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sweet swiss energy research for the energy transition

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Summary

Switzerland has committed itself to international climate goals, the achievement of which depends significantly on transforming the energy system toward renewable energies while moving away from fossil fuels. Although the Swiss population has repeatedly reaffirmed its support for these goals, and despite the fact that the necessary technologies such as hydropower, photovoltaics (PV), or wind energy have been available, their construction has been challenging.

This White Paper analyses the seeming inconsistency between general energy transition support by stakeholders and the low rates of actual installations being built by drawing on the concept of *social acceptance*. It provides three contributions:

First, it shows that a nuanced understanding is required of what type of acceptance is necessary in which situation and by whom to successfully build renewable capacity.

Second, it presents new data on the socio-political acceptance of various energy sources and fundamental energy policy principles. While this general form of social acceptance is often insufficient to actually implement associated projects and measures, it is nonetheless indispensable: If acceptance is lacking even at this abstract and hypothetical level, concrete implementation is often impossible. Based on this data, three groups of energy sources can be distinguished: the *"Public Favourites"* (large-scale hydropower and rooftop PV), the *"Non-Starters"* (gas-fired combined cycle power plants and electricity imports), and the group *"Debated but Viable"* (currently hotly debated technologies such as wind energy, open-space PV or nuclear energy).

Third, the White Paper presents six research examples that analyse specific technologies and different dimensions of acceptance. They discuss the conditions under which high socio-political acceptance can be translated into successful projects (*community acceptance*) or market products (*market acceptance*).

Finally, the White Paper formulates **five recommendations** to facilitate the implementation of renewable energy technologies. As social acceptance is a collective task, its generation cannot be allocated to a single stakeholder group. Rather, all involved stakeholder groups should consider the five recommendations from their respective perspectives:

1. Participatory processes are important but encouraging **local leadership** is key: Having local project developers and committed local political leadership makes a difference.
2. Leveraging **positive social dynamics** through networks and communication: Harness the fact that there is broad socio-political acceptance for the expansion of renewables. Peers and neigbours are generally *for* the transition.
3. Build **trust**: Knowing that responsible people are doing responsible things may compensate for the uncertainty of what a project may bring at the time of the decision.
4. **Suitable incentives structures** neet to be put in place: Effective, transparent incentives can support investment decisions and reduced institutional incentives for obstructional politics are important.
5. Anticipate **mobilization asymmetries between opponents and proponents**: Quite often, the problem is not a lack of a supporting majority but the presence of an engaged minority opposition.

Zusammenfassung

Die Schweiz hat sich den internationalen Klimazielen verpflichtet, deren Erreichung massgeblich von der Transformation des Energiesystems hin zu erneuerbaren Energien und der Abkehr von fossilen Brennstoffen abhängt. Obwohl die Bevölkerung die Unterstützung für diese Ziele und für erneuerbare Energien mehrfach bekräftigt hat und die notwendigen Technologien wie Wasserkraft, Photovoltaik (PV) oder Windenergie vorhanden sind, gestaltet sich der Bau entsprechender Infrastrukturprojekte weiterhin schwierig.

Das vorliegende White Paper widmet sich diesem scheinbaren Paradoxon und greift dabei auf das Konzept *sozialer Akzeptanz* zurück. Es leistet drei Beiträge:

Erstens zeigt sich, dass ein differenziertes Verständnis darüber erforderlich ist, welche Art von Akzeptanz in welcher Situation und von wem notwendig ist, um erfolgreich erneuerbare Kapazität zuzubauen.

Zweitens werden aktuelle Daten zur sozio-politischen Akzeptanz verschiedener Energiequellen sowie energiepolitischer Grundprinzipien präsentiert. Zwar reicht diese allgemeine Form der sozialen Akzeptanz oft nicht aus, um damit verbundene Projekte und Massnahmen tatsächlich umzusetzen. Dennoch geht es nicht ohne: Fehlt bereits auf dieser abstrakten und hypothetischen Ebene die Akzeptanz, wird eine erfolgreiche konkrete Umsetzung oft unmöglich sein. Basierend auf diesen Daten lassen sich drei Gruppen von Energiequellen unterscheiden: die *"Publikumslieblinge"* (Grosswasserkraft und PV auf Gebäuden), die *"Aussichtslosen"* (Gas und Stromimporte), die Gruppe *"Umstritten, aber möglich"* (stark diskutierte Technologien wie Windenergie, Freiflächen-PV oder Nuklearenergie).

