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Title	**Corporate Venturing for Swiss SMEs in the energy sector**
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Abstract German
Der Schweizer Energiesektor befindet sich in einem Wandel. Mit der Energiestrategie 2050 verfolgt der Bund ehrgeizige Ziele um den Klimawandel einzudämmen und die Schweiz nachhaltig zu positionieren. Um dieses Ziel zu erreichen, sind politische Maßnahmen wie Regulierungen und Subventionen sowie technologische Innovationen, die neue und effizientere Methoden der Energiegewinnung und -verarbeitung ermöglichen, notwendig. Die Beiträge des privaten Sektors sind grundlegend für den notwendigen Fortschritt in diesem Bereich. Um die Schaffung von Innovationen zu maximieren, ist die Beteiligung aller Marktteilnehmer, von großen Unternehmen bis hin zu kleinen, entscheidend.

Diese Arbeit widmet sich speziell den kleinen bis mittelgrossen Unternehmen (KMU). Insbesondere KMUs im Bereich der Energieversorgung weisen bei bestimmten Themen, wie Digitalisierung, eine grosse Wissenslücke auf. In dieser Arbeit wird untersucht, ob Corporate Venturing ein geeignetes Instrument ist, um die Wissenslücke von Schweizer KMU zu schließen und gleichzeitig Innovationen zu fördern. Dazu wird die folgende Forschungsfrage gestellt: «Wie können Schweizer KMU im Energiesektor erfolgreich Corporate Venturing nutzen?»

Durch eine Literaturrecherche kann der Begriff Corporate Venturing definiert werden. Dabei wird der Fokus auf die Gruppe der Venturing Allianzen gelegt, da diese eine enge Zusammenarbeit der beiden Parteien vorsieht. Die beiden Unterkategorien, direkte Minderheitsbeteiligung und Joint Venture, sind dabei die vielversprechendsten.

Es wird ausserdem eine Literaturrecherche über den Schweizer Energiesektor gemacht. Dabei zeichnet sich ein Bild eines stark regulierten Marktes ab. Desweitern zeigt sich, dass der Grossteil der Unternehmen und des Kapitals sich in öffentlicher Hand befindet.

Nach der Literaturrecherche beginnt die eigentliche empirische Forschung. Dazu werden Vertreter von KMUs als auch Startups, welche in der Energiebranche tätig sind, befragt. Das Ziel ist die Pains & Gains der jeweiligen Parteien zu verstehen. In der Auswertung der Interviews konnten gewisse Gemeinsamkeiten zwischen KMUs und Startups festgestellt werden. Die befragten KMUs haben alle ähnliche Stärken und Schwächen, wogegen es bei den Startups stark vom Produkt und dem Hintergrund abhängt. Die KMUs sind grundsätzlich an Corporate Venturing Möglichkeiten interessiert, ein paar wenige der Interviewten gab sogar

an bereits von Corporate Venturing Gebrauch zu machen. Bei den Startups stoss der Gedanke von einem lokalen KMU als Investor mehrheitlich auf Ablehnung. Die meisten Startups sind auf schnelle Skalierung aus und orientieren sich daher eher an Capital Venture Funds und Grossunternehmen.

In einem letzten Schritt werden die durch die in den Interviews gewonnen Erkenntnisse Venturing Strategien formuliert. Dabei zeigt sich, das direkte Minderheitsbeteiligung und Joint Venture beides mögliche Ansätze für KMUs sind, erfolgreich Wissenslücken zu schliessen und Innovationen ins Unternehmen zu holen.

Abstract English

The Swiss energy sector is undergoing a transformation. With the Energy Strategy 2050, the federal government is pursuing ambitious goals to curb climate change and position Switzerland sustainably. To achieve this goal, policy measures such as regulations and subsidies as well as technological innovations that enable new and more efficient methods of energy production and processing are necessary. Private sector contributions are fundamental to the necessary progress in this area. To maximize the creation of innovations, the participation of all market participants, from large companies to small ones, is critical.

This work is specifically dedicated to small to medium sized enterprises (SMEs). In particular, SMEs in the energy supply sector have a large knowledge gap on certain topics, such as digitalization. This thesis investigates whether corporate venturing is a suitable instrument to close the knowledge gap of Swiss SMEs and to promote innovation at the same time. Therefore, the following research question is posed: "How can Swiss SMEs in the energy sector successfully use corporate venturing?"

Through a literature review, the term corporate venturing can be defined. The focus is placed on the group of venturing alliances, as this provides for close cooperation between the two parties. The two subcategories, direct minority participation and joint venture, are the most promising.

A literature research of the Swiss energy sector is also conducted. A picture of a highly regulated market emerges. Furthermore, the majority of companies and capital are publicly owned.

After the literature review, the actual empirical research begins. For this purpose, representatives of SMEs as well as startups, which are active in the energy sector, will be interviewed. The goal is to understand the Pains & Gains of the respective parties. In the analysis of the interviews, certain commonalities between SMEs and startups could be identified. The interviewed SMEs all have similar strengths and weaknesses, whereas for the startups it strongly depends on the product and the background. The SMEs are generally interested in corporate venturing opportunities, a few of the interviewees even stated that they already make use of corporate venturing. Among the startups, the idea of a local SME as an investor met with rejection by the majority. Most of the startups are looking for fast scaling and therefore rather orient themselves towards capital venture funds and large companies.

In a final step, venturing strategies are formulated based on the insights gained in the interviews. This shows that direct minority participation and joint ventures are both possible approaches for SMEs to successfully close knowledge gaps and bring innovations into the company.

Place, date Horw, 11.06.2021

Preface

This thesis is the final result of my four years study at the Hochschule Luzern (HSLU). Several persons have contributed to its development and refinement in one way or another. In this preface, I would like to take the opportunity to thank them.

To begin with, I would like to thank my professor Dr. Bastian Widenmayer for his continuous support, encouragement, and valuable ideas and guiding me towards formulating the thesis foundations with his challenging comments and amazing intellectual curiosity that he shared with me during the process.

Secondly, a sincere thank you to my industrial coach, Michael Paetsch, for his mentoring during this thesis.

Thirdly, I would like to express my gratitude to all the interviewees for taking part in the interviews. Your insightful comments and ideas helped me a lot to get deeper insights about the topic.

Fourthly, I would like to give special thanks to my colleagues for your extraordinary cooperation. It was always helpful to bat ideas about my thesis around with you.

Moreover, I would like to thank the HSLU for giving me the opportunity to learn and increase my horizon. I can look back on 4 incredible years, with a lot of learnings and great experiences.

Finally, I would like to express the deepest gratitude to my girlfriend and life partner, Supitchaya, who gave me the support, help, and endless motivation. She stood by my side and provided me with the support I needed to complete this thesis. Her love and care were an essential input for this study. As well as everyone in my family, for providing the necessary support and for keeping up the patience during the relatively long process of accomplishing this thesis.

Thank you one more time to all of you for your unwavering support. – this great journey would not have been possible without having all of you on board.

Cyrril Portmann

Horw, 11.06.2021

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List of abbreviations and acronyms

HSLU	Hochschule Luzern
Lucerne UASA	Lucerne University of Applied Sciences and Arts
SME	Small and Medium-sized Enterprise
CV	Corporate Venturing
CVC	Corporate Venture Capital
ICV	Internal Corporate Venturing
ECV	External Corporate Venturing
VA	Venturing Alliance
SFOE	Swiss Federal Office of Energie
DETEC	Federal Department of the Environment, Transport, Energy and Communications
CORE	Energy Research Commission
ElCom	Federal Electricity Commission
EVU	Public utility (Energieversorgungsunternehmen)

1 Introduction

1.1 Initial Situation

The Swiss energy sector is currently confronted with significant changes. Climate change and the energy transition, overcapacities in power plants, the market price decline on the public electricity exchanges, exchange rate disadvantages, and the liberalization of the energy sector driven by the EU internal market are the main challenges currently faced by the Swiss energy sector (Postler & Schellinger, 2017, p. 156). The Energy Strategy 2050 of the Swiss Government was accepted by the Swiss electorate on May 21, 2017. The new federal strategy aims to increase energy efficiency and promote the development of renewable energies (SFOE, Swiss Federal Office of Energy, 2021b). To achieve this objective, political measures such as regulations and subsidies and technological innovations that enable new and more efficient energy production and processing methods are necessary. Contributions from the private sector are fundamental to the progress needed in this area. To maximize the creation of innovations, the participation of all market players, from large companies to small and medium-sized enterprises (SMEs), is crucial.

There are various methods of how to foster innovation and facilitate growth. The most straightforward approach is closed innovation, where all the intellectual property is developed within the company itself. This implies that the company has to rely on the creation of its own R&D department entirely. Therefore, it can be more challenging to keep up with the fast-moving technology trends of today because all the knowledge has to be created in-house. This method also exposes the corporation to the thread of intellectual property leaks, resulting in a possible loss of competitive advantages (Chesbrough, 2003, p. 41). That is why leading

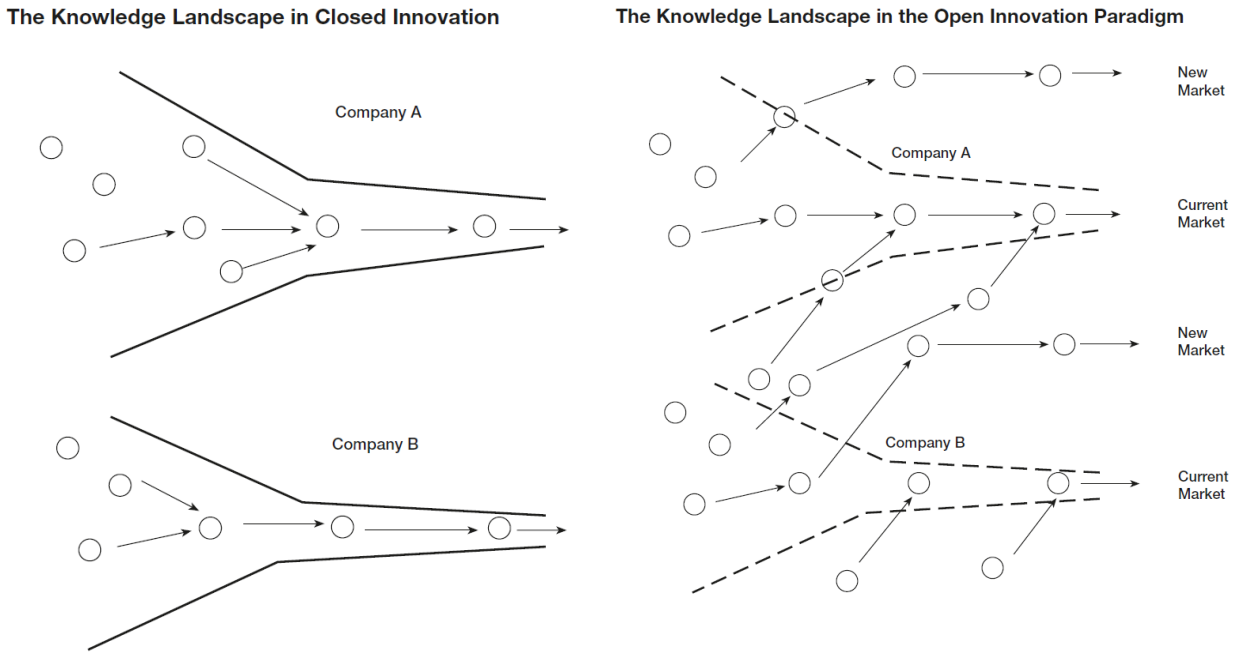

Figure 1 - Closed & Open Innovation Knowledge Landscape (adopted by Chesbrough, 2003, p. 31 - 44)

international enterprises have turned their approaches to open innovation. Henry Chesbrough describes an open innovation knowledge landscape as whereas "valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well" (Chesbrough, 2003, p. 43).

In his research, Chesbrough mentions corporates investing in ventures to access new knowledge (Chesbrough, 2003, p. 185). Corporate venturing (CV) comes in different forms and can have different goals, depending on the investees' strategies. In his work, Markku Maula lists different objectives of corporate venturing, financial profit in the form of return on investment being one of them. Furthermore, Maula mentions exposure to new technologies, business relationships, and markets (Maula, 2001, p. 25). CV offers a quick and successful way to access a pool of the latest innovation. Nevertheless, all of the above-mentioned literature talk about multinational corporations that have been using CV for years, but there is little literature about CV for SMEs. Therefore, this paper examines whether CV is a suitable method for Swiss SMEs in the energy sector to promote innovation in order to contribute to the Energy Strategy 2050.

1.2 Problem definition

The Swiss energy sector is a conservative market and heavily based on infrastructure. Furthermore, the energy market is a stable business, and companies have enjoyed successful financial years over the past decades. Moreover, the energy sector is one of the last areas in which state monopolies are granted. Although this makes sense in grid operations, this protection reduces the company's need for innovation because it offers them a guaranteed market. As a result, not many companies within the energy sector felt compelled to implement innovations and new technologies. Especially, SMEs in the area of energy utility have a gap in terms of knowledge and are threatened to fall behind the bigger corporates in terms of digitization. This paper aims to investigate whether corporate venturing is a suitable tool for filling the knowledge gap of Swiss SMEs while also promoting innovation.

