RRI LEADERS

RESPONSIBLE RESEARCH AND INNOVATION IN TERRITORIES

RRI AUDIT REPORT

Thalwil

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Name of the territory

Lead author	Dr. Richard Blaese
Contributors	Dr. Fridolin Brand, Dr. Martin Schmitz, Benjamin Ueltschi
Editors	Dr. Pascal Lienert, Michael Erdin,
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Table of content

List of Acronyms/Abbreviations Used in This Document

AIRR - Anticipation, Inclusiveness, Reflexivity, Responsiveness EU - European Union
NGO – Non-Governmental Organization
PV - Photovoltaics
RRI - Responsible Research and Innovation
R&I - Research and innovation
SME - Small and medium-sized enterprises
SWOT - Strengths, Weaknesses, Opportunities, and Threats
TOWS - Threats, Opportunities, Weaknesses, and Strengths

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Executive Summary

The energy turnaround and the achievement of net-zero CO_2 consumption is an important goal for the municipality of Thalwil. To achieve this goal at the municipal level, several issues need to be addressed, such as supplying the building stock with renewable energy sources, the conversion of the vehicle fleet to climate-neutral, the development of new funding sources and resources for this energy transition, the reduction of the personal carbon footprint of residents to nearly 0t CO_2 eq. per capita (net-zero) by 2050, and the improvement of the analysis and monitoring of energy balances. Several prerequisites must be fulfilled to meet these challenges, including a continuous exchange between the various community members and a broad public securing and communication of the goals and necessary implementation measures.

The Responsible Research and Innovation (RRI) approach is used to analyse the integration of sustainable development into innovation processes and identify both weaknesses and strengths. The RRI approach combines so-called RRI keys (ethics, public engagement, gender equality, open access, and science education) with AIRR dimensions (anticipation, inclusion, reflexivity, and responsiveness). It is continuously applied by researchers and practitioners to analyse innovation processes in different fields (see EU projects in the EU horizon cycle 2010-2020, for example, in climate change, digitalisation, and coal phase-out). As part of the ongoing three-year EU project RRI-LEADERS (Jan. 2021 – Dec. 2023), the Zurich University of Applied Sciences (ZHAW), and the Municipality of Thalwil are carrying out a series of measures to determine the embeddedness and significance of RRI keys and AIRR dimensions in the context of energy transition in Thalwil. Early in the year, interviews and focus groups were conducted with stakeholders from the Quadruple Helix (research and development, business, policy, and civil society). In addition, a comprehensive document analysis of the laws and ordinances relating to the energy transition in Thalwil was carried out, the results of which were discussed in depth at a workshop in summer 2021 with the stakeholders mentioned above.

The results of these steps provide an initial insight into the status quo of energy transition against the background of the RRI-AIRR approach. The results are reflected in the "Synthesis" chapter and then further processed in the analyses of strengths, weaknesses, opportunities, and threats (SWOT)[1] and threats, opportunities, weaknesses, and strengths (TOWS)[2]. This report follows with a description of the methodology, a synthesis, stakeholder mapping, SWOT and TOWS analyses, focus groups and policy recommendations and conclusions.

Preliminary results suggest that certain AIRR dimensions, such as anticipation in the form of forward-looking leadership, are already firmly embedded in policymaking, but that there is still room for improvement concerning other AIRR dimensions, such as inclusion (i.e. collaboration between representatives from business, government, civil society, and R&D) and reflexivity (i.e. evaluation of achieved goals).The chapter on TOWS offers specific recommendations for future action.

[1] SWOT analysis is a strategic planning tool. It is used for positioning and strategy development of companies and other organizations as well as in personnel and management development.

[2] The TOWS matrix is derived from the results of the SWOT analysis and is used to derive meaningful strategic approaches from the internal and external factors previously identified.

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Introduction

About the RRI Audit Report

This RRI Audit Interim Report by the municipality of Thalwil is based on research conducted between January and September 2021 as part of RRI-LEADERS project (duration 2021–2023), funded by the Horizon 2020 Programme. This included an intensive document analysis as well as interviews and focus groups with representatives of civil society, politicians and decision-makers, business people, and scientists dealing with urban and spatial development and energy transition.

The report provides an overview of the establishment of the RRI-AIRR approach in the municipal energy transition process and the status of energy transition in Thalwil. The concept of RRI has gained attention in recent years, both among policymakers and in academia. The model defines RRI keys, namely ethics, public engagement, gender equality, open access to data and scientific knowledge, and science education – understood as levers for implementing innovation topics. The RRI model, which is based on five guiding keys, is complemented by the AIRR dimensions (anticipation, inclusion, reflexivity, and responsiveness), representing the prerequisites for a sustainable innovation policy.

The basic assumption is that the energy transition can be driven forward based on technological and social innovation. However, broad support from various players is required to implement new technologies in energy transition sustainably and in the long term. In particular, the scientific RRI approach makes it possible to consider innovations against the background of the interests of various stakeholders (a detailed list is provided below) along the quadruple helix, who are new to the implementation of the energy transition in the municipality. The results of the following analyses show that most of the RRI guiding principles are considered beneficial for future measures in the energy sector (i.e. in the areas of mobility and housing).

Methodology

The information used to prepare this report was collected in several stages. First, a semi-structured questionnaire was developed in the spring of 2021. Subsequently, 19 interviews were conducted to investigate the state of embeddedness of the RRI-AIRR approach among selected parties from research, politics, business, and civil society organisations in the context of energy transition in Thalwil. A subsequent focus group led by ZHAW validated the findings from the interviews with other Thalwil stakeholders from the groups mentioned above. The results will be used later in the research project to identify best practices and gaps, barriers, and measures based on them and provide policymakers with recommendations for energy transition in Thalwil based on the RRI-AIRR approach.

In the second stage, a comprehensive document analysis was conducted in the early summer of 2021. Specifically, the document analysis of communal, cantonal, and national laws and ordinances (including the Zurich Cantonal Structure Plan, legislative goals of the municipality of Thalwil (2018–2022)[3], communal

[3]At the end of September 2018, with the support of the community service centre managers, the Municipal Council set out a series of 12 legislative objectives and priorities for the next four years, which are set out in this document. The legislative goals concern important strategic projects in connection with overriding requirements that the municipality must meet (e.g. CO_2 reduction).

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structure plan (28 October 2015)[4], communal energy plan[5] (2015, October) was carried out with the aim of better understanding the prerequisites of the energy transition in Thalwil against the background of RRI in depth. Followed by a workshop with representatives of the Municipality of Thalwil, the status of RRI integration in municipal and cantonal ordinances and legislative texts was further discussed. This also served to identify further resources, measures, and recommendations for action in Thalwil beyond the initial step and bring the various players to the discussion table.

These analysis findings were discussed again in a participatory workshop in July 2021, focusing on a more robust integration of RRI in the measures and administrative interpretation. A total of 15 stakeholders shared their knowledge on key areas of Thalwil's climate and energy policy and listened to a keynote speech on net-zero strategies in the neighbouring city of Zurich. They discussed the five thematic RRI keys and the AIRR dimensions relevant to improving Thalwil's climate and energy policy and specific measures that could be implemented to achieve the defined municipal policy goals. The aim was to synthesise specific fields of action for the energy transition and further implement RRI-AIRR in energy transition based on the document analysis findings and the focus groups from November 2021.

[4] The **municipal structure plan** for Thalwil consists of several sub-structure plans: settlement, landscape, transport, infrastructure, and public buildings and facilities. Thalwil is committed to sustainability and strives to achieve a balance between economic, ecological, and social aspects in its decision-making. The structure plan is a good long-term management tool for the municipality. The municipal structure plan was first introduced in 1997 and is revised every 15 to 20 years. As a rule, existing targets are further developed, and new targets introduced where necessary. Implementation focuses on devising options and realising sustainable solutions. The topics addressed in the sub-areas of the plan (e.g., building, mobility, and transport planning) include the development of concrete strategies taking into account economic and environmental sustainability.

[5] The **municipal energy plan** analysed the local heat supply and existing energy potential. The energy targets were adapted to the current energy policy guidelines and overarching goals and supplemented by an implementable catalogue of measures. The general objectives are an economical and environmentally friendly heat supply for the local building stock as well as a significant reduction of greenhouse gas emissions through an increased use of environmental heat and renewable energies. The main objective of the document is therefore to examine Thalwil's heat supply and the associated CO_2 emissions. The municipal energy plan is based on the requirements of the energy policy of the Canton of Zurich and on the guidelines of the above-mentioned "Energy City" label and was drawn up with the help of a group of energy experts from the fields of politics, society, research, and business.

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The Policy Area: Energy Transition in Thalwil

Since 1998, Thalwil has been striving for environmentally and socially compatible development, and in the last twenty years, sustainability has become a major political issue. Following the adoption of "Agenda 21", the Municipal Council set up a steering group to support sustainable strategies. As a result, sustainability is a firmly established goal for Thalwil and is being addressed through targeted measures. The energy transition seeks to reduce the personal carbon footprint of residents and the municipality as a whole. Energy transition in Thalwil and the role of the RRI-AIRR approach in municipal policy are, therefore, the political focus of the municipality.

Local authorities can make a valuable contribution to energy transition. Long-term reduction of energy consumption by private and commercial consumers to net-zero CO_2, in particular through appropriate measures, is the goal of scientists and politicians alike, and to achieve this, steps must be taken at various levels. Structural elements and regulations that influence consumer lifestyle and actions (e.g., choice of electricity and heat supplier, waste management, land use, and construction) and environmental education and awareness-raising measures can be managed at the municipal level.

The RRI-AIRR approach, which takes equal account of the various parties and focuses on the governance element (i.e., political action), is a useful tool for analysing the multiple interests, obstacles, and drivers of local energy policy. Measures at the local level require mainstream support – especially in a direct democracy such as Switzerland – if they are to be successful in the long term. In other words, political activities need to be devised and planned as carefully as possible against the background of social processes, which requires forward-looking and long-term planning, classification, and consideration of the needs of the various players involved in the political process. With the RRI-AIRR approach, it is possible to analyse these.

