plan




Dispatch week 12 of year 2025 - Case S04 - Optimal - RES_P_
MW
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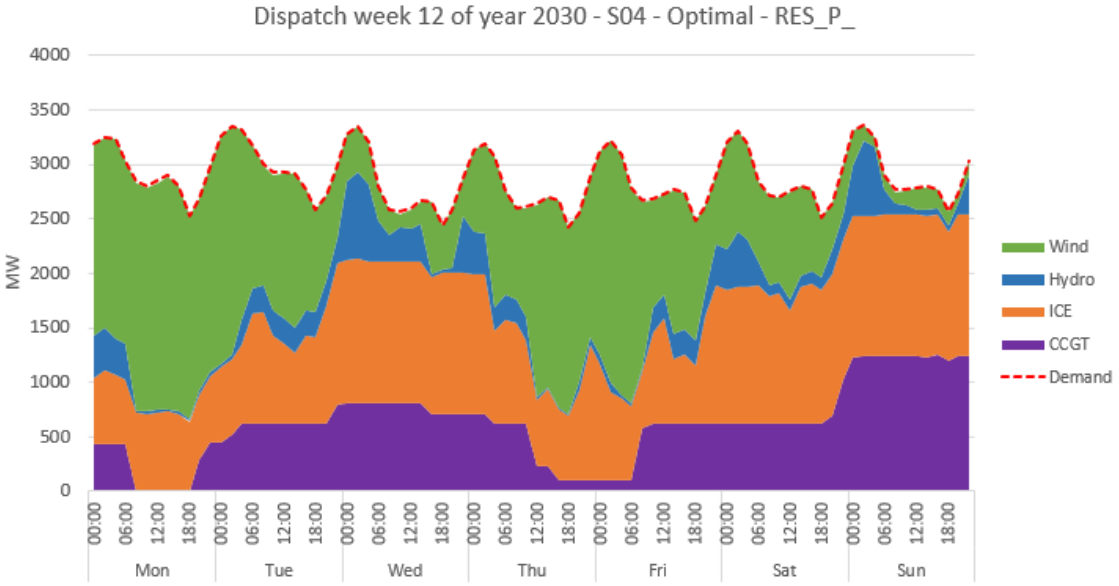
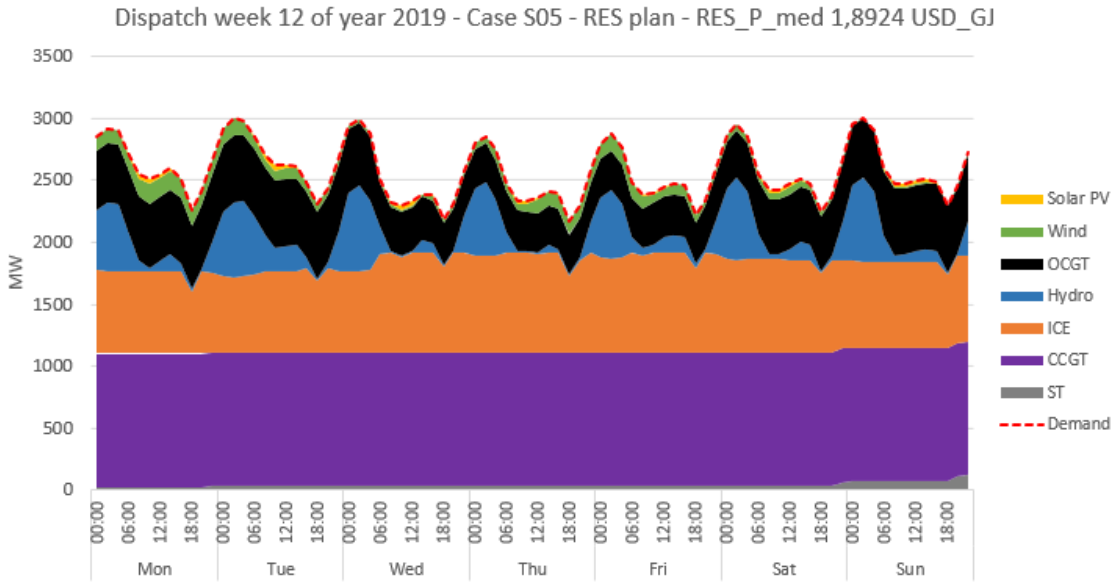