Drittens präsentiert das White Paper sechs Forschungsbeispiele, die spezifische Technologien und Dimensionen der Akzeptanz analysieren. Sie zeigen auf, unter welchen Bedingungen sich hohe sozio-politische Akzeptanz in erfolgreiche Projekte (*community acceptance*) oder Marktprodukte (*market acceptance*) übertragen lässt.

Abschliessend formuliert das White Paper **fünf Empfehlungen**, um die Umsetzung erneuerbarer Energietechnologien zu erleichtern. Diese richten sich an alle Stakeholdergruppen, die bei der Umsetzung erneuerbarer Energielösungen involviert sind, insbesondere **Projektträger sowie politische Entscheidungsträger:innen und Behörden der kantonalen und lokalen Ebenen**. Soziale Akzeptanz ist nicht die Aufgabe einer einzelnen Stakeholdergruppe. Um die soziale Akzeptanz bei der Umsetzung erneuerbarer Energielösungen zu fördern, sollten vielmehr alle involvierten Stakeholderguppen die fünf Empfehlungen aus ihrer jeweiligen Perspektive berücksichtigen.

1. Partizipative Prozesse sind wichtig, aber förderliches lokales Leaderhip ist zentral: Partizipative Prozesse sind für die Energietransition in der Schweiz unverzichtbar. Doch um Synergien statt Trade-offs in den Vordergrund zu rücken, braucht es mehr als blossen Einbezug, sondern echte lokale Initiative und das Vorangehen von lokalen Persönlichkeiten und Akteuren. Dies zeigen die alpinen PV-Projekte: Werden sie von grossen externen Unternehmen vorangetrieben, riskieren sie eine "Veto-Spieler-Dynamik", bei der einflussreiche Akteure aus Sorge vor externer Kontrolle oder ungleicher Nutzenverteilung Widerstand leisten. Die Gemeinde oder lokale Stromanbieter können hier als

lokale “entrepreneurs” wirken, indem sie wahrgenommene Trade-offs minimieren, die gesellschaftlichen Gewinne sowie Synergien betonen und so Akzeptanz schaffen.

2. Positive Dynamiken durch Netzwerke und Kommunikation stärken: Die Herausforderungen bei der Umsetzung erneuerbarer Energien überdecken teilweise die positiven sozialen Dynamiken, die es durchaus auch gibt. So wird etwa beim Solar-Express oft das Scheitern von Projekten betont, obwohl eine Mehrheit der alpinen PV-Projekte, die zur Abstimmung kamen, von den Standortgemeinden unterstützt wurden. Auch bei der Windenergie macht es einen Unterschied, ob man pauschal von einer “50:50-Chance” spricht oder gezielt zwischen Abstimmungen über Regulierungen und Projekten unterscheidet. Die breite sozio-politische Akzeptanz der Energietransition in der Schweiz bietet ein Fundament, das insbesondere Gemeinden, zusammen mit den Projektträgern nutzen. Durch öffentliche Debatten und öffentliche Abstimmungen an Gemeindeversammlungen (statt geheimen oder Urnenentscheiden) lässt sich diese Dynamik verstärken (vorausgesetzt, die Gruppendynamik ist positiv). Ebenso wirksam ist das Schaffen von Möglichkeiten zum Austausch in persönlichen Netzwerken, etwa durch Nachbarschaftsveranstaltungen, die frühe Nutzer:innen von PV mit Interessierten zusammenbringen.