1.3 Research Goal

The research goal can be conducted from the problem definition. The overarching project goals are analyzing the corporate venture possibilities for Swiss SMEs in the energy sector. Therefore, the main research question reads as follows:

Main research question

How can Swiss SMEs in the energy sector successfully use corporate venturing?

To answer this question, it is first necessary to understand the underlying concepts. To do this, further exploration will be carried out in the research sub-question. The first step is to take a closer look at the concept of corporate venturing. The following question serves this purpose:

1. Research sub-question

What are the available definitions of corporate venturing?

The answer to this sub-question will establish the foundation for this paper. The next step is to define the environment in which the thesis operates. Therefore, the current status of the Swiss energy sector will be analyzed, and the most critical stakeholders presented.

2. Research sub-question

What is the current situation in the Swiss energy market, and who are the relevant participants?

The answer creates an overview of the status quo in the energy sector, its players, and their relationships. Furthermore, it gives an understanding of the regulations and of how those affect the different participants in the sector. Based on this, the paper will focus on the SMEs in the sector and conduct interviews with their representatives to gather insights into their strategies and goals regarding innovation. This helps to understand the pains and gains of a SME, which in turn is vital for developing a CV strategy. Furthermore, the perspective of startups is also examined, as they are possible targets of corporate venturing and therefore also bring their own pains and gains. Hence, the following research sub-question is:

3. Research sub-question

What are the pains and gains of SMEs and startups?

The insights gained from this question enable a better understanding of the different company viewpoints, especially with regard to the topic of corporate venturing. The final step is to examine what a potential match might look like and develop a framework for a successful corporate venturing process. SMEs have limited resources, which increases the risk of an adverse selection. Therefore, the framework should provide a way, to better evaluate possible venture targets. Thus, the fourth research sub-question is:

4. Research sub-question

How could a corporate venturing process for a SME look like?

From the findings of all research sub-questions, the answer to the main research question can be derived. In the next chapter, the scientific approach of this paper is outlined and the reseach methods explained.

2 Methodology

The following subchapters define the research design to be used as the basis for achieving the objectives and answering the research questions.

2.1 Research Approach

In this paper the goal is to create a process model in which Swiss SMEs can successfully take advantage of corporate venturing. To establish this CV process model, the investigation conducted follows a predetermined research process. This process makes use of an inductive research approach to establish a general hypothesis. An inductive approach derives from a specific observation on to a generality.

This inductive approach is linked with qualitative research. Qualitative research is concerned with examining individual cases in detail and evaluating them interpretatively. In this paper, the qualitative approach is used to examine specific SMEs and startups and, based on this, formulate a generally applicable process for CV.

2.2 Research Process

The research process follows the model of Froschauer and Lueger (2020), as can be seen in Figure 2. The first stage, called the planning stage, is about defining the research topic and laying the foundation for the further procedure. In this stage, the research questions are formed and the research is organized.

After completing the first stage, the transition is made into the orientation stage. During the orientation stage, the fundamentals of the respective research areas are laid out and an overview of the subject matter is created.

In the next phase, the actual research is started. First of all, the theoretical knowledge is acquired by means of literature research, on which the empirical research later builds. This research phase is carried out in several successive cycles. At the end of each cycle, the research done is analyzed. The knowledge gained from this is incorporated into the next cycle, thus creating an incremental approach. After establishing the theoretical foundation through the literature, the empirical research is started.

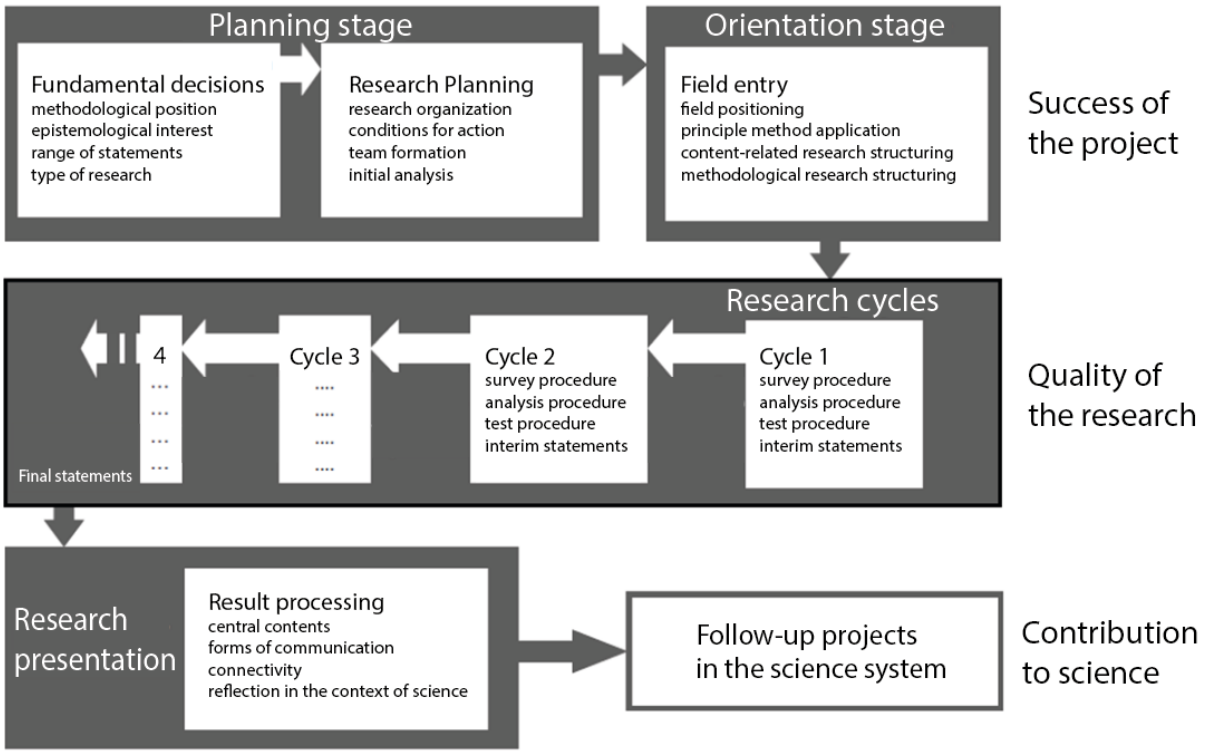

Figure 2 - Research process (adopted fromFroschauer & Lueger, 2020, p. 27)

For this purpose, representatives of SMEs and startups were interviewed. Due to the COVID-19 situation, all interviews were held as an online video call. The interview was conducted according to the model in Rainer Schnell's *Methoden der empirischen Sozialforschung* (2018, pp. 295–355) as can be seen in Figure 3. A semi-structured interview situation was created in which the interviewer can ask the predefined questions at his judgment. A pre-prepared interview template was used for this purpose (Schnell, 2018, p. 295). The questions used are open-ended; in other words, an answer in the respondent's own words is expected and no possible answers are suggested. This open-ended question was used in order to avoid limiting the experts' answers. This allows them to share knowledge outside the questioner's rada(Schnell, 2018, p. 303). Furthermore, after each interview, the interviews' insights are gathered, analyzed, and used to adapt the question for the following interview. All interviews were conducted either in German, as this was the native language of the representative in the majority of cases, or in English. This is to ensure that the experts understand the questions and can express themselves as desired without language barriers. The participating companies and representatives were anonymized and no transcript is provided, as confidential information such as pending transactions were mentioned in the course of the conversations.

The goal of these interviews is to get better insights in the pains and gains of the interviewees and their business. From this, the strengths and weaknesses and their standpoint on CV can be derived. Those insights allow starting a new and final cycle which target is to define a possible CV process for SMEs. In this cycle all the previous research comes together to a final result.

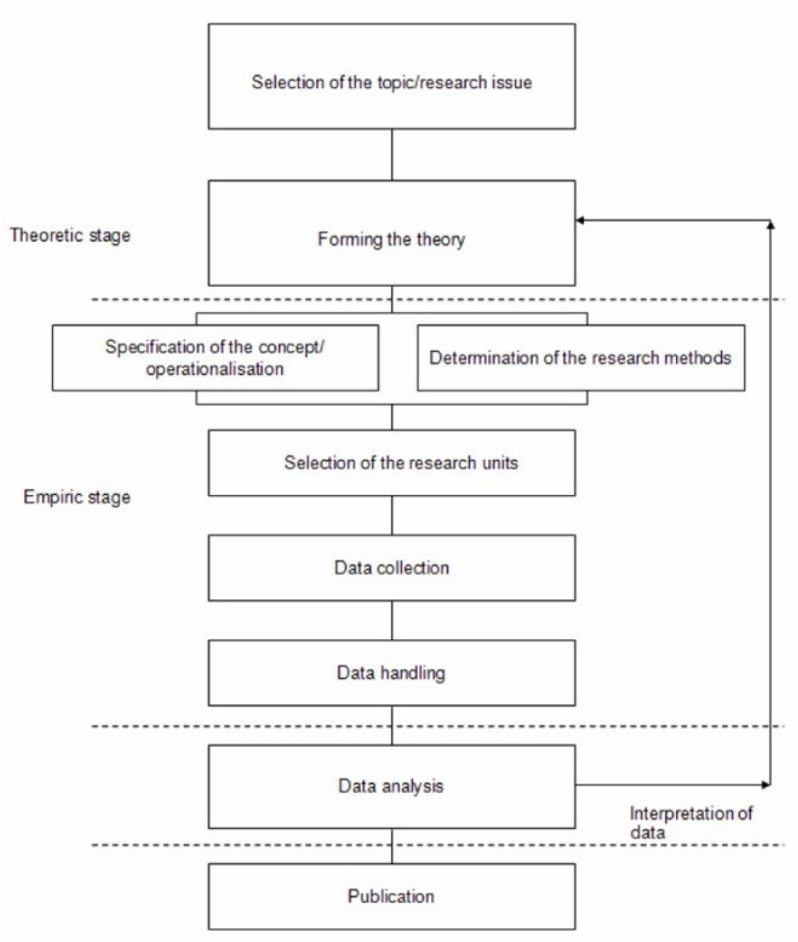

Figure 3 - Interview model (Schnell, 2018, p. 3)

The next step is the presentation stage, in which all the findings are summarized. After the results have been structured, they are reflected upon. Furthermore, the scientific methodology and the overall working process are evaluated. As a final and concluding step, an outlook is given on where further research could be conducted.

3 Corporate Venturing

In this chapter, the various definitions of CV will be looked at, which creates a theoretical understanding of CV, which in turn serves as a foundation for the thesis. Moreover, with the content of this chapter, the first research sub-question can be answered. Through literature research, the term CV can be defined, and the type of CV that will be used as a method for SMEs can be determined.

3.1 Definitions of Corporate Venturing

The literature provides serval definitions for CV. In his research, Thomas Keil describes CV "as the overall activity of building new businesses in an established organization. A new business may involve new markets, new technology, products, or services" (Keil, 2000, p. 9). This is similar to the definition of P. Sharma and J. Chrisman, who say CV involves entrepreneurial efforts in which established business organizations invest in and/or create new businesses (Sharma & Chrisman, 1999, pp. 11–28). Nevertheless, according to Block and MacMillian, CV has to be distinguished from general business development activities. Business development is geared towards the incremental development of existing businesses, whereas CV is non-incremental and aims to develop new product-market frameworks (Block & MacMillan, 1993). An important differentiating factor is the perspective from which CV is viewed. On one hand, CV can be viewed from the perspective of the corporate that invests in a venture. On the other hand, one can also take a startup's perspective, which accepts corporate venture capital (CVC) as funding (Maula, 2001, p. 9). Besides the perspective, the objective of CV may also differ. Thus, the reasons for CV could be of financial nature, or it may address a new business opportunity. In their research, Siegel et al. (1988) made the following findings. Most CVs are driven by financial interests, closely followed by developing a new technology or market. The other goals in Figure 4 have a lower significance.

Objective	Mean	SD
Exposure to new technologies and markets	3.12	1.01
Potential to manufacture or market new products	2.39	1.15
Potential to improve manufacturing processes	1.88	0.92
Potential to acquire companies	2.13	0.14
Return on investment	3.38	0.80

Scale: 1, irrelevant; 2, desirable; 3, important; 4, major objective.

Figure 4 - Objectives of corporate venturing (Siegel et al., 1988, p. 236)

Furthermore, a distinction often made in publications is between internal and external corporate venturing. Internal corporate venturing (ICV) is described as "firms' attempts to enter different

markets or develop substantially different products from those of its existing base business by setting up a separate entity within the existing organisational body" (Roberts & Berry, 1985citiced by). Keil (2000) refers to "venturing activities in which the ventures are kept within the established organization. The locus of these ventures may be existing businesses or a dedicated venture organization such as a new venture division" (Keil, 2000, p. 10). External corporate venturing (ECV), on the other hand, "refers to corporate venturing activities that result in the creation of semi-autonomous or autonomous organizational entities that reside outside the existing organization" (Sharma & Chrisman, 1999, p. 19). ECV activities can be further subdivided into subgroups, which in turn have different categories themself. In his work, Keil (2000, p. 109) talks about three subgroups of ECV, as can be seen in Figure 5. Those subgroups are corporate venture capital, venturing alliances, and transformational arrangements.