As part of the mission statement and embeddedness in the municipality's legislative goals for 2018–2022, sustainable development has become a principal component of Thalwil's political instruments. The municipality expects that the RRI-LEADERS project will help to accelerate the energy transition, change the energy market, and make Thalwil a leader in renewable energy and sustainability. Raising public awareness of this sustainable energy policy is as important as introducing successful measures to implement the envisaged energy transition. The following core goals could be discussed and implemented:

- **Development of a financing instrument until 2025** for financing the municipal energy transition.
- **Building stock across the municipality.** Priority for renewable energy for municipal building stock[6] by 2050.
- **Buildings of the entire municipality/area**. In municipal buildings, a thermal energy demand reduction of 30% by 2035.
- **Municipally owned buildings.** In municipal buildings, a specific energy consumption reduction of 20 % (incl. hot water) and a share of renewable energies of 75 % (incl. hot water) by 2035.
- **Total vehicle fleet registered in Thalwil.** Climate-neutral fleet (biogas, electric or hydrogen drive) of the municipality by 2050.
- **Personal carbon footprint (direct and indirect emissions) of all town residents**: almost 0 t CO_2 eq. per capita (net-zero) by 2050.
- **Analysis and reporting of all energy and CO_2 flows** at the territorial level by 2030.

[6] Municipal building stock is understood to include all buildings located in the municipal area.

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- **Territorial consumption**. A high degree of circularity for disposable consumer goods by 2030.
- **Utilities.** Biogas share of 30 % (from 20 % today) of total Gas Wasser Thalwil sales by 2030
- **Role-model function**. Strengthening the exemplary function of the Thalwil administration through specific measures.
- **Public engagement.** Improved participation/public engagement by all community residents and improved visibility of energy measures.

Important challenges in connection with the energy transition

Population growth requires more energy in heating and electricity: In 2020, the population numbered 18,263 and will grow by 1 per cent per year, with 29.6 per cent of the population being non-Swiss passport holders. The population density is 3,300 persons per km^2, and the average age is 42.9 years. While the age structure is comparable to that of the Canton of Zurich, the population density exceeds the cantonal average by a factor of three.

Promoting resident participation in the energy transition: The inclusion of all residents is an essential building block for a long-term development towards more sustainability and the reduction of energy consumption in Thalwil. The goal is to adopt and support, for example, new mobility concepts, technological innovations or, in general, tax and financial concepts that provide funds for sustainable investment.

Attractive solutions for the energy transition against the background of the topography and the proximity to the Zurich conurbation:

- **Urban Planning.** This results in urban planning tasks (e.g., structuring new settlement areas so that the interests of the various population groups can be well negotiated against the backdrop of the energy transition) and the preservation of existing green spaces against the backdrop of increasing energy demand.
- **Sustainable Energy Sources.** Further expansion of solar energy, lake water, geothermal energy, waste heat (ARA), wood, and biogas.
- **Mobility.** Here, requirements arise that go beyond existing shared-bike concepts and e-mobility (creation of charging stations) and create opportunities for senior citizens. But mobility services are also essential for younger and especially working people in the community and contribute to its attractiveness. Since the municipality is in the Zurich city commuter belt and there is a high demand for mobility services, the reduction of greenhouse gases caused by the use of fossil fuels in Thalwil (incl. mobility) and their replacement by renewable energies is an important goal for almost all political parties.

Involvement of multiple stakeholders in energy transition, including entrepreneurship and industry. Over 90 per cent of the 1,300 predominantly small and medium-sized enterprises belong to the tertiary sector (services). Existing companies in the urban area must be encouraged to support the energy transition more strongly and take measures to drive forward the net-zero target in the corporate sector. In the long term, the location could retain its attractiveness as an innovative location for existing companies as well as attracting new ones.

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Evaluating and creating further visibility through certification with the "Energy City" Gold Label[7]. Since 2010, Thalwil has been one of the "energy cities" – a European Energy Award programme label[8]. Together with the surrounding communities, Thalwil is actively committed to energy transition. One goal of the municipality is to reach the next certification level (i.e., gold) and thus prove that sustainability is actively practised in the municipality and that energy transition is being driven forward .

Key considerations for the transformative perspectives/political and social transformation process in the process of energy transition.

a. On a personal/individual level, the awareness of municipality residents needs to be changed so that action can be taken.
b. Additional funding must be generated (the budget must be approved by the municipal council or by the municipal assembly)

[7]An energy city is a municipality that is continuously committed to the efficient use of energy, climate protection, and renewable energies as well as to environmentally compatible mobility. The "Energy City" label is awarded every four years by the supporting association. Together with an accredited energy city consultant, an initial inventory with potential analysis is carried out. Based on this analysis, the municipality defines specific and tailor-made energy and climate policy measures for the following four years in a programme of activities. As soon as 50% of the possible measures have been implemented, the municipality can apply for a review by the independent label commission of the Energy City Association. For more information, visit https://www.local-energy.swiss/dam/jcr:0b72fbeb-4b5f-4369-b884-d5b6a3c0d6b2/Einfuehrung_Label_Energiestadt__August_2016_.pdf.

[8] Energy City Switzerland. Retrieved from https://energy-cities.eu/vision-mission/

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Synthesis of Experiences Related to RRI-AIRR

Anticipation

Anticipation is seen as an opportunity at the municipal level to address the future challenges of climate change proactively. Such perspectives on anticipatory leadership focus on the adaptability of organisational planning systems. The goal is to reduce future risk by strategically shaping political action to minimise risky scenarios and avoid destabilising developments.

During the project work, it has become clear that the people of Thalwil consider anticipatory governance at the community level to be a fundamental building block for implementing the energy transition. First, consistently anticipatory governance at the municipal (political) level not only helps mitigate the urgency of the energy transition and counteract the damage of climate change but also helps to reduce the costs incurred in the future (e.g. heating costs) in the long term. For example, the longer conventional parking spaces are created, the higher the cost for their subsequent conversion to e-mobility. Second, anticipatory governance rooted in local politics and governance helps develop sustainable solutions for populations that are difficult to implement at the individual level, for example, by planning the heating network for an entire neighbourhood years before the current system reaches the end of its life cycle. For example, suppose it becomes apparent that all heating systems in a neighbourhood will have to be replaced in the near future due to their expiring service life; in that case, the municipality can develop a concept for replacing the systems in advance. Third, it has been shown that anticipatory governance is crucial when promoting the participation of the population in political processes at an early stage; anticipatory governance promotes exchange between politics, business, and civil society by ensuring transparency and a voice in decision-making.

Representatives of the business community also cite anticipatory governance as an element of their internal organisational structure, as well as for the energy transition at the municipal level. As a key management principle for their companies in terms of risk assessment of internal decisions and practices (in the areas of purchasing, sales, consumer needs, and corporate responsibility), anticipatory governance helps to establish long-term processes. At the municipal level, this type of leadership allows companies to support energy transition by changing their business models over the long term to continue to profit while advancing the municipality's energy goals.

Concerning the energy transition, anticipation is structurally embedded in energy transition at various levels. On the one hand, advisory commissions were set up at the municipal level some time ago ("Energy Project Commission" and "Sustainability Steering Group"), which are regularly consulted on decisions by the Municipal Council. Further examples of the structural embedding of anticipation can be found in the further-analysed documents. For example, the *Kantonaler Richtplan Zürich (2019)* discusses both guidelines and measures based on future scenarios, a growing population, and new technologies. Such scenarios substantiate future energy consumption. Anticipation as a management tool means that costly, ecologically, and aesthetically unsatisfactory object protection measures do not arise. At the level of the municipality, a structure plan is drawn up that serves to coordinate spatial activities. In the spirit of forward-looking leadership, current and planned projects are coordinated, and their objectives are binding for all authorities.

Integration/inclusion

Thalwil respondents believe that inclusion is an essential guiding principle of energy transition planning in the national and municipal context. By inclusion, they understand the equal involvement of different stakeholders, including specialist and resident panels with their diverse interests. Since energy transition affects all levels of society, any measures must always be considered against the background of different

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interests to secure broad support in the long term. This is particularly important in Switzerland, as the political process often requires a public referendum (e.g. the "Thalwil Climate Initiative"). If a key stakeholder has been overlooked in the past, the likelihood of a project failing increases, especially in energy transition.

On the legal level, there are several indications of a desire to establish the guiding principle of "inclusion" in the laws relevant to energy transition in Thalwil. For example, promoting approaches can be found in the Canton of Zurich's Structure Plan (2019). In the case of mobility, efforts are being made to identify the needs of motorised transport and cyclists strategically and to network the various modes of transport to reduce motorised mobility gradually. In particular, the reduction of motorised traffic leads to energy savings. In addition, the Cantonal Structure Plan provides a coordinated network of footpaths and cycle paths across the municipalities, including historical traffic routes and wheelchair-accessible paths. The community's explicit legislative goals for 2018–2022 ensure that the diverse perspectives of a wide range of community stakeholders are being considered.

From the perspective of civil society, the local government must also involve those who can play a significant role in energy issues but who have little influence at the political level in shaping the energy transition (e.g. homeowners). This also includes creating communication channels to reach a broader section of the population in Thalwil and to anticipate their concerns. While various measures were discussed during the focus groups, it became clear that there is already some experience in organising events to strengthen commitment to energy transition in the community, for example, at the annual "energy aperitif" organised by the Ökopolis Association, when the people of Thalwil regularly exchange views on sustainability issues over a glass of wine. However, it is anticipated that more ideas of this kind will be developed and encouraged. This would be an important signal to focus on and represent the whole community by including residents who identify with the energy issue. Another way to strengthen inclusion would be to pay more attention to the different compositions (age, gender, level of education, etc.) when organising future public events. There are already good examples from Thalwil, such as the "Science et Cité"[9] discussion group, where strict attention is paid to a level playing field in terms of age and gender representation.