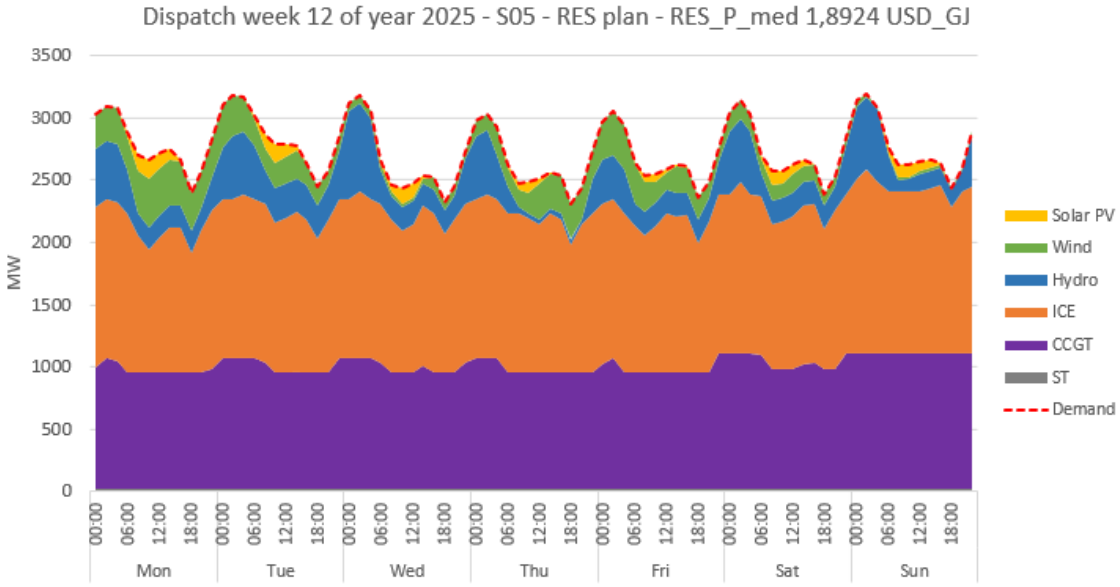
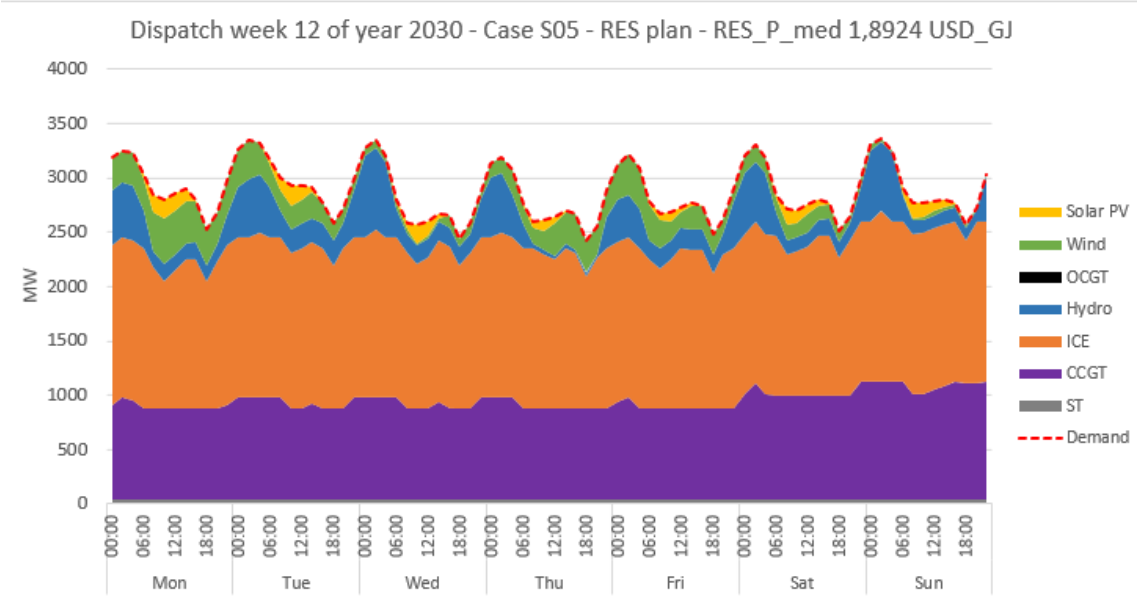
3000
2500
2000
1500
1000
500
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Solar PV
Wind
Hydro
ICE
CCGT
Demand