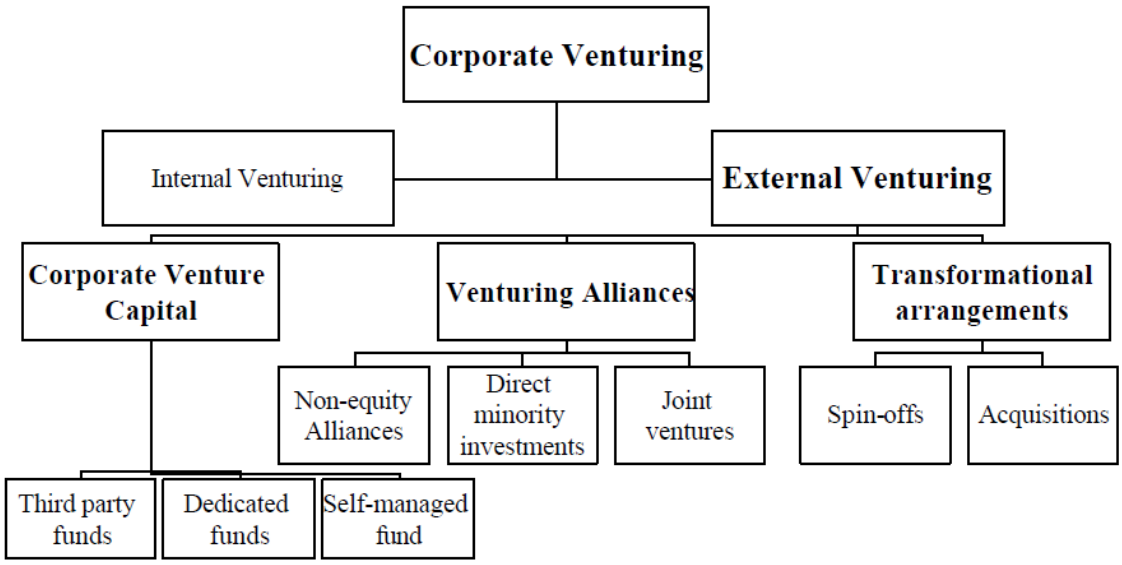

Figure 5 – External Corporate Venturing Categories (Keil, 2000, p. 109)

For the first group, corporate venture capital, Keil draws the link to private venture capital firms, which focus on the financial return of their investments as their business model. Despite the different organizational structures, CVC activities have in common that forming a relationship with a targeted venture is mainly through the investment itself. That differs from the second group, venturing alliances (VA), which focus more on building a relationship with the venture through solid cooperation. Thereby, VA are not providing capital to get financial returns, like CVC, but rather aim for in-depth cooperation between the two allying parties. This statement is fundamental for this paper and essential to find the right approach to the CV process for a SME. Included in this group are direct minority investments, non-equity alliances, and joint ventures. The third group is called transformational arrangements and is described as activities that "either internal ventures are externalized, or external or independent ventures are internalized" (Keil, 2000, p. 110).

This definition showed the various categories of CV and their strategic objectives. Since the focus of this paper is on CV as a tool for strengthening knowledge and innovation capabilities for SMEs, the next chapter will elaborate further on the VA category.

3.2 Venturing Alliances

Based on the definition of Keil (2000), VA is where the two parties work together with each other the closest. Consequently, it is also the CV category where the most significant knowledge transfer happens. Therefore, that is where it becomes interesting for a SME looking for new inputs for innovation. However, "compared to corporate venture capital, the phenomenon of venturing alliances is somewhat more difficult to delineate. Most corporations are involved in hundreds of alliances that may be geared to different purposes. In many cases it is difficult to identify if a relationship is focused on developing a new business or rather strengthening an existing business" (Keil, 2000, p. 118).

3.2.1 Non-equity alliances

As previously mentioned, the VA group consists of three subcategories. Non-equity alliances do not involve any equity investments, nor do they involve creating a new organizational structure. "Rather, it is part of normal business development activity and follows the well-researched logic of strategic alliances" (Keil, 2000, p. 121). The strategic objectives are more of an incremental nature. Thereby, the borders between normal business development and non-equity alliances are elusive. Hence, this approach is less interesting for the research topic of this paper concerning the SMEs in the energy sector.

3.2.2 Direct minority investments

Another subcategory is direct minority investments, which are defined as "alliances in which […] the corporation buys a significant part of the share capital of the partner firm" (Keil, 2000, p. 118). This is reminiscent of CVC; both have an investment as the foundation for the partnership. However, CVC's primary focus is the financial return of the investment; the investment itself and the strategical objective of the company often do not overlap. On the contrary, direct minority investments often seek exactly this strategic match. These strategic objectives can be access to new technologies or markets. "Benefits may be more direct and less financially motivated than in corporate venture capital investments. Investments are significantly higher than most venture capital investments as access and control rights play a more important role" (Keil, 2000, p. 119). Control can be a key factor if a company does not want to share a new technology with its competitors. Through control over the venture, conditions can be set for how the knowledge is to be handled. However, reference must again be made to Chesbrough (2003) and his work on open innovation. The company may deprive

the venture of its full potential by imposing too many restrictions. By collaborating with other firms, the venture could test and improve its technology, which in turn benefits the invested company. For the SMEs in the focus of this paper, this matter is critical. Because they are dependent on external innovation power, they must be careful not to nip this innovative strength in the bud by imposing too many restrictions.

3.2.3 Joint ventures

The third of the three subcategories is joint ventures. The difference between a joint venture and a direct minority investment is that a new legal entity is formed in a joint venture. Both of the alliance partners own this new organization, which allows the partners to share the risk. Moreover, Keil (2000, p. 123) states that joint ventures likely used to cooperate with larger companies, whereas minority investments often target smaller firms, especially startups. Furthermore, a joint venture is not limited to two parties; instead, ventures with more partners can be formed. Joint ventures have the advantage that they are formed for a clearly defined purpose and therefore, the direction and strategic objective are clear. As a result, the joint venture partners can better align their allocated resources with the target in order to maximize success. In addition, joint ventures have the advantage of forming a new entity outside an existing company, which gives it more freedom for decision-making. Then again, joint ventures are an entity independently and might develop in a direction the mother company did not intend. After all, it is harder to terminate a joint venture than a direct minority investment (Keil, 2000).

3.3 Conclusion

As mentioned before, this paper deals with the case that SMEs use CV as a tool to foster innovation. In order to drive innovation and acquire new knowledge, a close collaboration with the venture is crucial. Therefore, the choice is narrowed down to the category of VA. Within this category, direct minority investments, as well as joint ventures, are attractive from an innovation acceleration standpoint. In the end, it depends on the objective and the partner. A direct minority investment is more plausible when partnering with a newly founded startup, which brings new technology into the partnership. This is because the startup doesn’t have the resources yet to provide to a joint venture. Furthermore, through a direct minority investment, the SME can help the startup grow by providing funding, sales channels, and their network of partners and suppliers. A joint venture makes more sense, when the SME wants to partner with already established companies. In that case, all the partners can allocate a part of their resources to research and develop together in order to push a new technology or market.

In the next chapter, the Swiss energy sector is examined and the most important players are analyzed. Together with this chapter, it serves as a theoretical foundation for defining the CV process for SMEs.

4 Swiss Energy Sector

The Swiss energy sector has its peculiarity. “Switzerland has been referred to as the ‘water tower’ of Europe; indeed, hydropower accounts for about 59 per cent of electricity production in the country, while nuclear power accounts for about 32.8 per cent. Other conventional thermal and ‘new’ renewable energies, including solar, wood, biomass, wind, geothermal and ambient heat, account for about 8.2 per cent” (Schwartz, 2017, p. 391).

The increasing liberalization of the energy markets leads to a profound change in investor behavior, an increasing dynamization of business models, and a greater choice of technologies reaching market maturity. This development is in tension with the longevity of infrastructure assets. As a result, there is a growing awareness that, complementary to the technical and engineering aspects, the interaction of the energy system with a comprehensive final element, the dynamic market environment, must be understood. This is strongly determined by economic, regulatory and political conditions (Energy Research Commission [CORE], 2016, pp. 30–31).

On May 21.2017, the Energy Strategy 2050 passed the public vote, which implements broad ramifications. The new Energy Act introduces a number of measures aimed, in particular, at reducing energy consumption, increasing energy efficiency, and phase out nuclear energy. Existing nuclear power plants will continue to operate as long as they are considered safe, but no additional ones must be built. The measures are a radical step in the direction of renewable energy, considering the high dependence of Switzerland on nuclear energy (Schwartz, 2017). Especially in the winter, when Switzerland's hydro reservoirs are running low, nuclear power makes up 45% of the power generation. In recent years the net export balance, the difference between the electricity exports in summer and the imports in winter, has been decreasing. This calls for government action, as it is a matter that transcends the national borders of Switzerland and involves all neighboring countries. On top of that, there is a need to regulate and define policies for the energy supply and its warranty within Switzerland itself. In the following subchapters, the regulators, industry participants and research programs will be examined. Switzerland produces neither oil nor gas. As such, this thesis focuses on the electricity sector.

4.1 Participants

Various players are active in the Swiss energy sector. These can be categorized into several groups. Firstly, the Swiss government and its commissions create the political and legal framework of the Swiss energy market. They are essential for giving the direction in which the Swiss energy market should develop. Furthermore, there are many active associations in the swiss energy market which pursue different interests and goals. There are economic associations, energy associations, and environmental associations. These associations all

contribute their share to the swiss energy ecosystem. Another important group are the research institutions and research programs. They are constantly researching the latest topics and their results bring innovations and new technologies to the market. They are presented in more detail in this paper, as they also significantly influence the promotion of innovation, which benefits Swiss SMEs. Last but not least, there are of course the companies that are active in the energy sector. These are the driving force behind the whole market by offering their products and services to customers.

4.1.1 Regulatory Authorities

To understand how regulations are made in Switzerland, it is essential to look at Switzerland's legislation system. “Switzerland is a federal state comprising 26 cantons, with a high degree of autonomy and each with a constitution and an assembly. Powers are devolved to the lowest possible state level, following the subsidiarity principle, and the cantons and communes implement most of the federal policies. Vertical cooperation is maintained through close consultation between the Federal Council (government) and the cantons for policy and law-making processes. All policies not explicitly assigned to the federal level are the responsibility of cantons” (International Energy Agency [IEA], 2018, p. 17). While the subsidiarity principle increases the time, it takes to implement legislative changes, having the majority of the population behind it increases the acceptability and stability of the change.

“The Swiss energy institutional framework comprises a number of federal offices, regulatory authorities and specialised agencies. The Swiss Federal Office of Energy (SFOE) is the office responsible for all questions relating to energy supply and energy use. It sits under the Federal Department of the Environment, Transport, Energy and Communications (DETEC), which is responsible for ensuring sustainable development and the provision of basic public services in the interests of society, the environment and the economy” (Schwartz, 2017, pp. 391–392). In other words, the SFOE is responsible for the practical management of national energy policy within DETEC. Based on their responsibilities, the SFOE, Swiss Federal Office of Energy (2021d):

a) Creates the prerequisites for a sufficient, crisis-proof, broad-based, economic and sustainable energy supply.
b) Ensures the maintenance of high safety standards in the production, transport and utilisation of energy.
c) Creates the necessary conditions for efficient electricity and gas markets and an adapted infrastructure.
d) Actively promotes efficient energy use, an increase in the share of renewable energy and a reduction in CO2 emissions.

e) Promotes and coordinates national energy research and supports the development of new markets for sustainable energy use and supply.

The SFOE is supported by a number of commissions. The Energy Research Commission (CORE) assists with defining the policies regarding energy research and development. Other commissions include the Commission for Radioactive Waste Disposal, the Administrative Commission of the Decommissioning Fund and the Disposal Fund for Nuclear Installations, the Nuclear Safety Commission and the Commission for Connection Conditions for Renewables Energies. Yet, another crucial commison is the Federal Electricity Commission (ElCom). ElCom is responsible for "monitoring compliance with the Federal Electricity Act and the Federal Energy Act, taking all necessary related decisions and pronouncing rulings where required" (Schwartz, 2017, p. 393). The specific duties of ElCom are to:

a) verify the electricity tariffs of customers who do not have free access to the network, as well as the remuneration paid for the input of electricity into the grid. It is authorized to prohibit unjustified increases in electricity prices, and may order the reduction of excessively high tariffs, taking action on the basis of complaints or in its official capacity
b) mediate and pronounce rulings on disputes relating to free access to the electricity network
c) rule on disputes relating to cost-covering remuneration of electricity input that is to be paid to producers of electricity from renewable energy sources
d) monitor supply security and the condition of the electricity networks;
e) in the case of shortfalls in cross-border transmission lines, to regulate the allocation of network capacities and coordinate its activities with the European electricity market regulators
f) ensure that the transmission network is handed over to the national system operator (Swissgrid) according to schedule.