Inclusion at the community level is an essential key to the energy transition in Thalwil, requiring a more robust establishment of the issue at all levels, including business and civil society.

Reflexivity

Political respondents understand reflexivity as the need to integrate evaluation processes into the energy transition. While many measures are often adopted and implemented, there has only recently been a discussion on how the implementation processes can be included in a long-term learning and evaluation cycle. Support for a structural rooting of reflexivity was also found in dialogue with civil society stakeholders who consider reflexivity a learning process relevant for the energy transition in Thalwil. With a view to the region and the canton, there are many pilot projects (e.g. spatial planning, mobility, and housing) and a greater reflection on success factors. At the same time, the networking possibilities of ongoing processes are – according to the interviewees – increasingly oriented towards energy transition.

One facet of this guiding principle is measurability, which is particularly important for energy transition at the municipal level because many things are only tangible once they can be measured. Examples of the structural embedding of the issues in Thalwil are planning and evaluating measures and goals using a balanced scorecard approach (overview of all goals and rating them using a traffic light system). The "Energy City" label also makes energy transition and the implementation of specific actions measurable over time

[9]For more information, see https://www.science-et-cite.ch/en/

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through regular audits. Unfortunately, there is no direct access to data that makes individual aspects of the energy transition visible (e.g. a "water status report") to all residents. The better-informed people are (such as through local government channels), the better the implementation works because residents will begin to think and act together.

Researchers also underlined the role of structurally established reflexivity as part of any research process, helping to make research findings transparent and mistakes and lessons visible to third parties. Stronger embeddedness of reflection possibilities – through the definition of indicators and targets – should be structurally anchored and established before implementation. The extent to which the existing sustainability commission in Thalwil could also be activated for this purpose should be discussed further. In particular, transparent communication of the results of reflection processes also gives residents "control" since political action can be critically questioned/validated by the public/other stakeholders. This should also help shape social change towards sustainability.

Reactivity/responsiveness

Part of the RRI-AIRR approach is also to examine the role of responsiveness as one of the four key dimensions. Responsiveness is defined as using the collective process of reflexivity to both set direction and influence the further course and pace of innovation through effective mechanisms of participatory and anticipatory governance (Stilgoe et al., 2013).

In the spirit of a responsible municipality, Thalwil began promoting sustainable development in different ways as early as 1998 (e.g. energy consumption and environmental education). Two of the twelve legislative goals of the municipality (2018–2022) address the topic of sustainable development, more specifically regarding energy transition in Thalwil, with the long-term net-zero target. This leads to long-term planning and an assumption of responsibility already being applied to the energy transition. Article 10, for example, describes the objective of a general reduction in greenhouse gas emissions, the continuous development of renewable energies, and efforts to keep the "Energy City" label. Other signals for the guiding principle of responsiveness can also be found at the level of the Municipal Structure Plan (2015). This aims to ensure that new open spaces in the settlement area improve residents' quality of life and that care services for the sick and elderly are further expanded. To make compliance and the success of such measures visible, control systems such as the monitoring of several criteria must be established.

The setting, implementing, and evaluating of long-term goals supported by the entire community are a sign of responsiveness. The municipality's target is an energy reduction of 30% and a reduction in the use of fossil fuels to 55% by 2035 (Municipal Council Resolution, 2014). Concerning energy transition, the energy plan in Thalwil is quite specific. In the spirit of responsible leadership, it also discusses recommendations for measures, such as ambient heat, geothermal energy, solar energy, and natural gas. The document contains clear energy targets, which are to be achieved through further measures yet to be developed. The municipality has identified the reduction of energy consumption through building renovations as one of the most critical aspects, and the further expansion of heating networks is also possible (in Thalwil, 38% of heat is still generated by oil). This requires building renovations and heating conversions in both the residential and commercial sectors.

A change process such as energy transition requires measures that can only be implemented through smaller or larger actions over time. These must consider several factors (including scientific findings, cantonal and national requirements, and socio-economic interests), and the options for action differ. For example, civil society can exert an influence, for example, by organising itself into associations, voting in elections, exerting

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pressure on politicians, and fostering popular support (e.g. the "Thalwil Climate Initiative"[10]). From the perspective of civil society, greater leverage in energy transition can be achieved at the municipal level if the authorities/politicians are sensitive to the needs of protagonists from the outset – ideally by leading the way (e.g. in heating networks or spatial planning).

Possibilities of an evaluation commission for energy projects were suggested to extend the teaching cycles. Consequently, if an action was not feasible as planned or did not have the desired effect, it would be vital to analyse/reflect on what did not work well and how to correct it. Policy makers in the focus group also discussed how to make these processes more dynamic, given the importance of responding to changing resident needs within the legislature, such as the changing energy supply needs of the population (electricity prices and demand). The decision-makers interviewed also mentioned this aspect from the corporate world as a decisive factor, which is also adopted in business models to remain attractive to customers (e.g. supply and demand for ecological products on the electricity market). The extent to which responsible leadership must be expanded and structurally rooted in administration is an essential factor in supporting Thalwil's energy transition.

RRI-keys / Guiding Principles of RRI

Public engagement

The success of the energy transition and achievement of the net-zero CO_2 target in a municipality such as Thalwil depends primarily on the actions of residents. This was frequently highlighted in both the focus groups and interviews. Therefore, the goal must be to gain broad public support for the energy transition. In Thalwil, various events have been held in recent years to publicise energy transition, and as described above, through educational activities. These activities aim to increase public awareness and commitment to environmental issues and encourage people in the private and public sectors to act responsibly.

However, the understanding of public engagement within the RRI approach is that it should also include exchanges between researchers, policymakers, industry and civil society organisations, NGOs, and the public. This can manifest itself in open panels, opinion polls, and organised resident forums to identify solutions, accelerate the energy transition, and achieve net-zero CO_2 consumption.

However, some people are particularly active in this area and talk with local politicians and the local population. In particular, the Ökopolis Association[11] is a reliable energy transition partner in Thalwil, active in state-school education, and closely linked to the Sustainability Commission (and therefore with political decision-makers). The Association has also organised events to bring together different stakeholders to discuss energy issues at an "energy roundtable" or World Café.

Industry representatives consider public engagement with the energy transition in Thalwil to be necessary, although they are not yet very active in this area themselves. Energy companies also view greater public involvement as an opportunity to transfer know-how from the outside to the inside, sense needs, and maintain contact with the customer. Companies believe there are further opportunities for synergies here, but there is often a lack of motivation among the population. Civil society assumes that local politicians must take more responsibility for promoting public involvement by bringing different parties to the table through panels and events and creating channels to reach everyone. All the stakeholder groups interviewed agreed

[10] For more information, see https://www.thalwilerklimainitiative.ch
[11] For more information, see https://www.oekopolis.ch

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that the broader the support, the more can be achieved for energy transition in Thalwil. At the same time, it became clear in discussions that there is no consensus about which stakeholder groups should be responsible for generating more widespread interest. Although reference was made to political decision-makers in this context, party-political backgrounds mean that they are still at odds over the implementation and pace of the energy transition, and in turn, often refer back to the interests of business and civil society.

Open access

In the context of the RRI approach, open access means that research results and data relating to the planning of the energy transition in Thalwil should be available to interested parties free of charge. Furthermore, open access to the findings of publicly funded research in the form of energy data contributes to better and more efficient science and innovation in the public and private sectors. The results are structured as follows:

Business sector: Open access in the classical sense, namely "free access to research findings", is not relevant in the local industry's energy sector. However, open access is relevant for some industry players at the cantonal level if they do not want to miss opportunities in the strategic and innovative field. A significant obstacle in the energy sector for local companies in general is access to energy data (heating, electricity, etc.). Access to such data is often fundamental to a small energy cooperative or energy planner in Thalwil. However, the data is not accessible – or only with difficulty – and in some cases is not accessible or only in aggregated form.

C*ivil society* representatives in Thalwil have a different view of open access. In their opinion, they have little insight into scientific findings if they are not in the public domain. At the same time, open access is essential for them to provide argumentative support for vital initiatives (i.e. concerns that originate from the electorate and can significantly influence the legislative process at the municipal level in a bottom-up manner) and thereby make use of opportunities for political participation. From the point of view of knowledge transfer from research to society, this point is underlined, and initial approaches exist, for example, in the SwissEnergy programme[12] - a central federal platform for energy efficiency and renewable energies on which data and publications are made accessible.

As if that were not enough, data access must be expanded from the perspective of civil society players, data monitoring in the area of energy consumption (e.g. heating and solar energy) must be extended, and data located at the municipal level must also be made more easily accessible (i.e. the reduction of bureaucracy in data access must be accelerated). In the meantime, this point is already part of the Municipal Energy Plan (2015), which supports, for example, a solar register[13] to examine the suitability of individual roof surfaces and indicate their potential for solar power[14].

Transparency of data can also increase the willingness of the public and industry to contribute financially to the net-zero CO_2 target since the cost-benefit calculations for investments become more transparent for these stakeholders as well. However, this intention is point three of the municipality's legislative goals for 2018–2022. Accordingly, the digitisation and consequent accessibility of municipal administration data should be simplified and improved.

[12] Further explanations of the project can be found at https://www.bfe.admin.ch/bfe/en/home/swiss-federal-office-of-energy/the-swissenergy-programme.html

[13] Further explanations of the project can be found at https:// www.gis.thalwil.ch

[14] Interested property owners receive advice and detailed support for appropriate projects, and the Thalwil support programme provides targeted information and motivation – a good example of open access. However, awareness raising based on cost-benefit calculations and access to advice needs to be facilitated.

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Gender equality

Gender equality is understood to mean the promotion of gender balance in decision-making. Gender equality improves the quality and social relevance of the knowledge, technology, and innovation produced. In discussion with stakeholders of the Quadruple Helix, it is apparent that there is hardly any structured approach to ensuring gender equality in the listed projects and measures for the energy transition in Thalwil. Furthermore, the stakeholders interviewed did not express the need for this. However, in the higher education sector and in companies, measures are continuously taken to ensure gender equality in the respective organisational context, including developing gender equality plans and monitoring gender relations. These often belong to the public sector and are subject to equality legislation (e.g., prevention of pay discrimination). In the SMEs surveyed, these rules often did not exist.