Dispatch week 12 of year 2030 - S04 - Optimal - RES_P_
MW
4000
3500
3000
2500
2000
1500
1000
500
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Wind
Hydro
ICE
CCGT
Demand

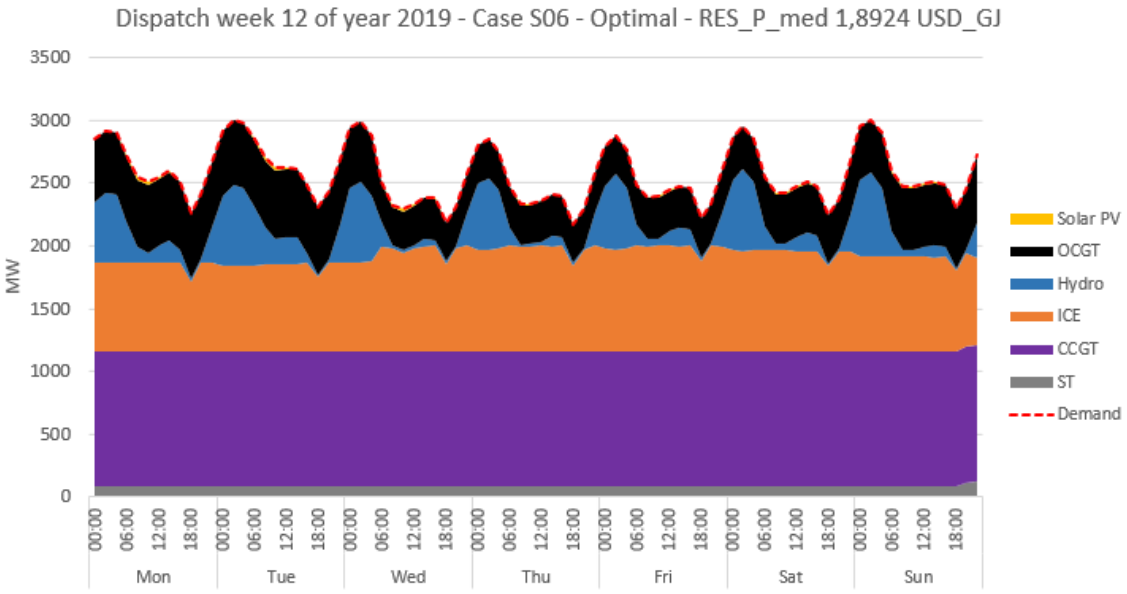
**Appendix 13** Azerbaijan Plexos Simulation RES plan with updated gas price of 1,89 USD/GJ