Therefore, ElCom acts as the price regulator in the electricity sector. Small-scale consumers currently do not have the option of choosing their electricity suppliers, thus ElCom supervises the electricity tariffs. On the other hand, large-scale consumers with annual consumption exceeding 100 MWh can freely choose their electricity provider since 2009. This is the closest Switzerland gets to a free, liberal market, as it is the case in Germany since 1998. However, ElCom monitors network use remuneration for all providers, as consumers cannot choose the network (ElCom, 2021). The reason for this is that it makes no sense to have more than one network operator. Each network operator would have to make its own connection to every one of its customers, and if the customer wants to change network operator, the new operator needs

to install its own line as well. In the end, no additional value is created for the end customer. As a result, the network operators maintain a monopoly position. As a result, network operators are to a certain extent protected and do not have the same pressure to innovate as other companies in the industry.

All in all can be said, that the Swiss energy sector is heavily regulated. This is reflected not only in the many regulations, but also in the positioning of the companies. This will be explained in the next subchapter.

4.1.2 Enterprises

The enterprise section is of most interest for this paper, as the SMEs and startups are located in this group of participants. First of all, the definition of an SME must be determined. There are different interpretations. The Federal Statistical Office (2021) defines SMEs by the number of employees, as shown in Table 1. It divides into three categories, micro, small, and medium enterprises.

Size category	Amount of employees
Micro Enterprises	**1 to 9 employees**
Small Enterprises	**10 to 49 employees**
Medium-sized Enterprises	**50 to 249 employees**

Table 1 - Criteria for classification of SMEs according to Federal Statistical Office definition

Another definition is provided by the European Commission (2003). The classification uses the number of employees to define the category too. However, this definition further includes the parameters turnover and balance sheet total, as shown in Table 2. This definition makes less sense concerning the research topic because it is thematically in the energy sector. Many power plant operators have less than 250 employees, but they have a much higher balance sheet total because they manage capital-intensive infrastructure. Consequently, this paper uses only the definition of the Federal Statistical Office.

Company category	Staff headcount	Turnover	or	Balance sheet total
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m		≤ € 10 m
Micro	< 10	≤ € 2 m		≤ € 2 m

Table 2 - Criteria for classification of SMEs according to EU SME definition

Of the 766 enterprises active in the energy sector in 2018, 730 are considered SMEs. Furthermore, a total of 31,114 people were employed in the energy supply sector in 2018. (FSO, 2020) Thus, it is evident that the Swiss SMEs are essential for the future development of the Swiss energy sector and for achieving the goals of the Energy Strategy 2050.

A further distinctive characteristic of the swiss energy sector emerges when analyzing the distribution of share capital. The public sector holds 89.3% of the total capital stock (shares, cooperatives, endowment capital), the private sector 8.1% and other countries 2.6% as is illustrated in Figure 6. The public sector can also be divided into cantons and municipalities, with municipalities accounting for almost one-third of the share capital. With these average values, it should be borne in mind that the private sector has an above-average share of the capital stock in the production and transmission areas and that the public sector is primarily involved in the distribution area. Moreover, it should be noted that numerous electricity companies at the municipal level have no endowment capital and are thus more or less directly involved in municipal finances. As a result, the influence of the public authorities tends to be even stronger than is evident from the purely capital-based participation (SFOE, Swiss Federal Office of Energy, 2020, pp. 43–44).

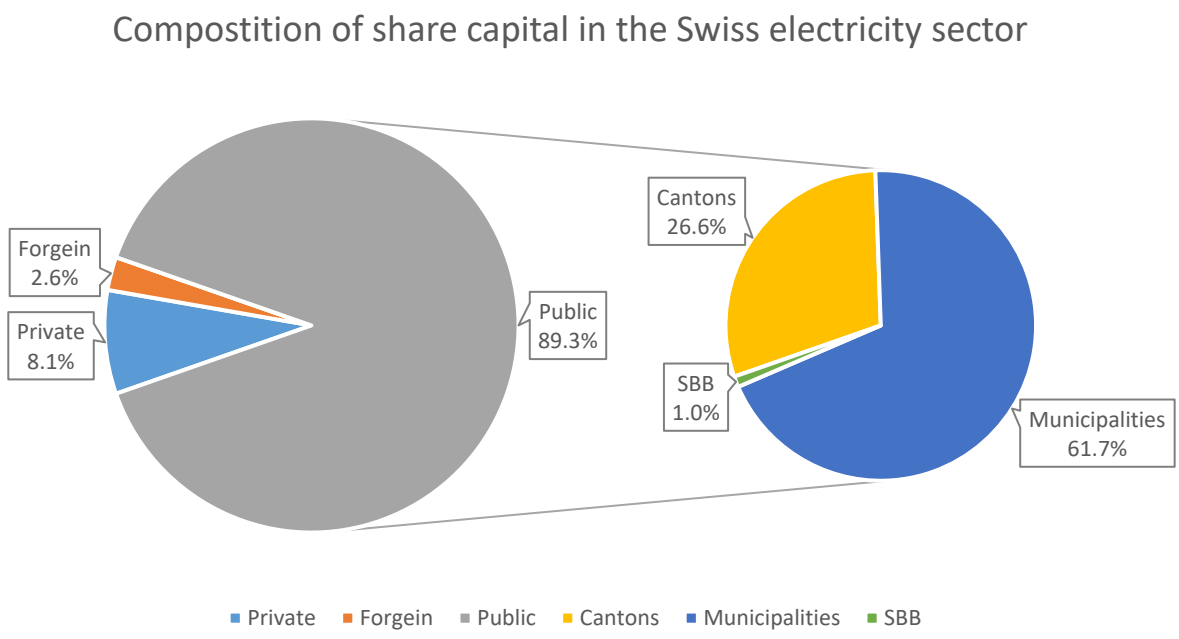

Figure 6 - Composition of share capital in the Swiss electricity sector (SFOE, Swiss Federal Office of Energy, 2020, pp. 43–44)

This is an important finding, as the public authorities often bring their own dynamic to how a company operates. It is worth investigating how this affects the fostering of innovation and the SMEs standpoint on CV. Because of this and the fact that the majority of enterprises are in the public sector, Chapter 5 primarily presents interviews with SMEs that are publicly owned. Most of them are public utilities, so-called “Energieversorgungsunternehmen” (EVU). All companies

in the electricity industry, i.e. the entire supply chain from generation through trading, transmission, such as long-distance transport, and distribution to the consumer, are included under this term.

In a report of Kleinschmidt (2020) for Ernest & Young AG, nine SME-sized EVU are analyzed on their financial performance. The Figure 7 shows, that the average EBITA, as well as the EBIT has been on an upwards trend for years. If compared with the large-sized electricity producer, which had a rough time, especially in the years 2011 -2014, it shows that the smaller EVUs were more persistent. The broad positioning of the smaller utilities in the cross-utility network partly explains the stability of the financial results over this period (Kleinschmidt, 2020, p. 4).

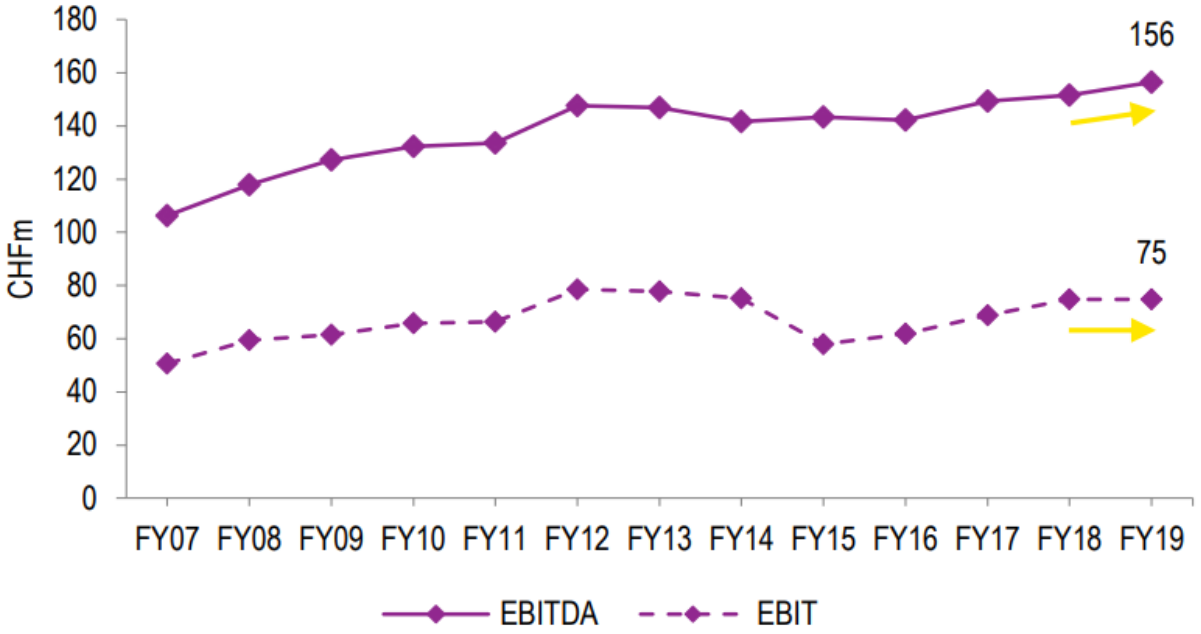

Figure 7 - Financial performance of SME-sized EVUs (Kleinschmidt, 2020, p. 4)

However, this continued stability can be deceptive, as it can lead a company to neglect the promotion of innovation and the adaptation of new technologies. It is therefore of utmost importance to maintain a constant overview of the state of the art. That is where internal research and cooperations with external research programs and institutes come into play.

4.1.3 Research institutions

In addition to companies, research also plays a central role in the Swiss energy sector. According to WIPO (2020), Switzerland is the world's most innovative country. This is largely thanks to the outstanding universities and research institutes that help make Switzerland a pioneering country in many fields.

In Switzerland, there are several programs that promote research in the field of energy as can be seen in Figure 8. These include programs that support basic research at universities as well as programs that support companies in the development of marketable innovations. Since this paper deals with SMEs, the latter are of particular interest. The programs SFOE ProKilowatt and Swiss Energy, which both run under the umbrella of the SFOE, are to be emphasized.

The SFOE ProKilowatt program supports companies in the field of electricity efficiency measures with up to 3 million swiss francs. The Swiss Energy program supports companies in the energy sector with up to 500,000 swiss francs.Another interesting program for Swiss SMEs is the Horizon Europe - European Innovation Council EIC. Up to 400-500 SMEs are financially supported annually and Swiss companies can also participate.

For further information on the various programs, please refer to tables of the Swiss Federal Office of Energy (SFOE, Swiss Federal Office of Energy, 2021c) in Appendix A.

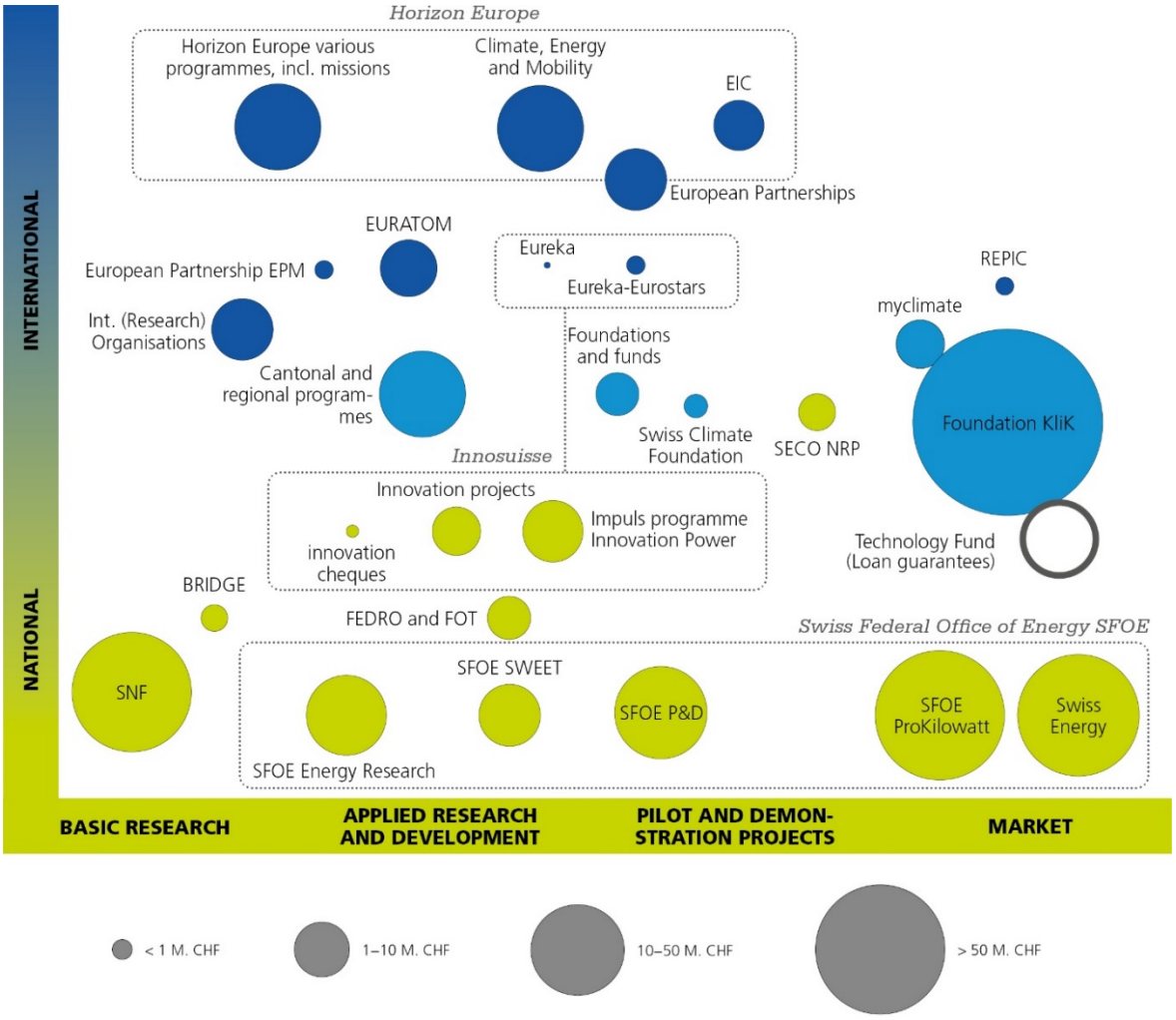

Figure 8 - Overview of innovation promotion (SFOE, Swiss Federal Office of Energy, 2021a)