Overall, civil society protagonists were frequently unaware that gender equality might be of interest to the energy transition. At the same time, it was noted that the energy transition is a male-dominated area, and that discourse should be held on how women, in particular, could be more involved in the responsible bodies. Furthermore, all Thalwil residents must be involved and represented for this long-term project to be successful. However, this matter was quickly dismissed by the workshops, so there is still an awareness deficit that needs to be addressed by all parties.

Ethics

In discussions with Thalwil stakeholders, it became clear that energy transition can be understood as an ethical issue shaping a resource-conserving and environmentally conscious way of life, protecting the future and viability of other generations. Consequently, the term “ethics” is rarely used in connection with research, measures, or energy planning to achieve net CO_2 zero – but seen as a motivating factor. Here, the RRI key was perceived by interviewees and the focus groups as a central element for the energy transition in Thalwil.

Small businesses often act “to the best of their knowledge and belief” when it comes to ethical behaviour and do not have a written code of conduct, unlike larger companies with specific guidelines or similar instruments. Companies with many employees approach this issue more actively and strategically than, for example, the micro and craft enterprises often located in Thalwil. Larger companies, for example, are often obliged to give themselves relevance in terms of ethical issues, such as promoting corporate responsibility (e.g. purchasing sustainable electricity, avoiding grey emissions where possible). This also applies to companies in the public sector that social stakeholders require to prepare sustainability reports. For companies involved in the energy transition, ethical behaviour also has a credibility and reputation component since they are in the public eye.

In previous discussions with civil society and political players, it was challenging to establish anything about the procedural application of “ethics”. This is because they view ethics as a motivating factor in creating a sustainable community life in harmony with the available resources. Consequently, they emphasise the motivational aspect of ethics that produces and underscores the net-zero CO_2 target. Nevertheless, some considerations seek to develop energy transition measures – particularly against the background of heterogeneous public interests – that are reflected in these measures and prevent discrimination.

While the motivational component seems understandable, against the backdrop of the term “ethics”, it would be interesting to determine which social aspects are related to energy transition or can be triggered by it. Indeed, it may be possible to identify further barriers to energy transition in this way. An example of

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this was the summer workshop, which sparked a debate about social justice since energy transition could have financial implications for some people and potentially increase social segregation.

Science education

The range of opinions from the original interviewees underlined the need for "science education" related to energy transition in a municipal and national context. This key factor is about making scientific knowledge related to climate change and measures against climate change more accessible to the public, thereby increasing society's appetite for innovation and enabling further research and innovation. Therefore, it is unsurprising that the issue of science education is deeply rooted in the relevant legal texts and standards for Thalwil. For example, in the current legislative period 2018–2022 the second legislative goal (Cf. Legislaturziele Gemeinde Thalwi[15]) is the sustainable development and qualification of public employees (including administrative and janitorial staff), making this issue a core task for the administration. Similarly, the eighth legislative goal promotes environmentally conscious and future-oriented thinking and action in state schools, where environmental topics are included in the curricula. The municipality and its stakeholders (e.g. the service centre infrastructure and wider society (energy officers and the Ökopolis Association) must ensure that local and global environmental issues are addressed in the classroom. Environmental education is promoted through the programme "PUSCH - Practical Environmental Protection" and, in this way, pupils are introduced to waste and environmental protection issues from an early age.
Industry and business representatives all consider science education related to energy transition necessary, although opinions vary depending on the size of the company. Small and medium-sized enterprises take few if any active/strategic measures regarding science education either in-house or externally. Even in larger companies, external training is still rare. For example, a major energy company in the region promotes science education by running an "education fund" sponsoring professorships, projects, and other activities (thereby positioning itself as an attractive employer).

Internally, science education in large companies in the energy sector is mainly carried out by enabling and promoting the further training of employees. Interestingly, industry and business representatives would also like to see greater scientific understanding about energy transition, as outdated and inaccurate knowledge sometimes hinders progress. The scientists interviewed often feel that they cannot ensure sufficient knowledge transfer to the public because of a lack of capacity and channels; this may be a point for future discussion. Civil society protagonists consider science education to be highly relevant for the energy transition in Thalwil, and to achieve a continuation of this knowledge transfer, scientific advisory boards will be formed at a political level or through the existing follow-up steering group in Thalwil. According to statements made by civil society protagonists, science and energy education for children and adults could be intensified. In past workshops, thought had also been given to creating attractive offers and information channels for this purpose.

[15] Legislaturziele Gemeinde Thalwil. (2018, November 22). Legislaturziele 2018-2022. Retrieved from https://www.thalwil.ch/_docn/2311342/Legislaturziele_2018-2022_Zusammenstellung_nach_Klausur_genehmigt.pdf

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Stakeholder Synthesis Mapping of Experiences Related to RRI-AIRR

Table: Systemic categorisation of stakeholders in Thalwil

Stakeholder organisations	Stakeholders with high levels of interest concerning RRI in practice	Stakeholders with high levels of experience in RRI	Stakeholders with high levels of influence on RRI in practice	Stakeholders with high levels of power
(Territorial) Policy Makers				
Federal Department of the Environment, Transport, Energy and Communications (DETEC)		Experience in the balance of interests (AIRR)	Sustainability as a core value (reflexiveness)	
Swiss Federal Office for Energy (SFOE)		Experience with anticipation, science education, and public engagement	Funding of research and information platforms (science education)	
Cantonal Office for Spatial Planning (ARE)			Setting specific rules and regulations (AIRR)	Cantonal authority
Cantonal Office for Waste, Water, Energy and Air (AWEL)			Setting specific rules and regulations (AIRR)	Cantonal authority
Swiss People's Party Thalwil (SVP)				Major political party (22%)
Liberal party Thalwil (FDP)				Major political party (20%)
Green Liberal Party Thalwil (GLP)				Major political party (17%)
Social Democratic Party Thalwil (SP)				Major political party (15%)
Green Party Thalwil (GP)				
Center Thalwil (centre)				
Municipal Council (GR)			General governance (AIRR)	Executive power

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Commission for Planning and Construction (PBK)			Advisory role (AIRR, science education)	Advisory board
Steering Committee Sustainability (StGN)			Advisory role (AIRR, science education)	Advisory board
Project Commission Energy (PK Energy)			Advisory role (AIRR, science education)	Advisory board
Research and Academia				
Swiss Federal Institute of Technology (ETH)	Pioneer in transdisciplinary research and education	Research in energy science engagement, science education)		
University of Zurich (UZH)		Research in ethics and open access		
Zurich University of Applied Sciences (ZHAW)	Territorial partner in RRI-LEADERS	Energy research and societal change (responsiveness)		
Eastern Switzerland University of Applied Sciences (OST)		Teaching in spatial development (anticipation)	Engage with municipality	
Civil Society				
Energy City Label Association	Strong collaboration with municipalities	Highly experienced with label development (AIRR)	Audit municipalities (public engagement, science education)	
Energy Panel Zurich (EPZ)		Offers public tours (science education and public engagement)		
Village Association Thalwil (DVT)				Interest group
Village Association Gattikon (DVG)				Interest group

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Ökopolis Thalwil – Sustainability Association	High interest in sustainability (reflexiveness)			
Small Trade and Industry Association Thalwil (HGV)				
Thalwil residents				Can launch a political initiative
Business Sector				
Electricity Utilities of the Canton of Zurich (EKZ)				Holds power monopoly, operates DH network
Energy 360°				
ewz energy solutions				Operates district heating network
Energy Cooperative Zimmerberg (EZS)				
Gas Water Thalwil[16]				Utility that sells water and gas (monopolist)
PLANAR AG for Spatial Development		Experts in sustainable development	Advises the municipality on energy issues	
Homeowners Association Thalwil-Rüschlikon-Oberrieden (HEV)				
Precision Landing GmbH				
Naef energy technology		Offers sustainable energy solutions		

[16]Gas Water Thalwil is a public body run by the municipality.

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SWOT analysis

STRENGTHS	*WEAKNESSES*
S1 - Strategic municipal documents typically cover time frames of ten to fifteen years, purposefully preventing legislative (4-year-terms) disruptions **(anticipation).**	W1 - Communal structures are characterised by stringent rules and regulations, with a tendency of being too rigid and slow (**responsiveness).**
S2 - Written down in the municipal code, sustainability has been considered in municipal policymaking for over 20 years. Additionally, the "Sustainability Commission" actively engages in policymaking. Municipal energy planning is covered by an "Energy Officer" and accompanied by the "Energy Project Commission" **(reflexiveness).**	W2 - Despite energy-related information being readily available, its accessibility has been criticised. For example, how many subsidies are currently available and what sort of forms are required. To some extent, this is due to the complexity of energy topics; however, it could be improved nonetheless **(open access, science education).**
S3 - Strategic policy development follows an inclusive process involving experts, commissions, politicians, and laypeople **(inclusion).**	W3 - The energy challenge affects different parts of the municipal authorities. Strengthening the internal collaboration on energy topics beyond the individual "service centres" (DLZ) could benefit energy policies in general **(AIRR).**
S4 - The "Energy City" label works inherently with many AIRR elements. With Thalwil being a certified "Energy City", AIRR has been automatically embedded in municipal processes and decisions **(AIRR).**	W4 - By mobilising a few people, the low participation rate in municipal assembly meetings (often <2% of all voters) may outperform public interest **(AIRR).**
S5 - The municipality of Thalwil uses several instruments to interact with the local community: social media channels (Instagram, Facebook), website (Thalwil informs) and a monthly office hour by the Municipal President **(public engagement).**	W5 - Thalwil's tax system has attracted many wealthy people, some of whom have the primary intention to save taxes. Many of them have an international background and non-Swiss passport holders are prevented from political participation. Others may not wish to participate in the community at all **(inclusion).**
OPPORTUNITIES	*THREATS*
O1 - The Swiss direct-democratic system can be a catalyst in forcing faster political responses regarding the energy transition (popular communal initiatives such as the "Climate Initiative" 2020 in Thalwil). **(responsiveness)**	T1 - The Swiss direct democratic system is partially characterised by slow processes and long reaction times **(responsiveness).**
O2 - Energy science still is a "male domain". Despite any assumed stereotypes, increased participation by women could benefit the energy transition **(gender equality).**	T2 - Some homeowners have little motivation to invest into renewable energy technologies and thus may actively engage against energy policies **(inclusion).**
O3 - The current climate narrative has some alarmist elements, which may fail to address sections of the community. Besides "solving climate change", other reasons for the energy transition include energy safety, energy independence, job creation or added value, which might convince a broader political range (**AIRR**).	T3 - As an implication of the Swiss citizen legislature (militia system) communal policy making is executed by laypeople, doing politics alongside other professions. This may delay or hinder fast action in the energy challenge **(science education).**