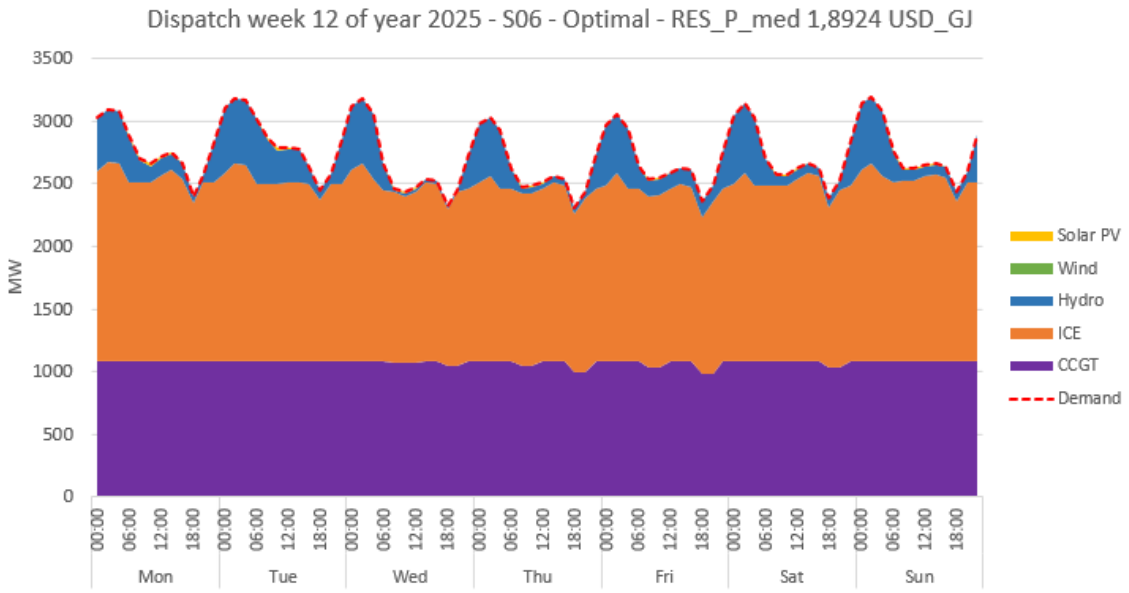


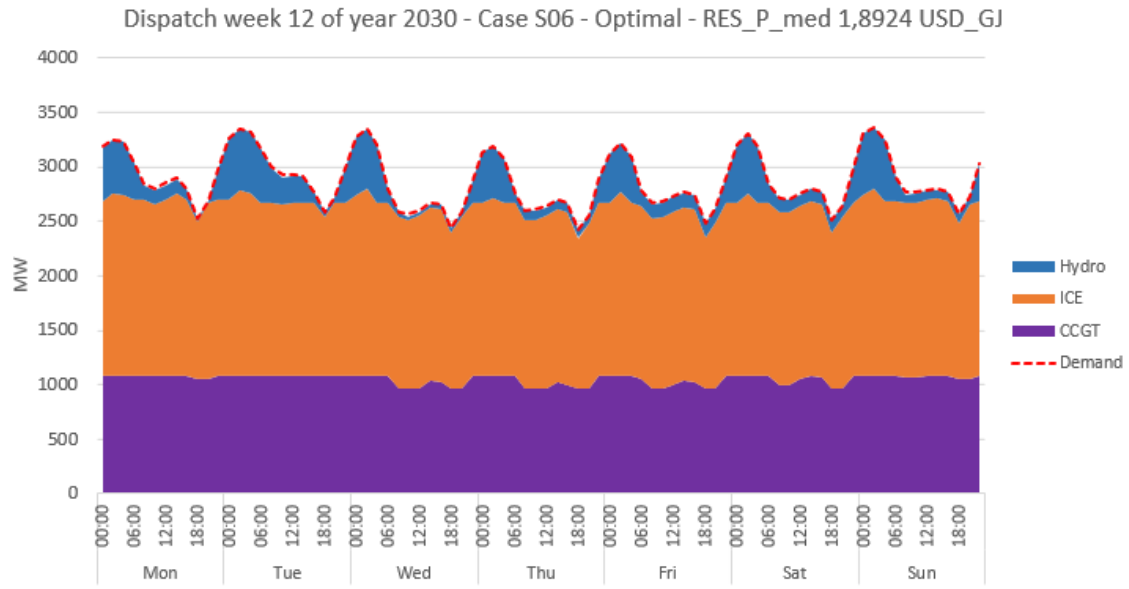






**Appendix 14** Azerbaijan Plexos Simulation Optimal RES plan with updated gas price of 1,89 USD/GJ




Dispatch week 12 of year 2025 - S06 - Optimal - RES_P_med 1,8924 USD_GJ
MW
3500
3000
2500
2000
1500
1000
500
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Solar PV
Wind
Hydro
ICE
CCGT
Demand


Dispatch week 12 of year 2030 - Case S06 - Optimal - RES_P_med 1,8924 USD_GJ
MW
4000
3500
3000
2500
2000
1500
1000
500
0
00:00
06:00
12:00
18:00
Mon
Tue
Wed
Thu
Fri
Sat
Sun
Hydro
ICE
CCGT
Demand

**Appendix 15** Interview 17.6.2019 and 1.7.2019 with Head of Sales in Nokia SECA area

**General Questions:**

- Your company and position?
  Nokia & Market Unit Head SECA

- What countries are you working with?
  Countries in Central Asia

- Why are some Central Asia countries more attractive than others?