5 SMEs & Startups

This chapter is where the actual research takes place. Through the literature analysis made in the previous chapters, an overview of the current situation in the Swiss energy sector could be created. This enables a basic understanding of SMEs as well as startups active in the sector to be gained. On the basis of this, interview questions could be prepared in order to understand the individual perspectives of the representative better. As described in chapter 2 under the research process, the questions were open-ended and continuously adapted and expanded.

In total 17 interviews were conducted. The breakdown of the interviewees can be seen in Figure 6. The distribution of interview partners between SMEs and startups is equally split. In the course of the research, 3 additional interviews with platforms were conducted. These platforms are active in the field of match-making, i.e. they mediate between SMEs, startups, and research institutes.

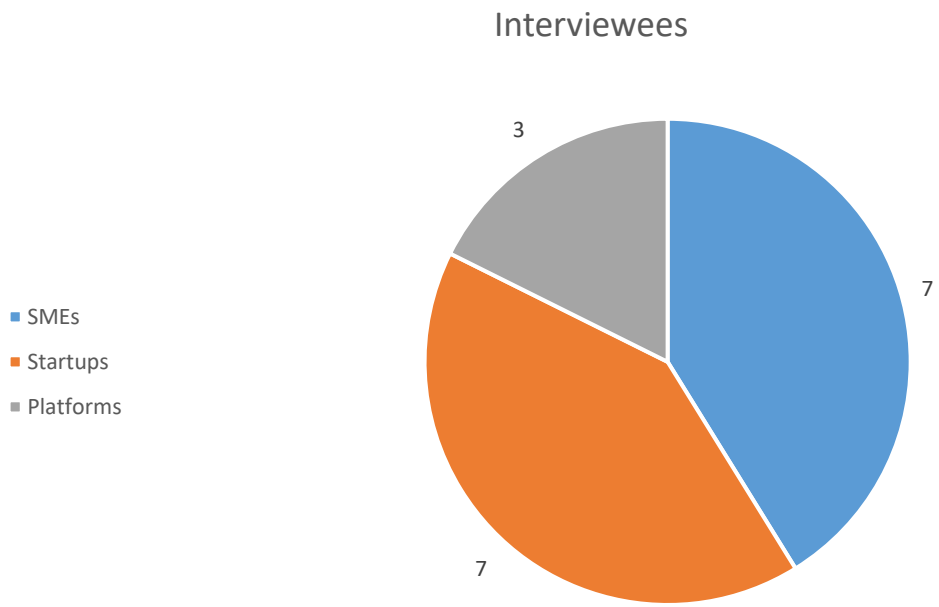

Figure 9 - Composition of Interviewees

This chapter contains three main parts. In the first part, the SMEs' perspective is examined and it is shown what their pains & gains are and their current status. In the second main part, the same is done from the perspective of a startup. The third chapter analyzes the insights gained from the interviews with the platforms. The findings of this chapter are used to define a possible CV process finally.

5.1 SME

As mentioned in Chapter 4.1.2, all SMEs interviewed are EVUs or have a connection to EVUs. Five of the seven SMEs are municipality EVUs. Additionally, one representative of a Switzerland-wide EVU alliance was interviewed, and moreover, one SME emerged from a joint venture of EVUs. It should be noted that these are very specific cases, as they all come from the public sector, and therefore the findings from the interview cannot be transferred to companies in the private sector without further ado.

5.1.1 Pain & Gains

In this part, the pains and gains of the SME are examined. The pains describe situations and circumstances that prevent the company from performing at its best. The gains help the company to achieve a better result and drive the business further.

Pains:

Since all companies are directly or indirectly active in the public sector, control by the public sector was cited as a major pain. Since the companies are dependent on public funds, any significant investment must be justified to the board of directors or even the relevant parliament. This makes it difficult to promote innovation, as the public sector wants to avoid risky investments. On the one hand, this is due to the fact that the municipality utilities are primarily responsible for fulfilling a supply mandate. Furthermore, they operate with public funds, which in turn must be accountable to the civilian population. The representative of a swiss alliance of EVU mentioned the example of a joint investment fund, which would have aimed to promote innovations and new technologies in the energy sector. However, the project failed because the responsible public authorities of some participating utilities did not release the financial resources.

In addition, the attitude to innovation often plays a role. The energy sector is a rather conservative industry that is strongly focused on infrastructure and has been doing well for decades. Therefore, the motivation to deal with new technologies is rather low. One representative gave the example that the Board of Directors was strictly against innovation because innovation projects would only destroy money. Fortunately, in this case, there has been an internal culture change in the last three years, where it was recognized that innovation is needed and essential for the company's future success.

Another frequently cited pain is the scarcity of available resources. Since the companies surveyed are SMEs, they do not have the same resources at their disposal as a large corporation. The lack of resources is not only evident in financial terms, but also in the area of human resources. The EVUs must first and foremost fulfill their supply mandate. Consequently, they

often do not have the capacity to hire someone to look for and evaluate potential CV opportunities.

A third and essential point is that the EVUs now understand that innovation is essential for the future of the business but do not know how to foster it appropriately. While some interviewees were already successfully exploring and deploying new technologies, they were not yet exploiting their full potential.

Gains:

What is positive for SMEs is that more and more boards of directors and public authorities are slowly recognizing now that innovation is important and that new approaches are needed to promote it. This helps to accelerate the transition and achieve the targets for the energy strategy 2050. Furthermore, the fact that strategic decisions have to pass the public authorities means that after approval, the SME has the support of the local parliament and its citizen. Through that, the risk for future problems, such as objections, is lower.

Another point that benefits SMEs is increased collaboration. This is also evident among the interviewees. In addition to the alliance of utilities and the joint venture, which was also formed by several utilities together, all participants said that they are cooperating with other partners beyond their supply base.

In addition, a big gain for some of the interviewees is the monopoly position in network operation. This means that at least one part of their business is protected by the law and they do not have to face any competition in that area. This can have an impact on innovation work, but it is clearly a financial advantage.

5.1.2 Strengths & Weaknesses

After getting to know the pains & gains of the SMEs it is now time to understand more about their business itself, what they are good in and where they still have potential to improve. The CV process can later be built on this knowledge. The strengths found can be exploited and further strengthened while trying to minimize the weaknesses found.

Strengths:

In terms of strengths, all interviewees agreed that SMEs have the advantage over larger companies of being small and therefore having flatter hierarchies. On the one hand, this has the effect of being able to react more quickly, and on the other hand, of having a better overview of the entire company. This means that proposals only have to pass through a few hierarchical

levels, making decisions faster. A valuable advantage in the business world. For this reason, EVUs have the ability to quickly adopt a new technology once it has proven itself on the market.

A further strength mentioned by all participants is the relationship with their customers. The fact that the utilities only operate locally and therefore have a smaller customer base, and the fact that most of them are companies that have been in the market for a long time, means that they know their customers and understand their needs. Furthermore, the small number of employees in an SME has the advantage that the customers tend to have the same contact person, making the cooperation more efficient and effective.

Another advantage that has been mentioned several times is the broad range of business areas. Several interviewees stated that their company is active in other business areas in addition to energy production and distribution. For example, many utilities are increasingly focusing on building technology in order to be able to offer their customers a more comprehensive solution. At the same time, it is also a hedge against the possible liberalization of the electricity market and the likely collapse in electricity prices.

Weaknesses:

The SMEs' weaknesses go hand in hand with the pains already described. All participants cited a lack of financial resources as a weakness, which has a direct impact on the funds made available to promote innovation. The shortage of qualified personnel and the resulting lack of expertise in implementing new knowledge in one's own field of business were also mentioned.

As already mentioned under the pains, the often conservative mindset at management level also plays a major role. This determines the strategic orientation of the company and means that attempts to integrate innovations into the business tend to fail more often. In addition, there is the dependence on the public sector, which wants to pursue a low-risk strategy, since public funds are involved.

A final weakness that has often been mentioned is that the utilities are local companies. On the one hand, this brings advantages, as described above under strengths. At the same time, however, it limits the range and thus the maximum market size.

5.1.3 CV Perspectives

The final step was to examine how their current attitude is towards CV and where there may be opportunities in the future. Thereby, three important observations could be made.

First, three of the seven companies said they currently have no plans for CV. This is primarily due to their lack of financial resources and small company size. In fact, these were actually the

three smallest EVUs interviewed. However, they also said that if the right opportunity arose in the future, they would consider CV. However, they would instead target inorganic growth through acquisitions. Moreover, they would only consider startups from the same area due to their commitment to the region.

Another observation arose in connection with a single EVU. This EVU was the largest of all the SMEs interviewed, both in terms of turnover and staff. After the board of directors had initially considered innovation unnecessary for their own business, the topic of innovation was taken more seriously after a change in the board of directors and it was recognized that a structure was needed for this. As a result, an internal team was set up to take care of innovation management. Furthermore, an external company was commissioned for scouting. This scouting company searches for startups in predefined areas that could be interesting for the EVU and presents them at monthly intervals. The EVU then decides whether to contact the startup and whether this will lead to a collaboration. This has the decisive advantage that the EVU does not have to deal with the scouting and at the same time benefit from the extensive network of the scouting company. In this way, the EVU is introduced to startups that it would not have had on its radar. The EVU has also hired an employee specifically for the case that it comes to a cooperation with a startup to then work through all legal processes as quickly as possible. Other SMEs could also adopt this approach to increase their exchange with startups and foster innovation.

The third observation that could be made was in relation to the establishment of a joint venture by seven EVUs. One of the founding EVUs as well as the joint venture company itself were interviewed. The joint venture aims to offer future-oriented solutions with innovative products and services, drive forward the energy transition, and be prepared for the complex requirements of the future energy supply. Each founding EVU provides personnel, knowledge and financial resources. Furthermore, the joint venture makes use of innovation teams consisting of members of the respective founding utilities, in which new technologies and trends in the energy sector are discussed extensively. Moreover, the products developed by the joint venture are used by the EVUs itself, creating a secure customer base from the very beginning. The joint venture itself is still in the establishment phase, which is why CV is not yet an option for them, as they also do not yet have the financial resources. However, they do not rule out CV for the future and even see it as a way to circumvent public control. In this way, the founding EVUs can also profit from riskier investments in startups that the public authorities would otherwise not approve.

In conclusion, SMEs are generally not averse to external opportunities for generating innovations and building knowledge. However, financing plays an important role. Therefore, joint collaboration, as in the case of a joint venture, is a good way to share knowledge and build partnerships. Furthermore, options such as outsourcing startup scouting offer SMEs new and

potentially interesting opportunities, while at the same time not consuming their own human and time resources.

5.2 Startups

In this chapter, the startups interviewed are introduced, their pains & gains as well as strengths & weaknesses are explained and their attitude towards CV is examined. As described in the introduction to Chapter 5, seven startups in the energy sector were interviewed. The Swiss energy sector can be divided into different fields of activity, as can be seen in Figure 10.