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O4 - Use synergies with existing organisations that actively engage in the energy transition debate. For example, “energieschweiz” as an information platform, PUSCH in environmental education, Forum Energy Zurich for energy technology, and Science et Cité as a public engagement enabler **(inclusion, science education, public engagement).**	T4 - Highly complex issues, such as the energy transition harbouring the danger of disregarding or discouraging people from partaking in the discourse **(science education)**.
O5 - Some homeowners may simply not be able to afford clean energy technologies such as photovoltaics or a heat pump. How could (local) funds be tapped to invest in local infrastructure **(public engagement)?**	T5 - With an increasing focus on energy topics in municipal policymaking, the likelihood of ignoring other municipal issues may arise. Even though energy policies benefit society as a whole, they may neglect certain groups or individuals (**ethics**).
	T6 - Basic energy data (electricity, power, heating, etc.) is impossible or very difficult to access for the local industry (energy planners, energy cooperatives, etc.) but plays a central role in the energy transition. Data is widely scattered (in different levels of public authorities, but also within private entities) or only available in aggregated form. **(open access)**

TOWS analysis

The **TOWS** (inverse SWOT matrix) analysis is action-oriented and aims to identify the dependencies and relationships between the internal and external factors (identified in the SWOT analysis). This will help partners outline the development strategies and propose actions to take advantage of identified opportunities, exploit existing strengths, focus on minimising/mitigating external threats, and overcome internal weaknesses.

INTERNAL STRENGTHS (S)	EXTERNAL OPPORTUNITIES (O)				
How can we use Strengths to develop Opportunities?	O1 - The Swiss direct-democratic system *can* be a catalyst in forcing faster political responses regarding the energy transition (popular communal initiatives, such as the “Climate Initiative” 2020 in Thalwil). (**responsiveness**)	O2 - Energy science is still a male domain. Despite any assumed stereotypes, increased participation by women could benefit the energy transition **(gender equality).**	O3 - The current climate narrative has some alarmist elements, which may fail to address sections of the community. Besides “solving climate change”, other reasons for the energy transition include energy safety, energy independence, job creation or added value, which might convince a broader political range **(AIRR).**	O4 - Use synergies with existing organisations that actively engage in the energy transition debate. For example, “energieschweiz” as an information platform, PUSCH in environmental education, Forum Energy Zurich for energy technology, and Science et Cité as a public engagement enabler **(inclusion, science education, public engagement).**	O5 - Some homeowners may simply not be able to afford clean energy technologies such as photovoltaics or a heat pump. How could (local) funds be tapped to invest in local infrastructure **(public engagement)**?

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S1 - Strategic municipal documents typically cover time frames of 10–15 years, purposefully preventing legislative (four-year-terms) disruptions (**anticipation**).	Anchor and support awareness for direct-democratic instruments (municipal assembly, municipal initiative) in strategic documents.	Promote gender equality by including the issue in strategic municipal documents.	Stress the positive aspects of the energy policies (local job creation, added value, energy security) in the energy plan.	Consider or adopt external strategies and policies that suit your own purposes.	-
S2 - Written down in the municipal code, sustainability has been considered in municipal policymaking for over 20 years. Additionally, the "Sustainability Commission" actively engages in policymaking. Municipal energy planning is covered by an "Energy Officer" and accompanied by the "Energy Project Commission" (**reflexiveness**).	Proactively engage with the initiators to generate a consensus early on.	Encourage greater participation by women in political commissions.	Stronger focus on the political consensus when developing strategies.	Reach out to external organisations that engage in energy-related topics.	Develop strategies for renewable energy funding (e.g. tap into local pension funds, financial institutions).
S3 - Strategic policy development follows an inclusive process, where experts, commissions, politicians and laypeople are jointly involved (**inclusion**).		Identify policies to bring more women into the energy debate.	Think win-win-win (strategies where all involved parties profit)	Target interest groups rather than individuals.	Check strategy for political feasibility.
S4 - The "Energy City" label works inherently with many AIRR elements. With Thalwil being a certified "Energy City", AIRR has been automatically embedded in municipal processes and decisions (**AIRR**).	Align or adopt energy label processes into the potential policy initiative.	Identify energy label processes that could benefit from greater female integration.	Highlight the impact of successful energy policies in other municipalities (best practices).	Identify potential synergies with the label.	Consult best practices on how to attract funding.
S5 - The municipality of Thalwil uses several instruments to interact with the local community: social media channels (Instagram, Facebook), website (Thalwil informs) and a monthly office hour by the Municipal President (**public engagement**).	Allow for a short public window to engage in the discussion of a particular initiative.	Include women (e.g. mothers and housewives) in the energy debate.	Emphasise the positive side of energy measures in public communication.	Actively engage with existing groups and associations that have a stake or interest.	Ask the public for ideas about how to increase renewable funding.

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INTERNAL WEAKNESSES (W)					
What Weaknesses should be eliminated to utilise Opportunities fully?	**O1** - The Swiss direct-democratic system *can* be a catalyst in forcing faster political responses regarding the energy transition (popular communal initiatives such as the "Climate Initiative" 2020 in Thalwil). (**responsiveness**)	**O2** - Energy science is still a male domain. Despite any assumed stereotypes, increased participation by women could benefit the energy transition (**gender equality**).	**O3** - The current climate narrative has some alarmist elements, which may fail to address parts of the community. Besides "solving climate change", there exist other reasons for the energy transition such as energy safety, energy independence, job creation or added value, which might convince a broader political range (**AIRR**).	**O4** - Use synergies with existing organisations that actively engage in the energy transition debate. For example, "energieschweiz" as an information platform, PUSCH in environmental education, Forum Energy Zurich for energy technology, and Science et Cité as a public engagement enabler (**inclusion, science education, public engagement**).	**O5** - Some homeowners may simply not be able to afford clean energy technologies such as photovoltaics or a heat pump. How could (local) funds be tapped to invest in local infrastructure (**public engagement**)?
W1 - Communal structures are characterised by stringent rules and regulations, with a tendency of being too rigid and slow (**responsiveness**).	Promote direct-democratic instruments to circumvent slow and rigid communal structures.	-	Pressure rigid and slow municipal structures by highlighting "positive urgency".	Critically assess existing rules and regulations and exploit current know-how (best practices of other municipalities).	Create boundary conditions that benefit renewable energy funding.
W2 - Despite energy-related information being readily available, its accessibility has been criticised. For example, how many subsidies are currently available and what sort of forms are required. To some extent, this is due to the complexity of energy topics; however, it could be improved nonetheless (**open access, science education**).	Use a direct-democratic tool to foster science education.	Specifically target women with energy topics by adopting new approaches.	Improve the quality of the information being provided.	Work with the best existing tools and information sheets.	Highlight potential business cases which may be adopted by the private sector.
W3 - The energy challenge affects different parts of the municipal authorities. Strengthening internal collaboration on energy topics beyond the individual "service centres" (DLZ) could benefit energy policies in general (**AIRR**).	-	-	Stress the benefits for each department of the municipal administration.	-	-

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W4 - By mobilising a few people, the low participation rate in municipal assembly meetings (often <2% of all voters) may outperform public interest (**AIRR**).	Introduce a parliament instead of the municipal assembly (political initiative required).	-	-	Address opposition to a popular referendum at an early stage and consider coping strategies used by other municipalities.	-
W5 - Thalwil's tax system has attracted many wealthy people, some of whom have the primary intention to save taxes. Many of them are non-Swiss passport holders and are prevented from political participation. Others may not wish to participate in the community at all (**inclusion**).	Develop strategies for the introduction of voting rights for non-Swiss passport holders.	-	-	Learn from highly educated expats or gain insights by adopting a different perspective	-

INTERNAL STRENGTHS (S)	**EXTERNAL THREATS (T)**					
How can we use Strengths to deal with Threats successfully?	T1 - The Swiss direct democratic system is partially characterised by slow processes and long reaction times (responsiveness).	T2 - Some homeowners have little motivation to invest in renewable energy technologies and may actively disagree with energy policies (inclusion).	T3 - An implication of the Swiss citizen legislature (militia system) is that laypeople carry out communal policymaking, combining politics with another profession. This may delay or hinder fast action in the energy challenge (science education).	T4 - Highly complex issues, such as the energy transition harbour the danger of disregarding or discouraging people from the debate (science education).	T5 - With an increasing focus on energy topics in municipal policymaking, the likelihood of ignoring other communal issues may arise. Even though energy policies benefit society as a whole, they may neglect certain groups or individuals (ethics).	T6 - Basic energy data (electricity, power, heating, etc.) is impossible or very difficult to access for the local industry (energy planners, energy cooperatives, etc.) but plays a central role in the energy transition. Data is widely scattered (different level of public authorities, but also within private entities) or only available in aggregated form (open access).
S1 - Strategic municipal documents typically cover time frames of ten to fifteen years, purposefully preventing legislative (4-year-terms) disruptions (**anticipation**).		Ensure that strategic municipal documents create a favourable environment for homeowners to invest in renewable energy.				Set the legal basis to make energy data readily available when reviewing strategic documents.