  Function of political environment and the volumes of the population. Development phases of the countries in Central Asia.

- What are the key points of making business in Central Asia countries?
  Competitive environment and political relations with the right people.

- How do you win the customers over?

  Must build the relationship on all levels especially on politics. Balanced between political factors and work your way up to politics.

- How long took it to gain the customers trust?

  Trust is given not asked.

- What kind of feeling does central Asia have about Finland for making business. Advantages and disadvantages?

  Finnish people are respected due to their rightfulness. Finland is seen as a neutral partner

**PESTEL Questions**

**Political factors:**

- What is the role of the government in business of these countries?
  Private operators in Uzbekistan.
  Uzbek prime minister.

- Can you describe the decision-making culture in these countries?
  Byrokratic and complicated. Nokia is doing well with “corruption”. Finnish companies tend to have 0% corruption.

- How stable is the political environment?

Uzbekistan little bit worries. Azerbaijan no real change expected.

- Describe the perception and influence of different world powers (EU, Russia, China, USA) on business environment.
  Huawei challenge gives Nokia a great opportunity. Russia has a big impact in these countries. Balance risk between Europe and china. China vs US

- Could you describe the Foreign direct investment policy?
  Uzbekistan: Newly formed, no R&D there to be planned
  Azerbaijan: Heavily investing from Azerbaijan

- What is importance of Finnish political representatives and embassy's to help open the markets?
  Embassy.
  The importance is huge, especially from embassy's office as they are business minded to help the companies succeed in these countries and be able to provide a key partnership between Finland and Central Asia countries.

**Legal factors:**

- Can you describe the problems post by corruption?
  It is deeply integrated in the culture of these countries in general

- How do your company deal with corruption?
  Walk out of the cases if corruption appears. Nokia has been selected multiple times as most ethical company of the year. Nokia has zero corruption acceptance.

- How is it to handle contracts in these countries?
  No specific things for handling the contracts, customers best interest always first on focus. There is government/political side of the contracts of course.

- What is the contract negotiation phase like?
  Similar as any government organization, normal legal way.

- Do they follow the contract terms or is it likely to be negotiated after signing?

  Yes, ethical in contract terms.

**Economic factors:**

- Exchange rates

  Careful with these ones, value is lost here easily. Nokia works with 85% pre-payment and the customers are not allowed to do currency conversion. 30 days conversion time for Nokia. Local currency for local service. Minimize the ex-change risks.

- What is the role of international financing and export credit agency?

  Finnvera supports on different projects in these countries, the challenge is how to organize the guarantee. It is important to find the right banks.

- What is the capability of these countries to finance their own investments?

  The countries in Central Asia can finance but condition with terms and conditions needs to take into consideration with risk minimization.

- Usual payment terms?

  Own usual payment terms pay in Soms, it was formerly an issue, one example in the past that had problems with payment terms was Telia.

**Social factors:**

- What is the main interest for the population in these countries when it comes to the development.

  It really depends on the city, like Tashkent is well developed, but in rural areas there are no communication opportunities, power outages exist and sometimes even no clean water. No high education in these rural areas. The annual income is poor usually in Central Asian countries.

- Level of education in these countries?

  Depending where you are in the country, but as earlier pointed out, poor compared to Finland.

**Technological factors:**

- Can you describe the technological level of the infrastructure in these countries?

  Less power cuts in Tashkent than in India. Again, not as evolutionary as western world.

**Environmental factors:**

- Please describe the general environmental problems in these countries and the level of environmental awareness.

  Soviet time problems, old waste and environmental awareness is high. Tashkent is very clean.

- How do you see the corporates responsibility?

  International companies tend to have good responsibility. Local companies have very different approach.