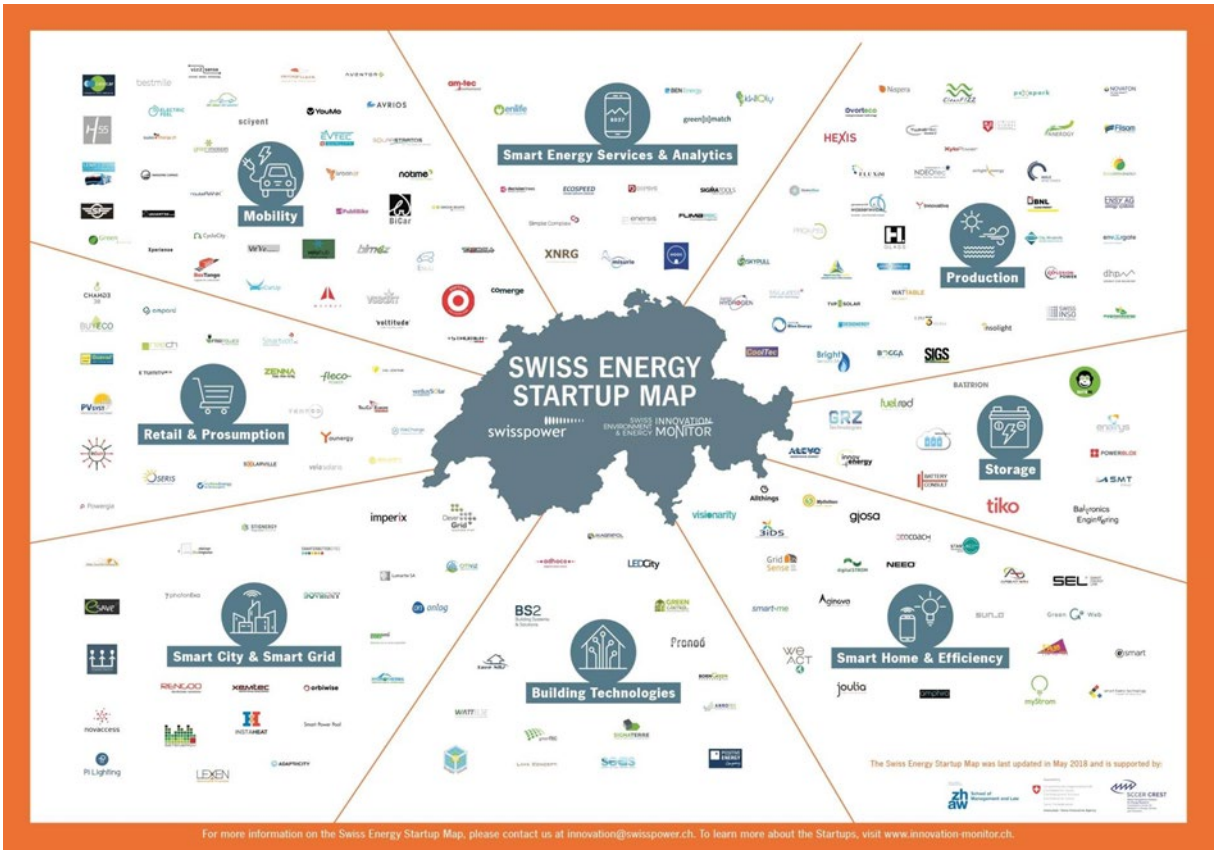

Figure 10 - Swiss Energy Startup Map (Swisspower, 2018)

As shown in Figure 11, the majority of the seven startups interviewed are active in the smart home sector. This reflects the market as a whole. Many startups in the energy sector are active in the field of software. Only two of the seven startups interviewed focus on hardware, namely the startup in power production and the startup in the area of storage. This can be explained by the funds required, as energy solutions in the hardware field very soon demand a great deal of capital for further development. Software solutions are less capital-intensive and, therefore, particularly interesting for startups as they can be scaled up faster.

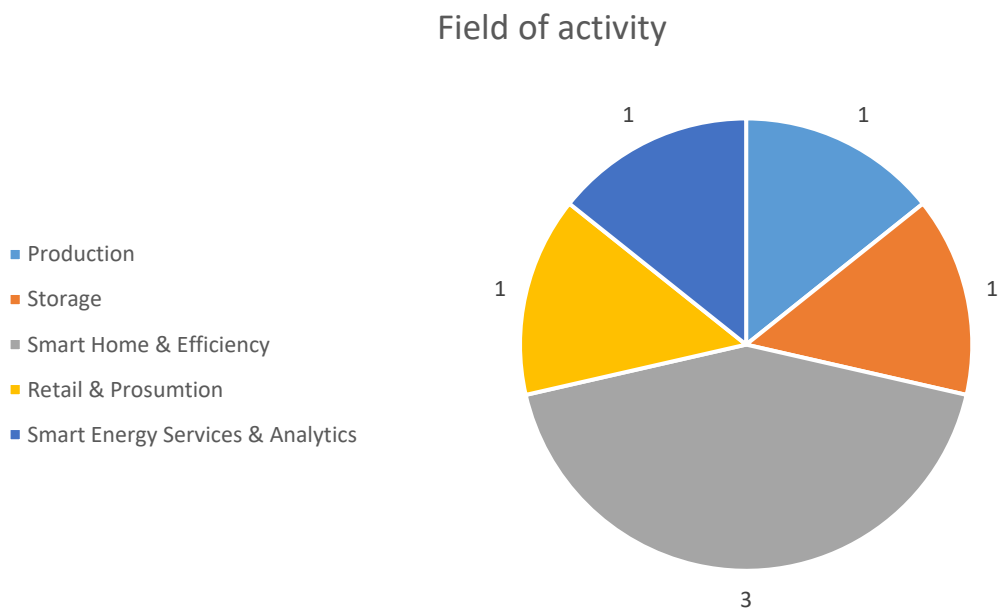

Figure 11 - Startup field of activity

In addition to the field of activity, the background of the startup is also important for this paper. Depending on their background, startups bring a completely different dynamic with them. The startups interviewed are either industrial spin-offs, started as hobby projects or were launched within a university environment as can be seen in Figure 12. The industry spin-offs can often access resources from their parent company(ies) and therefore have a wider network and reach right from the start. Startups from university environments are most sought after by corporate venture funds and startup accelerator programs. Startups that have their origins in hobby projects usually take longer to realize a market-ready solution.

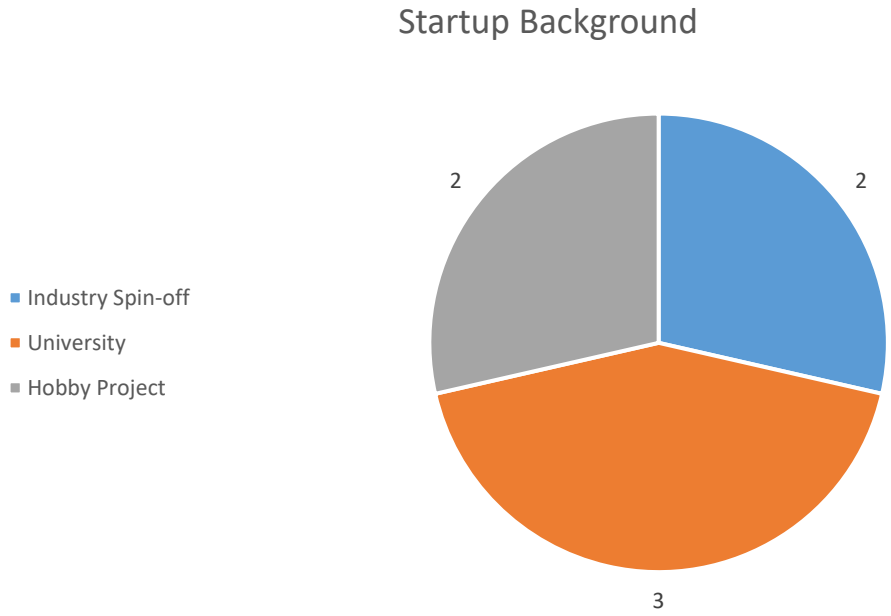

Figure 12 - Startup Background

In the next subsections, it will be explained how the different fields of activity and founding backgrounds of the startups affect their pains & gains as well as how this plays into their strengths and weaknesses.

5.2.1 Pain & Gains

In this part, the pains and gains of the startups are examined. The pains describe situations and circumstances that prevent the company from performing at its best. The gains help the company to achieve a better result and drive the business further.

Pains

One of the pain points for startups mentioned by all representatives is the constant need and search for capital. Since startups are still in their infancy, they need capital to grow and bring their solution to the market. Nevertheless, in order to get capital, the right investors have to be found first. This search is time-consuming and prevents the founders from working on the realization of their product. It is also vital for the startup that the investor's goals match with the startup's strategic goals.

Another pain, which was emphasized especially by the startup representatives with a hobby project as background, is that they lack the reach to market their solution and attract investors. This mainly due to the previously mentioned lack of a comprehensive network.

A third pain that was mentioned is the dependence on regulations. Especially startups tend to build their entire business model on a specific regulatory framework. If this base is no longer given due to changes in the regulatory framework, this can pose a significant risk for a startup's existence.

Gains

A gain that the industry spin-offs have mentioned is that they have the support of their parent company, which gives them access to a network with already established sales channels. This gives them a reach and awareness advantage over other startups. Furthermore, it allows them allocated more of their focus and work time in releasing the final product, and therefore shorten the time it takes to enter the market.

Another big gain is when the startup gets support in funding programs. This usually has not only financial advantages but also boosts the awareness of the startup enormously. Furthermore, it gives the startup a certain degree of validation, which can attract further potential investors.

5.2.2 Strengths & Weaknesses

After getting to know the pains & gains of the startups, it is now time to understand more about their business itself, what they are good in and where they still have potential to improve. These insights help to understand if a startup can help a SME to increase its innovation and knowledge.

Strengths

All participants in the interview stated that their greatest strength compared to larger companies was their innovative strength. Each startup interviewed pursued either a novel technology or a new business model and thus exploited a gap in the market that larger companies had neglected.

Another strength that all the startups questioned can identify with is their agility. Due to the extremely flat hierarchy and the small number of employees, decisions can be made at short notice and a strategic reorientation is easier to implement than it would be for larger companies.

Last but not least, the startup culture was also mentioned by ever representative as a strength, because it encourages and even demands innovation and new ideas.

All those mentioned so far were named by all startups, respectively. The following are strengths that were only mentioned by specific startups.

Both industry spin-offs cited their background as a strength, as their parent company supports them with resources and gives them access to its network. This is especially valuable at the beginning, as it gives them the opportunity to focus on their core business, as mentioned in the gains. Furthermore, it gives them a certain degree of security, especially in uncertain times like today with COVID-19.

A representative of a startup from out the university environment named the close cooperation with universities as a strength since the startup gains a great deal of insight into the most current research topics. Another strength mentioned was that his startup operates in a very specific and, therefore, small niche in which there is little competition.

Weaknesses

As the first weakness, all the representatives named the financial resources. Financial resources are essential for the company's survival, which is why the startups have to talk to potential investors in addition to the daily business and the development of their solution. This ties up time and personnel.

Other weaknesses are the already mentioned limited range and awareness. Especially in the beginning, startups have to invest a lot of time in marketing to attract potential business partners.

Another weakness that a startup brings with it are dependencies. On the one hand, the dependence on investors and financiers, on the other hand, on their product. If their product does not manage to enter the market, it usually results in the end of the startup.

The startups with a background in the industry both mentioned the weakness that it was not clear to the customer at the beginning whom they were dealing with. Furthermore, the image of the parent company can rub off on the image of the startup, which can prove to be a disadvantage.

5.2.3 CV Perspectives

The final step was to examine how their current attitude is towards CV and if there is potential for match-making with SMEs. The following observations were made. All the startups interviewed were looking for new investors. Several factors play a decisive role in the question of who comes into question as a potential investor.

It made a difference whether the startup primarily offered software or hardware. The software-based startups tend to have a strategy of scaling as quickly as possible, since they are not tied to capital-intensive resources. Because of this, SMEs and especially EVUs are less attractive, as they are only locally active and the software-based startups have international goals. Therefore the focus is more on capital venture funds and large corporates. The hardware-based startups are less attractive to SMEs. However, they offer solutions for a market worth billions with their products and therefore also prefer large industry corporates.

Another critical factor is the background. The two industry spin-offs stated that their parent companies as owners did not want to dilute their shares without further ado. This is primarily due to the fear that the competition can acquire the knowledge and the parents lose their control over the startup. Therefore, it should be a good offer and the timing has to be right.

Timing was also mentioned by other startups. A representative with a hobby background in software said that capital venture funds and SMEs were out of the question for him as an investor. He is primarily looking for angel investors and if the timing is right, a large corporation would also be an option.

Another startup, which is active in the area of storage, also relies on private investors, as they offer more independence than CV does. Moreover, they focus on a close cooperation with the investor, so that both sides can benefit from each other besides monetary returns.

The other startup in the hardware field must also rely on private investors. In this case, it is unique because their product is very capital intensive, but at the same time has little chance of being supported by large investors in the early stage. The representative said that the big players prefer to wait and leave all the risk to the startup. If their solution proves to be successful, they can still make acquisitions.

To summarize, most startups have little interest in SME-sized EVUs as investors. However, they are quite interested in partnerships and joint collaborations with them.