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S2 - Written down in the municipal code, sustainability has been considered in municipal policymaking for over 20 years. Additionally, the "Sustainability Commission" actively engages in policymaking. Municipal energy planning is covered by an "Energy Officer" and accompanied by the "Energy Project Commission" (**reflexiveness**).	Find ways to overcome administrative hurdles by using practical advice from the industry (e.g. heating replacement or the construction of a PV plant should be as easy as possible)	-	Consistently brief municipal council with the latest facts (e.g. policy briefs or fact sheets provided through the commissions)	Review municipal communication in terms of the energy topic (e.g. check official documents for a better understanding)	Discuss potential disruptions at an early stage and emphasise the positives rather than the negatives.	Municipal sustainability bodies should work towards greater open access (e.g. define the essential key metrics)
S3 - Strategic policy development follows an inclusive process involving experts, commissions, politicians, and laypeople (**inclusion**).		Involve the major opposition groups when fostering energy policies.		Make policy developing processes transparent and easy to understand.	Consult marginalised groups.	Ensure "data collecting" bodies (energy authorities, cantonal electricity, and energy companies, etc.) are onboard.
S4 - The "Energy City" label works inherently with many AIRR elements. With Thalwil being a certified an "Energy City", AIRR has been automatically embedded in municipal processes and decisions (**AIRR**).		Follow recommendations of best practice by the "energy-city" label.	Educate with best practice examples from the "energy-city" label.	Adopt information material from the "energy-city" label.		Consider the recommendations for individual metrics.
S5 - The municipality of Thalwil uses several instruments to interact with the local community: social media channels (Instagram, Facebook), website (Thalwil informs) and a monthly office hour by the Municipal President (**public engagement**).	Learn more about the public perception of administrative hurdles.	Listen to the opposition and find common ground.		Evaluate any lack of understanding.	Identify the disadvantaged and try to find alternatives for them.	Develop user-friendly and appealing channels and data platforms.
INTERNAL WEAKNESSES (W)						

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Which Weaknesses must be eliminated to fight Threats successfully?	**T1** - The Swiss direct democratic system is partially characterised by slow processes and long reaction times (**responsiveness**).	**T2** - Some homeowners have little motivation to invest in renewable energy technologies and may actively disagree with energy policies (**inclusion**).	**T3** - An implication of the Swiss citizen legislature (militia system) is that laypeople carry out communal policymaking, combining politics with another profession. This may delay or hinder fast action in the energy challenge (**science education**).	**T4** - Highly complex issues, such as the energy transition harbour the danger of disregarding or discouraging people from the debate (**science education**).	**T5** - With an increasing focus on energy topics in municipal policymaking, the likelihood of ignoring other communal issues may arise. Even though energy policies benefit society as a whole, they may neglect certain groups or individuals (**ethics**).	**T6** - Basic energy data (electricity, power, heating, etc.) is impossible or very difficult to access for the local industry (energy planners, energy cooperatives, etc.) but plays a central role in the energy transition. Data is widely scattered (different level of public authorities, but also within private entities) or only available in aggregated form (**open access**).
W1 - Communal structures are characterised by stringent rules and regulations, with a tendency of being too rigid and slow (**responsiveness**).	Revise existing regulations on their practicability.	Address regulations that enable systematic opposition.			Consider temporary solutions for affected people.	
W2 - Despite energy-related information being readily available, its accessibility has been criticised. For example, how many subsidies are currently available and what sort of forms are required. To some extent, this is due to the complexity of energy topics; however, it could be improved nonetheless (**open access, science education**).		Systematically eliminate misinformation (of homeowners).	Provide the municipal council with the best material available (e.g. regular policy briefs).			Avoid misinformation with the help of solid and reliable data
W3 - The energy challenge affects different parts of the municipal authorities. Strengthening internal collaboration on energy topics				Foster a better understanding of communal energy issues.	Learn about adverse policy effects within different service centres.	

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beyond the individual "service centres" (DLZ) could benefit energy policies in general (**AIRR**).						
W4 - By mobilising a few people, the low participation rate in municipal assembly meetings (often <2% of all voters) may outperform public interest (**AIRR**).				Focus on clear and straightforward formulation when preparing voter material.	Identify the marginalised at an early stage.	
W5 - Thalwil's tax system has attracted many wealthy people, some of whom have the primary intention to save taxes. Many of them are non-Swiss passport holders and are prevented from political participation. Others may not wish to participate in the community at all (**inclusion**).						Ensure that the non-Swiss population is informed about energy issues appropriately (language etc.)

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Identification of Strategic Policy Priorities

Based on the SWOT/TOWS analysis, important strategic focal points for integrating the RRI-AIRR approach were identified. In this context, the RRI keys and the AIRR dimensions could be of particular importance for the energy transition in Thalwil. Technological solutions for the expansion of renewable energies have been known for some time, but there is a lack of broad social acceptance and recognition of the topic's relevance. The RRI-AIRR framework particularly emphasises these "soft" factors. The following is a selection of strategies that could be critically discussed in the focus groups:

(1) Positive aspects of the energy transition are still frequently perceived as arduous, expensive, and time-consuming. As a result, positive factors, such as local added value and the associated job creation, or lessening dependence on a given energy supply, often remain hidden. The municipality of Thalwil could draw more attention to the advantages of renewable energy sources in its communications and root this more firmly in its corporate culture.
(2) Learning from others: the 2,200 municipalities in Switzerland all have different strengths and weaknesses. Some communities are true pioneers in energy transition. In the meantime, there is a wealth of information and a palette of best practice examples. Above all, the Energy City label documents give prime examples of successful governance, which can be considered as an effort towards anticipation.
(3) Financing the energy transition involves high investment, as do renewable energy systems. Thalwil has limited room for manoeuvre here but can function as an intermediary between lenders and homeowners. Other possibilities include investments by the administration's pension fund or the sale of shares to the population in an extensive PV system.
(4) Although the energy industry is still primarily a male domain, better representation of women is likely to be valuable for many reasons. This could be achieved, for example, through a more mixed composition of political bodies and commissions. In addition, through targeted communication, women could be made more aware of energy and climate issues, contributing to a greater general understanding of this complex topic.
(5) Exploiting synergies: the energy issue has preoccupied Switzerland for over 20 years, and during that time, many institutional players and groupings have emerged. Thalwil does not have to begin from scratch but should focus on collaborating with existing players and seeking dialogue with antagonists. The goal must always be to identify majorities for solutions that serve Thalwil's energy policy. Improved coordination between the various departments of the public administration would be straightforward and effective, which can be considered as an example of inclusion.
(6) Energy transition requires the early setting of the course in a variety of planning instruments – spatial planning, landscape development, energy planning, procurement, and transport concepts, to name but a few. Thalwil must continue to make targeted use of this opportunity in the future to promote good framework conditions for the rapid expansion and conversion of the energy system. Examples of this are the target network planning for gas supply and the expansion of district heating in the municipal area.
(7) Monitoring: to achieve the federal net-zero CO_2 target in Thalwil, a reduction path and the actual state must be defined. This can only be achieved with the help of objective criteria and corresponding measurements. In this context, the transparent presentation of sources and methodology is vital. The basis for this is the most comprehensive energy data possible, which the municipality makes freely available. In addition, of course, the necessary data protection regulations must be observed.
(8) As an administration, Thalwil must set a good example. This includes the energy-efficient refurbishment of buildings, the replacement of renewable heating systems and, of course, the vigorous expansion of PV systems to municipal properties. The exemplary role begins with planning,

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continues with the realisation of new projects or procurement, and is particularly evident in maintenance and thus in the attitude of individual employees. With the help of targeted staff training, additional awareness could be raised, and resources saved. What can be considered as an effort towards scientific education.

(9) Through sustainable procurement, Thalwil can make an essential contribution to energy transition. For example, the locality or grey emissions of a product or service could be set as a purchasing criterion. In addition, electric vehicles are already increasingly being used instead of those with conventional combustion engines.

(10) Simplified processes: the energy transition is closely interwoven with many official requirements, approval procedures, and subsidies. Barriers to a renewable heating system replacement or a PV system must be kept to a minimum. Unnecessarily complex bureaucracy not only deter investors but also leads to inefficient processes. Here, the municipality can remedy this by evaluating its processes and procedures, standardising them, and simplifying them if necessary.

(11) Policy briefing: energy issues are diverse, complex, and among the most researched topics. Consequently, it can be challenging to keep up with the current state of the science. Through policy briefings, commissions could keep local councils systematically up to date.

(12) Energy communication: a flood of information competes for our attention every day, but political consent demands reliable facts. Thalwil could improve communication on energy issues at various levels. Access to information on the municipality's website could be facilitated by linking the current best pages. Information boards or handouts in the entrance areas of civil buildings could sensitise the public to energy-related issues. In addition to continuing environmental education in Thalwil schools, campaigns to improve understanding among the general population could also be effective.

(13) Alternatives for losers: like any transformative process, energy transition will not bypass specific industries or business models. To this end, it is necessary to anticipate any systematic disadvantages early and develop solutions if these fall within the municipality's jurisdiction. The municipality needs to be clear about which businesses or groups might be affected.

(14) The direct democracy political system works well, but political processes can be very slow-moving. One disadvantage of a community meeting is that only a tiny proportion of the representative voting population has any real power. Here, the municipality could be more proactive with political participation processes such as surveys, resident panels, and discussion forums. All these could support the sustainable energy supply goals in Thalwil and can be seen as an effort towards public engagement.

Summary of Focus Group Discussions

At the beginning of November, four focus groups were held with representatives from the fields of business, politics, research, and civil society. Their collective aim was to deepen current understanding regarding the integration of the RRI-AIRR approach into the political focus and concerning the energy transition in Thalwil. The discussion focused on the vision, necessary changes, and strategies resulting from the energy transition vision and implementation of the RRI-AIRR key and its dimensions, and recommendations for integrating the RRI-AIRR approach.

Business Focus Group with ten participants, held on 11 November 2021 in the premises of the municipality of Thalwil.