5.3 Match-making Platforms

Three platforms were interviewed as part of this work. These are match-making agents, which connect different actors with each other. Among others, a platform specialized in the energy sector was interviewed. Its activities include support for current and future ventures of SMEs, corporates, and market-oriented research with projects and innovation initiatives. Another platform also specialized on the energy sector, but this one focused more on linking institutional research and industrial companies. The third platform acts as a coach and consultant for SMEs and startups in particular.

The interviews with these platforms served as an opportunity to understand the two sides better. In addition, they gave brief insights in what key characteristics are in order to find a potential matching partner.

6 Venturing Process

In this chapter, the aim is to combine the insights gained through the literature research in Chapter 3 and 4 as well as the interviews from Chapter 5 and define possible CV processes through which SMEs can successfully gain novel technologies and knowledge.

6.1 Venturing Strategy

The findings from the literature research on CV in chapter 3 showed that the collaboration between corporate and venture is strongest when entering into a VA. The three approaches - non-equity alliance, direct minority investment, and joint venture - were then explained. Subsequently, the non-equity alliance was discarded as a possible approach, as it was not in line with the research direction of the thesis. Chapter 4 presented the current situation in the Swiss energy market. The political and regulatory framework conditions were outlined and the definition of a SME for this work was determined. It became clear that the public authorities have an influence on companies in the energy sector. In chapter 5, the SMEs and startups were scrutinized through interviews and their pains & gains, as well as their strengths & weaknesses, were analyzed. This provided a better understanding of their perspective and their point of view on CV.

In chapter 5, it became clear that not all SMEs and startups have the same strategic goals. Therefore, different CV strategies need to be developed. The fact, however, is that CV is not suitable for all companies. The following two subchapters each describe a possible corporate venturing strategy.

6.1.1 Direct Minority Investment

In the direct minority investment strategy, the goal is to obtain a minority stake in the startup and share knowledge and resources through collaboration. As was illustrated in chapter 5, it takes a lot of time and deep knowledge of the entire startup environment to make a suitable choice. However, as was evident from the interviews, SMEs do not have the time or the knowledge to do so. In order to not miss out on this opportunity, the SME uses the services of a match-maker. The SME benefits from the match-maker's long-standing market knowledge and broad network. The match-maker screens the startup landscape for potential candidates who might be suitable for the specific SME. The screening is performed either periodically or upon request of the SME. When the match-maker has found a promising candidate, the prospect is presented to the SME. Both parties, SME and startup, are in continuous exchange with the match-maker as can be seen in Figure 13.

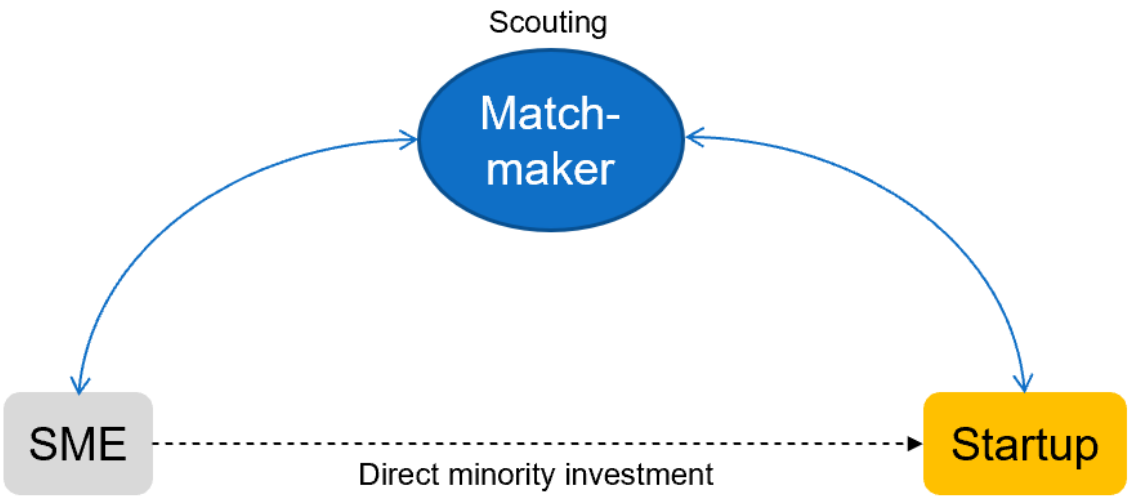

Figure 13 - Direct minority investment process

Then it is at the discretion of the SME whether to seek collaboration or not. The goal is for both partners to first feel each other out to see if they are at all suitable for one another. This can be done through joint project activities. In this way, an understanding of the other side is created. If both parties then have a positive feeling for one another and aspire for further cooperation in the future, they can discuss the possible participation of the SME in the startup itself.

This initial scanning of the respective opposite can minimize the risk of an adverse selection. SMEs, in particular, are exposed to this risk, as they do not possess the relevant experience in the CV area and are therefore less able to assess whether the investment is worthwhile. Yet it poses a great risk for the SME since an investment that does not pay off in the end could endanger the company's continued existence due to its limited resources.

This venturing strategy is primarily suitable for SMEs who want to expand their business areas and who have the necessary funds to invest in a startup. Through the initial collaboration with the startup, a relationship can be built with the startup itself, showing the startup that you both have the same goals. This makes it easier to offer even smaller investments to the startup successfully.

6.1.2 Joint Venture

In addition to direct investment in startups, there is also the possibility of founding a joint venture together with other partners. In this case, the potential partners are primarily other companies that are already established in the market and pursue a similar vision. The companies jointly establish a new entity that is legally independent. The number of funding partners is irrelevant; there can be more than two parties. Each company is allocated a certain share of the newly formed company.

The newly founded company follows a previously defined goal. Because most partners have a similar background, this has the advantage that the strategic goals are comparable. In this case, it may be research, which benefits the parent companies. The joint venture allows the individual partners to combine their resources and knowledge and furthermore, synergies can be exploited through the mutual exchange. This is particularly interesting for SMEs, as this combination of their otherwise scarce resources suddenly gives them the chance to compete with larger companies.

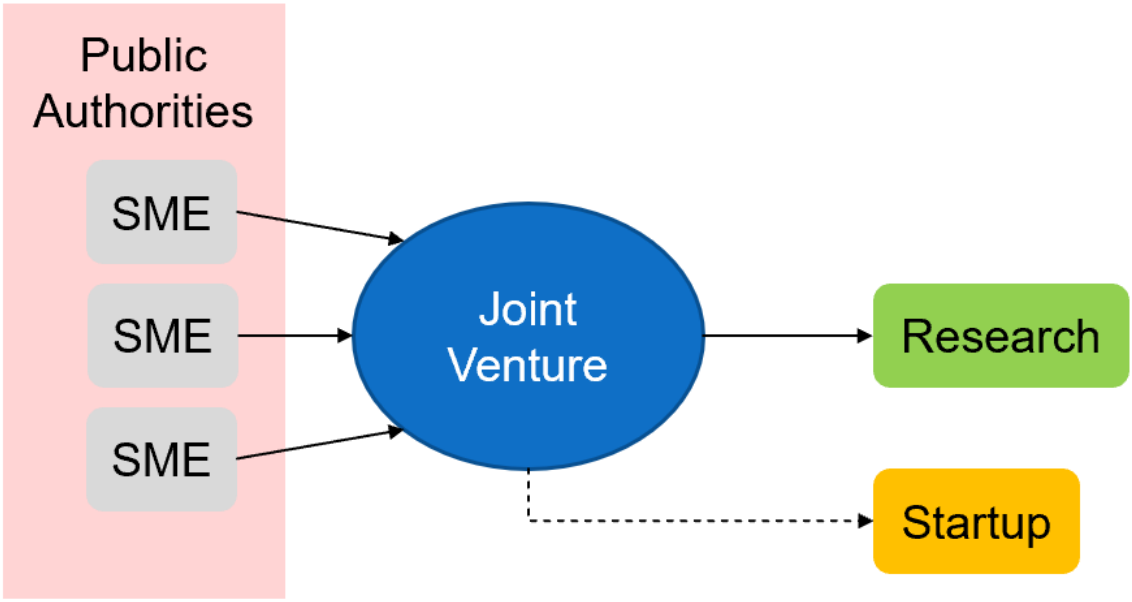

Figure 14 - Joint venture process

Another advantage that can result from a joint venture, and which is particularly interesting for publicly owned companies, is the possibility of circumventing them in this way. By investing in a cooperation with other already established companies, the investment is much more likely to be approved. At the same time, as can be seen in Figure 14, the newly established venture is not subject to direct influence (in red) by the public authorities. This allows SMEs to invest in attractive startups via the joint venture. Moreover, the risk is spread over several parties by having the different parent companies carrying the joint venture without losing the benefits of access to new innovations.

In the case of EVUs, the risk of cooperation with other companies in the same field of business is low. This is because the EVUs are primarily active locally and do not compete with each other in the same market. Instead, the mutual exchange helps to identify common problems and to develop a mutual solution.

In conclusion, CV through joint venture is an opportunity for all SMEs and especially smaller firms can benefit a lot from a collaboration.

7 Conclusion

This last chapter serves to summarize the findings of the entire work and to answer the research question defined in chapter 1.

7.1 Summary of the results

In the first chapter, the main research question was defined and in order to answer it, further research sub-questions were defined.

1. Research sub-question

What are the available definitions of corporate venturing?

In Chapter 3, different definitions of CV were introduced. The definition used in this thesis divides CV into internal and external CV. Since this thesis is about how SMEs in the Swiss energy sector can benefit from external knowledge, it focuses on external CV. This can be divided into three groups: corporate venture capital, venturing alliances, and transformational arrangements. In particular, the VAs were examined since this form involves an intensive collaboration between the investor and the venture.

2. Research sub-question

What is the current situation in the Swiss energy market, and who are the relevant participants?

In chapter 4, the conditions on the swiss energy market were explained. It became clear that this market is in a state of change. The Energy Strategy 2050 requires from all participants their participation and willingness to transform. Furthermore, it became clear that the Swiss energy market is highly regulated and that many companies and capital are in public hands.

3. Research sub-question

What are the pains and gains of SMEs and startups?

Chapter 5 introduced the empirical research. For this purpose, representatives of SMEs and startups active in the energy sector were interviewed. The aim was to identify the pains and gains of the respective parties. In addition, the strengths and weaknesses were analyzed and their current viewpoint on CV was ascertained. It turned out that both parties, SME and startup,

are struggling with limited resources. This is reflected in the fact that most SMEs do not have the financial capacity to invest in startups. In the case of startups, it is the fact that as young businesses, they have to seek capital and therefore, valuable time is lost in searching for investors.

Another key pain for SMEs is that they are publicly owned and therefore have to pursue a low-risk strategy, which is difficult to reconcile with CV. This has a substantial impact on their innovation generating capabilities.

4. Research sub-question

How could a corporate venturing process for a SME look like?

With the insights gained in chapter 5, two possible venturing strategies were defined in chapter 6. On the one hand, a direct minority investment approach was used, which, together with otusourcing of the startup scouting process, leads to an efficient and relatively safe path to CV. An external match-maker proposes startups to the SME that are strategically compatible with the SME's goals. Then, joint projects are conducted to determine whether the two parties are a suitable match. If this is the case and both parties see the strategic advantage, the SME will invest in the startup.

The other venturing strategy is based on joint ventures. In this case, several already established companies come together and establish a new, legally independent entity. This newly founded company pursues a previously defined objective that supports the parent companies in achieving their strategic goals. For SMEs in the energy sector, this is an excellent opportunity to exchange and build knowledge together. Further, it can serve as a loophole for them to evade the control of the public authorities.

Main research question

How can Swiss SMEs in the energy sector successfully use corporate venturing?

Finally, the main research question can be answered with all of the previously mentioned research sub-questions.

SMEs must first and foremost be aware that innovation and change are an essential part of the company's existence. Therefore, it needs the cooperation and exchange with external partners. CV is an opportunity to bring in knowledge and new technologies from outside the company in order to achieve its own strategic goals. As the answer to the fourth research sub-question shows, direct minority investments and joint ventures are ways in which SMEs can expand their

knowledge and business. However, for the CV approach to be successful, the intensive cooperation of all parties involved is required. Only then a long and profitable future can be expected.

7.2 Outlook

The entire Swiss energy market is changing. Climate change demands a full commitment of all companies, the research community, and the civilian population. It is therefore to be expected that there will be further adjustments in regulations in the future. One of these will be put to the vote on June 13, 2021, in the form of the CO_2 Act. Furthermore, the expected liberalization of the electricity market will also have an impact on the entire market.

SMEs in the energy sector will have to cooperate more in the future to meet the challenges of the future. This is an opportunity for CV. A recommendation for further research is to broaden the focus from only EVUs to all SMEs in the energy sector. Furthermore, it is recommended to investigate how SMEs can cooperate more closely with research institutions in order to expand their own knowledge.

Furthermore, it is recommended that match-making agency and plaftforms be studied in more detail. They have the potential to revolutionize the way companies interact with each other. By quantifying different variables representing the companies in combination with artificial intelligence, new and more effective scouting possibilities may emerge in the near future.