(1) Vision for territorial development in the selected policy area by 2050: The municipality must achieve a net-zero CO_2 target by 2050 in line with national goals. It also highlights the challenges and tasks – as well as the social, technical, and economic opportunities – associated with this change in society as a whole. For example, alternative technologies in the areas of heating and heat generation, housing and entertainment, and scenarios of mobility and transport were discussed, accompanied by

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adaptations of existing and innovative new business models. In terms of opportunities, participants also emphasised the possibility of creating new jobs and tax revenue in the community.

(2) Strategic priorities to achieve this transformation: At the level of spatial planning and in the approval procedures for construction projects, the participants saw enormous potential for shaping the energy transition at the municipal level. Criticism was levelled at lengthy approval procedures and the lack of (or inadequate) standards, as well as poor information-transparency at the municipal level concerning existing funding instruments. The first point included, in particular, the revision of the building code and, in general, the reduction of bureaucracy in approval procedures (e.g. specifically for photovoltaics and heat pumps). The second point also included the creation of innovative (financial) incentives for investments and their transparency at the municipal level. An incentive for additional investments by companies can be expected if the issue is supported visibly by the local administration, for example, by investing in an energy-saving vehicle fleet, real estate, and in a strategic communication initiative, such as introducing an energy barometer and regular communication about the investments and measures taken. This would make the community a tangible and visible role model.

(3) How the RRI-AIRR approach fits best to achieve the intended transformation: In terms of AIRR dimensions anticipation and reactivity, the following examples were offered: Firstly, the forward-looking design of the building code on the part of the municipality, which can react flexibly to technical adjustments, and secondly, the design of heat generation is also a critical lever for the energy turnaround because every gas heating system that is replaced now will be in operation for another 30 years (i.e. until 2050) and not contribute to achieving the energy transition. Thirdly, ensuring affordability requires its own long-term strategy; for owners, calculation examples must be communicated and visually presented to show when an investment pays off. The AIRR dimension of inclusion is critical in bringing together expertise: for example, retrofitting heating systems requires an integrated approach that involves installers, architects, and other stakeholders. From the point of view of the business representatives, the design of data accessibility (open access) is a local government issue. It was noted that data is often limited or difficult to access, while information on the energy transition needs to be low-threshold, free of charge, prominent, and up to date. Criticism was made that advisory services often cease when the funding is exhausted. Here an extra budget is needed to safeguard counselling services. These services should be personal and offered in a comfortable, private setting such as the home. Incorporating RRI keys and AIRR dimensions helps identify interrelated energy transition control levers that stakeholders are often unaware of.

(4) The role of the participating stakeholder group: Local government and politics can only create the framework conditions and function as role models. Ultimately, energy transition must be implemented by consumers and companies.

(5) The role of the other stakeholder groups: The need to involve the trades, business, and industry more closely in the dialogue on measures for the energy transition was emphasised. The energy turnaround is relevant for all sectors and must encourage all entrepreneurial players in the community to rethink. For example, the municipality can promote working from home through a fast internet connection. At the same time, attractive leisure facilities (e.g. a local cinema) might encourage people to spend more free time in Thalwil and not travel out of the region. In the area of energy generation, participants saw great potential in the expansion of photovoltaic systems. While growth in the core zones has been severely restricted from the outset, there is still insufficient potential for developing photovoltaics on the often-decentralised industrial roofs (outside the town centre).

(6) Recommendations: The stakeholders also emphasised a range of strengths that Thalwil has regarding energy transition. These highlighted existing support programmes, effective communication and healthy dialogue, and a tangible will to change. The participants saw opportunities for transformative change in the areas mentioned above, especially in mobility and heat supply.

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Policymakers Focus Group with five participants, held on 11 November 2021 in the premises of the municipality of Thalwil.

(1) Vision for territorial development in the selected policy area by 2050: The main objective is to develop appropriate measures to achieve climate neutrality by 2050, including municipality-wide building stock. In municipal buildings, specific targets are energy reduction of 20 % (incl. hot water) and a share of renewable energies of 75 % (incl. hot water) by 2035. Total vehicle fleet registered in Thalwil: climate-neutral vehicle fleet (biogas, electric, or hydrogen drive) for the municipality by 2050. Rapid progress by the municipality in energy transition is crucial because the municipality has a role-model function concerning its own "low CO_2" lifestyle (e.g. for heating and heat supply). However, the local government can evaluate technological innovations ("Internet of Things") and the increased energy efficiency.

(2) Strategic priorities to achieve this transformation: Participants stressed that the technical requirements and possibilities already exist today; the only question is how to get the community to support the process. There is a need for improved communication on sustainability and energy transition issues. There are currently many projects at the cantonal and municipal levels, but the information is only available to residents with a particular interest. Participants pleaded for a more targeted use of communication strategies and for communicating and highlighting successes during and after a project. However, there is often a lack of systematic monitoring of energy projects that could be made public. Moreover, communication should be linked to projects that residents can relate to in the first place; this must not simply create an additional flood of information but inform people about existing projects and awaken their interest in energy and climate issues. To improve existing funding opportunities and create new ones (such as heating and heat supply), it is worth considering new financing options such as leasing expensive heating systems over a certain period.

(3) How the RRI-AIRR approach fits best to achieve the intended transformation: Since energy transition is a task for society as a whole, Thalwil residents need to become more aware of that goal at the community level. This is the starting point for AIRR's "inclusion" dimension; reaching the public is often a significant challenge from a policy perspective, as energy-related issues are often highly technical, expensive, and involve waivers. It was noted that although there are many projects today, the same few people are always involved, and only a few hundred people come to the special meeting. Most people are hard to reach and know little about energy planning and existing financing options. It is also an essential task regarding "open access" to identify the communication channels to address specific target groups. One option would be to target specific groups such as homeowners directly (emphasising long-term financial prospects, current technical status, and investment benefits) and increase collaboration between the community and the homeowners' association. The nature of the information transfer is crucial. Participants acknowledged a need for a change in the narrative – away from obligations and declarations of renunciation, emphasising the added value that the energy transition brings for people and the environment. Although, it has already been shown that the key facts about the energy transition are known, action is often not taken. In addition, the information offered in schools is to be expanded to turn children into multipliers (e.g. regarding energy-saving measures).

As far as gender equality is concerned, there are often very few women represented, especially among older participants. Yet, as voters and community members, women are important sources of input for energy measures and decisions that have received too little attention in the past.

(4) The role of the participating stakeholder group: Municipal policy is a crucial pillar in shaping the framework conditions for the energy transition in Thalwil. Regarding the RRI-AIRR approach, coordination and long-term planning between the partners involved can be strengthened. Anticipatory communication must also be expanded so that, for example, major development projects are also communicated at an early stage. At the same time, there are already many successful examples where anticipation has already worked well (e.g. climate-adapted settlement development).

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Also, with relatively low-cost measures (e.g. CO_2 consumption indicators), the visualisation of data and thus the sensitisation of the population to the issue of energy transition can already be expanded.

(5) The role of the other stakeholder groups: It is important to keep all stakeholder groups in mind; i.e. the rural population with specific needs, depending on the age group, which have to be taken into account for the energy transition to be cushioned socially. Only close cooperation between civil society, business, and policymakers can embed social and technological innovations that advance the energy transition.

(6) Recommendations: The energy transition can succeed if all stakeholders become active across party lines, are committed to the issue, and engage in a deeper dialogue. Additional promotional opportunities must also be created at the cantonal level. Awareness-raising measures must begin sooner to involve the civilian population in measures and decision-making processes that can ultimately achieve a majority at the ballot box.

Research Focus Group with six participants conducted on 12 November 2021.

(1) Vision for territorial development in the selected policy area by 2050: The Energy transition is necessary as CO_2 neutrality is targeted at the national level. However, thinking about the appropriate implementation is directed towards the municipal level.

(2) Strategic priorities to achieve this transformation: While there are many prominent, alternative ways to generate and conserve energy, energy storage is rarely discussed. Here we need new solutions that are tested in the community, such as power-to-gas, smart grids. In addition, consideration should be given to how the municipality's resources (e.g. its vehicle fleet and buildings) can be made climate-neutral more quickly. The procurement of materials should also continue to be monitored for sustainability as a purchasing criterion, and this point should be visibly established (role-model function). If procurement guidelines already exist, they are still too rarely consulted. The expansion of the circular economy at the municipal level and in the administration could also be interesting. Digital platforms are also needed to promote participation in the community; corresponding offers can be found on the market (see Loco-Bubbles[17]). Gamification approaches were also mentioned, for example, encouraging competition between neighbourhoods within the municipality to see who is the most climate neutral. It would also be interesting to compare Thalwil directly with other municipalities in terms of the energy transition (carbon footprint). The data need not necessarily be communicated in abstract quantities such as tonnes of CO_2 but more comprehendible units such as parking spaces. In this way, the reduction path could be demonstrated.

(3) How the RRI-AIRR approach fits best to achieve the intended transformation The RRI-AIRR approach and aspects related to leadership generated some interesting suggestions. Concerning anticipation, for example, looking to the future is essential, but planning must not be too rigid, otherwise options will be blocked. Nevertheless, planning periods of up to 20 years already exist in most areas (e.g. heating networks conversion etc.) Regarding the development of science education, it was proposed to launch an awareness-raising campaign to demonstrate the added value for residents and strengthen the will for change. In addition, there is already a strong information network that needs to be more focused and to facilitate the search for information such as funding for example for PV. A contact point within the municipality administration could be established for the purpose of funding support. There should also be a greater distinction between scientific and action knowledge, the latter being needed more. In addition to extending financial incentives, personal examples would help; if some neighbours put solar panels on the roof of their house, it would have a greater impact than other forms of campaigning. These individuals need to be identified. In this context, cooperation with existing (sports) clubs could be strengthened and public commitment increased. As for equality, diversity is always an asset; the inclusion of different perspectives (beyond gender) is always an asset because it is usually the same people who get involved. To this end, groups such as "climate youth"

[17] https://apps.apple.com/at/app/loco-bubbles/id1540301038

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(who are not represented in Thalwil) must also be specifically addressed. Families could be addressed through specific topics, e.g. "What does Thalwil look like to our children?" Adopting female role models can also have a positive impact on consumer choice.