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A. Appendix

Opportunites for Innovation Support in the Energy Field 2021-2022

for Swiss enterprises and research institutes

Executive Summary (SFOE, Swiss Federal Office of Energy, 2021c)

Table 4: Tabular overview of the opportunities for innovation support in the energy field

The herein listed links lead to the programme websites, in the comprehensive report to the detailed (German) description of the relevant programme.

Programme	Financial means, thereof energy [million CHF / year]	Support segment: Basic Research	Applied R+D	P+D	Market	Support range [empirical values per project in CHF]	Maximum contribution rates [%]	Number of new projects per year [empirical values]	Form of support [Definition of direct project costs: Wages etc., w/o overhead and laboratory infrastructure]	Requirements
National support programmes										
SFOE – Energy Research	18, thereof 18					0–several millions	Up to 100 %	100	- All direct project costs	- Topics need to be within the focus of the SFOE energy research concept
SFOE – SWEET-Programme	11, thereof 11					50'000 – several millions	ca. between 50 –80 %	1–4 consortia	- All direct project costs	- 1–2 thematic calls per year
SFOE – Pilot- and Demonstration Programme (P+D)	28, thereof 28					50‘000–several millions	40 % (exceptionally 60 %)	40	- All eligible project costs	- Development and testing of innovative energy technologies and solutions acc. Art. 49 und 53 EnG.
SFOE – ProKilowatt-Projects	Up to 50, thereof 50 (20 for projects, 30 for programmes)					20‘000–2 millions	30 %	39–75	- All direct project costs	- 3 calls/year (Projects) - call/year (Programme) - Just for electricity efficiency measures - Just projects with pay-back of 4 years and more
SFOE – ProKilowatt-Programmes						150‘000–3 millions.	30 %	10–30	- All direct project costs	
SFOE – EnergieSchweiz	44, thereof 44					5‘000–500‘000	40 % (exceptionally up to 60 %)	ca. 200	- Only ‘soft’ measures are supported	- No standardised requirements
Regular Innosuisse Projects	145, thereof ca. 20 (about 80 million will be spent on the impulse programme listed below.).					100‘000–1 million (upper limit open, especially also for flagship initiative with 2–4 million)	50 %	400–450 (thereof ca. 30 projects in the segment „Energy and environment“ und and ca. 30 in other segments	- All direct project costs	- Min. 1 public research partner and 1 application partner / Flagship-Initiative 3 public research and 2 application partners - private companies contribute 50 % in-kind and pay a cash contribution of 0–10 % in favour of the public research partner

Programme	Financial means, thereof energy [million CHF / year]	Support segment				Support range [empirical values per project in CHF]	Maximum contribution rates [%]	Number of new projects per year [empirical values]	Form of support [Definition of direct project costs: Wages etc., w/o overhead and laboratory infrastructure]	Requirements
		Basic Research	Applied R+D	P+D	Market					
Innosuisse - Impulse Programme Innovation Power Switzerland	113, thereof ca. 10 (means mostly from the regular Innosuisse budget)					100'000–1 million (Upper limit open)	- Max 70 % for measure 1 '- Max 80 % for measure 2	Not yet available	- All direct project costs	- Measure1: Min. 1 public research partner and 1 application partner - Measure 2: In addition to the 2 partners, a consulting or engineering service provider
Innosuisse – Innovation checks	3–4,5, thereof ~0,4					Max. 15'000	100 %	200–400 (thereof ~10 % in energy)	- Small pre-studies - Cost of wages	- Payment exclusively to public partner - just one innovation check per company every 2 years
Swiss National Science Foundation SNSF	2021: 1'108, thereof ~45 2022: 1'137, thereof ~45					Project support: 100'000–600'000 Careers support: 50'000–360'000 Others: not specified	100 %	1'000 projects 1'000 careers 1'000 others (thereof ca. 2 % each in Energy)	- wages - Costs of infrastructures - Publications, seminars, and events	- Participation restricted to scientific staff - Calls for proposals with strict specifications
BRIDGE (Innosuisse and SNF)	26, thereof ca. 2,5					Area Discovery: max. 2,55 million Area Proof of Concept: max. 130'000/year	Up to 100 % for both areas	Area Discovery: 10–12 Area Proof of Concept: ca. 30–35	-- All relevant project costs	- Participation limited to research staff of the research organisations defined in the Research and Innovation Promotion Act (FIFG)
SECO New Regional Policy NRP	90, thereof 2,7					Project support Federation: 10'000–1 million Loans by the Federation: 300'000–2 million	<50 % SECO >50 % cantons	ca. 300, thereof ~10 in energy	-- All relevant project costs	- Co-financing by cantons and SECO is requested - No individual company support but for groups of companies
FEDRO and FOT – Federal Roads Office and Federal Office of Transport	FEDRO: 8,5, thereof ca. 0,9 OFT: Ca. 9, thereof ca. 3					FEDRO: 50'000–700'000 OFT: 20'000–700'000	10–100 % Energy projects FOT: 40–(60) %	ca. 50, ca. 15 in energy	- Energy strategy public transport ESöV: All relevant project costs	- ESöV: Contribution to energy saving or energy production, innovation, benefit for practice
Federal Offices with Energy Topics	200, thereof 4 (external studies 37, thereof 0,74)					NA	Variable	NA	NA	NA

Programme	Financial means, thereof energy [million CHF / year]	Support segment				Support range [empirical values per project in CHF]	Maximum contribution rates [%]	Number of new projects per year [empirical values]	Form of support [Definition of direct project costs: Wages etc., w/o overhead and laboratory infrastructure]	Requirements
		Basic Research	Applied R+D	P+D	Market					
Cantonal support offers	NA, thereof min. 20					NA	Variable	NA	NA	- Variable
Foundations & Funds (w/o Swiss Climate Foundation, myclimate and KliK)	200, thereof 10 (ca. 5 %)					Variable	Variable	NA	NA	Variable
Swiss Climate Foundation	2,4–4,7, thereof 1–3					up to 200‘000	50 %	ca. 140	Reduction of CO_2 with energy–efficient technologies and measures	- Individual grants - Project realisation and seat of applicant in CH or LI
myclimate	6–11, thereof 6–11					NA	NA	ca. 6	- Compensation CO_2	- Individual grants
KliK	2021: 160, thereof 136 2022: open due pending vote on the CO_2 Act					NA	NA	NA – several hundred	- Compensation CO_2	- Individual grants - Funding from 2022 onwards also abroad in developing countries
Technology Fund (Federal)	2021: 25, thereof ~16 (loan guarantees) 2022: open					50‘000–3 million (mean value1,6 million)	60 %	20, thereof ca. 16 in energy	- OpEx and CapEx for the commercialisation of innovation	- Applicant and lender with seat in Switzerland

Programme	Financial means, thereof energy [million CHF / year]	Support segment				Support range [empirical values per project in CHF]	Maximum contribution rates [%]	Number of new projects per year [empirical values]	Form of support [Definition of direct project costs: Wages etc., w/o overhead and laboratory infrastructure]	Requirements
		Basic Research	Applied R+D	P+D	Market					
European and international support programmes										
Horizon Europe[6,7] (w/o the following separately shown EU programmes and Partnerships)	7'200, thereof ~720 (10 %) in energy. Swiss share: 220, thereof ~22 in energy					600'000–100 million	100 % R+D 100 % acc. measures 70 % P+D	~3'000, thereof 10 % in energy)	– All direct project costs + overhead of 25 %	– Min. 3 partners from 3 EU or associated countries. Min. 1 partner from an EU country. - Applications just on the basis of calls for proposals
Horizon Europe – Climate, Energy and Mobility	2'390, thereof ca. 1'200 in energy. Swiss share: ca. 40, thereof 30 in energy					3–15 million	100 % R+D 100 % Acc. measures 70 % P+D	230–300 (incl. SME projects) in old H2020, thereof 11–14 % Swiss partners	– All direct project costs + overhead of 25 %	– Min. 3 partners from 3 EU or associated countries. Min. 1 partner from an EU country. – Applications just on the basis of calls for proposals
Horizon Europe – European Innovation Council EIC (SME Part)	1'500, thereof 300 in energy / Estimate Swiss share: 3 %					0,55–2,75 million ------ Plus up to 16,5 million equity investment	70 % ------ --	400–500 (estimate)	– All direct project costs + overhead of 25 %	– Individual grant for SME – Participation just for EU or associated countries but not for countries with a third country status
Horizon Europe – European Partnerships	ca. 3'900, thereof ca. 585 in energy. Swiss share: ca. 117, thereof 20 in energy					3–15 million	100 % R+D 100 % Acc. measures 70 % P+D	NA	– All direct project costs + overhead of 25 %	– Min. 3 partners from 3 EU or associated countries. Min. 1 partner from an EU country. – Applications just on the basis of calls for proposals

[6] For Horizon Europe (2021–2027) the Swiss Parliament approved a (negotiation) credit of CHF 4,65 billion in Dec. 2020, i.e. on average about CHF 665 million per year. These means are also used for the partial financing of European partnerships, including Eureka-Eurostars, EPM, as well as in the case of Switzerland's third-country participation. The allocation of funds to the sub-areas is not explicitly defined.

[7] Horizon Europe is made up of various sub-areas, incl. the following energy-relevant topics: Climate, Energy and Mobility; European Innovation Council EIC; and the embedded European Partnerships. Other themes with less energy relevance are only listed here in summary form and include: ERC European Research Council, JRC Joint Research Centre of the EU, EIT European Institute of Innovation and Technology, etc.

Programme	Financial means, thereof energy [million CHF / year]	Support segment				Support range [empirical values per project in CHF]	Maximum contribution rates [%]	Number of new projects per year [empirical values]	Form of support [Definition of direct project costs: Wages etc., w/o overhead and laboratory infrastructure]	Requirements
		Basic Research	Applied R+D	P+D	Market					
EURATOM	340, thereof 340 / Swiss share: up to 19					1,25– 470 million	100 % R+D 70 % P+D 50 % Cofund	10–15, thereof 5–6 with Swiss partners	– All direct project costs + overhead of 25 %	– Min. 3 partners from 3 EU or associated countries. Min. 1 partner from an EU country. – Applications just on the basis of calls for proposals
EUREKA – Network Projects	Support by the member states / CH: ~1 million CHF/year 10 % in energy					0–1,5 million	0–50 %	70–100, thereof 3–6 with CH partners (10 % in energy)	– All direct project costs – Industrial projects	– Min. 2 partners from 2 countries / usually 3–5 partners
Eureka – Clusters	Support by the member states – Network Projects					500‘000–50 million	0–50 %	20–50, thereof 0–1 with CH partners (10 % in energy)	– All direct project costs – Industrial projects	– Min. 2 partners from 2 countries / usually 10–30 partners
Eureka –Eurostars	Support by the member states and EU / CH: ~12 million, thereof <5 % in energy					500‘000–1,65 million CH support: Max. 550‘000 pert project	50 % (SMEs and science) 25 % Others	350, thereof ~40–50 with CH partners (<5 % in energy)	– All direct project costs	– Min. 2 partners from 2 countries – SME with high R+D share > 10–20 % of turnover / open for other partners – Innosuisse rates to be used
EPM – European Partnership on Metrology	EU support: 33 (2021) – 60 (2022), thereof ca. 20 % in energy Swiss share in the programme: 3,3 %					600‘000–2 million	50 %	30–40, thereof 8–12 with CH partners (20 % in energy)	– All direct project costs + fix share for overhead	– As a rule, at least 3 partners from 3 countries – Euramet members and project partners contribute the remaining 50 % – Applications just on the basis of Euramet calls for proposals
ERA Nets (still running Nets in Horizon 20220 with SFOE participation)	NA, primarily means from existing national funding programmes					6–16 million	40–100 % by SFOE Max. 33 % EU share	ca. 20, thereof 2–4 in energy	– Support in Switzerland acc. to SFOE rules	– Applications just on the basis of ERA calls for proposals – Co-financing by SFOE

Programme	Financial means, thereof energy [million CHF / year]	Support segment				Support range [empirical values per project in CHF]	Maximum contribution rates [%]	Number of new projects per year [empirical values]	Form of support [Definition of direct project costs: Wages etc., w/o overhead and laboratory infrastructure]	Requirements
		Basic Research	Applied R+D	P+D	Market					
REPIC – Renewable Energy, Energy- and Resource Efficiency Promotion in Intern. Cooperation	2,0, thereof 1,25					100'000–150'000	50 %	10–15	– All direct project costs	– Min. 1 Swiss partner and 1 partner from a developing or transition country
Other International (research) Organisations	Total ca. 90[8] Ca. 110 million as return flow for R&D projects, services and procurements					NA	Variable	NA	- NA	- NA

[8] The annual investments by Switzerland are taken into account. Reflux occurs through supplier contracts from Swiss industry for construction projects and components, and to a lesser extent through the use of facilities by Swiss researchers for R&D project. The high return flow is largely due to CERN in Geneva. The energy-relevant share of the return flow cannot be estimated.