(4) The role of the participating stakeholder group: The scientific community sees itself as a developer of technological innovations for tangible CO_2 reduction and social science findings for their integration. Specifically, scientists propose that issues such as information campaigns and energy measurement and calculation should also be accompanied and promoted by student work. In this context, scientists also see themselves as advisors and generators of ideas.

(5) The role of the other stakeholder groups: This requires the involvement of all parties, in particular, politics, business, and civil society, accompanied by dialogue to stimulate technological and social innovations at the local level.

(6) Recommendations: Previous successes in energy transition should also be presented more clearly to residents, the added value of energy transition should be communicated more clearly, gamification approaches should be expanded, and awareness of the need for energy transition among citizens should be raised.

Civil Society Focus Group with five participants, held on 10 November 2021 in the premises of the municipality of Thalwil.

(1) Vision for territorial development in the selected policy area by 2050: The energy transition in Thalwil should be oriented towards national goals and implemented as quickly as possible. This requires an effort by society as a whole and involve business, politics, and civil society. In addition to heating and heat generation in private households, the main focus is on grey emissions (which can only be corrected by the municipality to a limited extent), but which cause the most significant CO_2 emissions. In this area, only civilians in the role of consumers and industries in the role of producers can act in a meaningful way.

(2) Strategic priorities to achieve this transformation: The involvement of the average citizens in the processes of the energy transition is crucial at every point. Even if the people (local council) must decide the measures, this presupposes that the population is aware of its actions and changes (Attitude-Behaviour-Gap – as soon as it costs something, it becomes difficult). The energy transition can be implemented sufficiently quickly only through changes in behaviour and the willingness to make sustainable investments. In addition, approval procedures (specifically for heat pumps and photovoltaics) must be simplified and accelerated; otherwise, residents will perceive this as a negative incentive and resort to fossil-fuel technologies. The municipality must also think "outside the box" concerning best practice examples and take its lead from the successes of other municipalities and cantons. Specifically, consideration should be given to how mobility can be improved (e.g. bicycles and pavements).

(3) How the RRI-AIRR approach fits best to achieve the intended transformation Individual aspects of the RRI-AIRR approach work very well with the issues of the energy transition. In the field of information and scientific education, there is often a lack of simple solutions and case-related calculation examples regarding investments made by private households (e.g. when buying a new heating system). Many homeowners are unaware of the long-term cost if they opt for a conventional fossil-fuel heating system. The municipality could expand its free advisory services here, and timely regulations are also needed concerning oil and gas heating systems. It is essential to consider how the new heating system can become an attractive "status symbol" and how such investments can also achieve an external effect. The facade of a house is often the focus of investment because of its visibility, but the heating system is invisible in the basement. The municipality could increase this visibility through campaigns. A more visually oriented form of communication should be found that appeals to a broader social spectrum when communicating action knowledge. Here too, participants suggested a marketing campaign and specific lead-users such as advertisers to promote a gamification effect, thereby giving CO_2 saving a competitive feel. Concerning public involvement, it would be

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necessary to consider how all social groups in the community might be included in discussions on the energy transition. For example, schools (including environmental schools) could be more involved in this process. In principle, several instruments, such as the Ökopolis Association, "energy aperitifs", and the Sustainability Steering Group, should be expanded more consistently.

(4) The role of the participating stakeholder group: The main task of implementation and adaptation lies with civil society, although poicymakers and business must create the framework conditions and products. Since civil society is not always aware of the tasks (or will not act), ways must be found to expand public interest in the topic further, even if the goals set by the 2050 energy transition policy still seem a long way off.

(5) The role of the other stakeholder groups: Policymakers must set appropriate framework conditions, including planning scenarios, regulations, and the provision of essential data. This includes technical data, overviews of funding opportunities and guidance, and the municipality's progress. To develop a gamification character, comparability with other communities and updates on local progress are needed. For example, CO_2 barometers could be set up and solar panels equipped with a board showing their performance. Another idea was to offer prizes to people who make a particularly significant reduction in CO_2 emissions. Energy transition requires not only innovative technical solutions from research but also innovative approaches to implementation in the community.

(6) Recommendations: Thalwil is a municipality that has been committed to sustainability for many years, but this is outwardly visible only to a limited extent. However, the successes achieved so far are reflected in the high quality of life and could be made more visible so that the residents continue to rise to the energy transition challenges in the future.

Analytical Resumé

There were divided views between the groups on the goal of climate change. While the civil society and research representatives called for stricter targets, representatives from policymaking and business quickly moved to specific measures that could be implemented as soon as possible. In particular, the topic of heat, energy production, and the conversion of heating systems came up in this context, where mainly bureaucratic hurdles still block existing (financial) incentives. Overall, however, it was clear that viable means, technologies, and incentives already exist to make heat generation in private households more CO_2 efficient.

Thalwil has already made efforts to inform homeowners about opportunities and investments – such as PV and heat-pump systems – but general interest is still limited. In this context, gamification and game-based approaches were also discussed as possible ways to close the gap between attitude and behaviour (energy transition was predominantly perceived as positive by all participants) and to encourage residents to invest. It was also agreed that there are already many sustainability measures in the municipality, but these are not yet sufficiently visible (lack of communication). As a result, residents still lack the motivation to become more involved in energy-saving projects.

Concerning the RRI-AIRR approach, it was clear that although this approach is unknown per se, individual dimensions such as anticipation and inclusion (and keys such as scientific education and open access) are accepted as critical guiding principles for the energy transition. In particular, an ongoing conscious reflection at the municipal administration on how all stakeholders can be involved at an early stage in the overall goal of the energy transition at the measures and strategy levels appears to be one of the most urgent requirements. Without the involvement of residents (who bear the greatest responsibility for participation in the energy transition owing to grey emissions), specific and rapid implementation will fail at the ballot box because there is no groundswell of political support for behavioural change. The four focus groups discussed many specific examples and actions that could serve as incentives and suggestions for public adoption.

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Policy Recommendations and Conclusions

The RRI Audit Report for Thalwil provides a summary analysis based on the mapping analysis of the R&I ecosystem and stakeholders, the results of the SWOT and TOWS analyses, and the regional focus group reports.

Thalwil is in an excellent position to achieve the energy transition since many measures have already been implemented over the past 20 years. As a result, sustainability is already established as a guiding principle in the municipality's legislative goals for 2018–2022, while the national orientation calls for net-zero CO_2 consumption by 2050. Nevertheless, Thalwil's policy goals are ambitious and include the strategic objectives from the section "The Policy Area: Energy Transition in Thalwil"

Specifically, the research to date has explored how the RRI-AIRR approach can provide additional clarity to achieve these goals. To this end, the extent to which the AIRR dimensions and RRI keys are already embedded today and where they could be further expanded was examined.

Anticipation: As far as anticipatory guidance is concerned, there were already clear indications of systematic embeddedness at the municipal level, reflected in legislative texts and existing projects. It is also clear that forward-looking leadership is an important political instrument for involving the entire population and other stakeholders from industry/trade and civil society organisations in the energy transition. For a start, this strengthens commitment to the process since many measures extend into the individual decision-making sphere and require additional financial resources.

Furthermore, forward-looking leadership promotes exchange between politics, business, and civil society by ensuring transparency and a voice in decision-making. On the one hand, advisory committees such as the Energy Project Group and the Sustainability Committee have been developed; on the other hand, they could play a more critical role in analysing future scenarios and making recommendations for political decisions. To this end, the role of these commissions and their involvement in the political process at the local level should be re-examined.

The analysis also showed that greater cooperation on energy issues between municipalities could be developed, at least at the project and action levels. In this context – and also at the action level – it would be helpful to learn more about innovations and good practices from the national and international context and adopt ideas well-applied in other areas. Project commissions should conduct this task with support from science and research representatives. Anticipation could be strengthened by these and other measures listed in the report.

Another important pillar for the energy transition in this context is tapping additional financial resources, for example, based on other tax revenues, committed financial resources, or cantonal subsidies. This will create incentives for private investment (e.g. in renovations and generally to gain planning security).

The involvement of the various stakeholders beneath the umbrella of energy transition can be seen under the heading "inclusion"; here, there are already many examples in the community pointing to a systematic anchoring of these AIRR dimensions. Nevertheless, it is necessary to promote energy transition and sustainability in a targeted manner and, in particular, to establish target group-specific communication, which has also been shown in previous focus groups.

A well-devised campaign that allows the positive aspects of the energy transition to be given greater prominence, (e.g. that energy transition creates new jobs and a higher quality of life in the community) would significantly increase the willingness of the population to become involved. Another critical aspect of inclusion is the systematic creation of collaborative partnerships. In the last 20 years, many contact points and projects in energy production have also been established at the cantonal level.

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These resources could be better used through enhanced cooperation, while exchanges between existing working groups should also be strengthened at a local level.

The need to catch up in the area of monitoring projects and measures also became apparent. To achieve the net-zero CO_2 target in Thalwil set by the government, a reduction path and the actual situation must be defined. This can only be achieved with the help of objective criteria and appropriate measurements. The basis for this is the most comprehensive energy data possible, which the municipality makes freely available.

The expansion of science education, already included in two 2018–2022 municipal legislative goals, is also an important pillar in advancing the energy transition. The eighth legislative goal in Thalwil also promotes environmentally conscious and future-oriented thinking and action in state schools, which is why environmental topics are to be included in all curricula. In this way, the next generation is already being educated to live in a sustainable and resource-conserving way and function as multipliers in the community.

With the "Energy City" energy label, Thalwil is already ahead of many towns and municipalities in Switzerland. The community can build on this success and act as a role model for the entire region and reaching the next category – gold status – would be a valuable milestone. This report lists many proposals that will achieve this goal.

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