3. Vertrauen schaffen – die Basis für Akzeptanz: Vertrauen ist der Schlüssel, um sozio-politische Akzeptanz in konkrete Markt- und lokale Akzeptanz zu überführen. Menschen müssen den Technologien, den Verantwortlichen und den Prozessen vertrauen können. Dieses Vertrauen kann Unsicherheit kompensieren, welche bei solchen Infrastruktur-Entscheiden oft im Raum steht. Vertrauen entsteht auf vielfältige Weise: Erneut können lokale Behörden, Entscheidungsträger:innen oder Projektträger:innen als lokale “entrepreneurs” und über persönliche Kontakte und Austausch eine wichtige Rolle spielen, wenn sie als kompetent und glaubwürdig wahrgenommen werden. Vertrauen kann aber auch durch transparente Prozesse oder durch partizipative Gestaltung, in der Co-Design wirklich gelebt wird, kreiert werden.

4. Geeignete Anreizstrukturen müssen zur Verfügung gestellt werden: Die Entscheide relevanter Akteur:innen in erneuerbaren Energieprozessen werden oft von verschiedenen, teils widersprüchlichen Kriterien beeinflusst. Fehlen wirksame, transparente Anreize, werden erneuerbare Energieziele kaum priorisiert, was mit ausbleibenden Investitionen verbunden sein kann. Dies zeigt sich besonders bei der Marktakzeptanz: So sind finanzielle Anreize, etwa für integrierte Lösungen wie die Kombination von PV mit Wärmepumpen oder E-Mobilität, für “wahrscheinliche Nutzer:innen” von PV-Dachanlagen wichtig, um diese rentabel zu machen. Auch das Beispiel der netzfreundlichen Einspeisung zeigt: Prosumer:innen nutzen Anreize, wenn sie verfügbar sind. Hier gilt es von Seiten Entscheidungsträger:innen auf lokaler oder kantonaler Ebene Massnahmen zu finden, welche die Verbreitung solcher Instrumente unter Netzbetreibern fördern. Institutionelle Anreize auf kantonaler Ebene, wie im Fall der Windregulierung, können zudem Planungssicherheit erhöhen und den Einfluss von Oppositionsgruppen begrenzen.

5. Asymmetrien der Mobilisierung zwischen Befürworter:innen und Gegnerschaft in Implementationsprozessen antizipieren: Im partizipativen und direktdemokratischen Schweizer Kontext zielen Kampagnen und Bevölkerungseinbezug meist auf die

Mehrheit ab. Das scheint zunächst sinnvoll, denn viele Projekte benötigen die Zustimmung einer Mehrheit in einer Abstimmung. Doch oft scheitert die Umsetzung nicht an fehlender Mehrheitsakzeptanz, sondern am Mobilisierungspotenzial einer engagierten Minderheit. Kantonale und lokale Entscheidungsträger:innen müssen daher frühzeitig antizipieren, welche Art von Akzeptanz im konkreten Fall entscheidend ist. Oft ist es die Verhinderung aktiven Widerstands. Strategien obstruktiver Akteure gilt es zu antizipieren und mit gezielten Massnahmen entgegenzuwirken.

Résumé

La Suisse s'est engagée à atteindre les objectifs climatiques internationaux, dont la réalisation dépend largement de la transformation du système énergétique vers les énergies renouvelables et de l'abandon des combustibles fossiles. Bien que la population suisse ait réaffirmé à plusieurs reprises son soutien à ces objectifs et aux énergies renouvelables, et que les technologies nécessaires, telles que l'hydroélectricité, le photovoltaïque (PV) ou l'énergie éolienne, soient disponibles, la mise en œuvre de projets d'infrastructures correspondants reste difficile.

Ce White Paper aborde ce paradoxe apparent en s'appuyant sur le concept d'*acceptation sociale*. Il apporte trois contributions :

Premièrement, il montre qu' une compréhension nuancée est requise pour savoir quel type d'acceptation est nécessaire, dans quelle situation et par qui, afin d'ajouter de la capacité renouvelable avec plus de succès.

Deuxièmement, il présente de nouvelles données sur l'acceptation sociopolitique des différentes sources d'énergie et des principes fondamentaux de la politique énergétique. Bien que cette forme générale d'acceptation sociale soit souvent insuffisante pour concrétiser les projets et mesures associés, elle n'en reste pas moins indispensable : Si l'acceptation fait déjà défaut à ce niveau abstrait et hypothétique, une mise en œuvre concrète réussie sera souvent impossible. Sur la base de ces données, trois groupes de sources d'énergie peuvent être distingués : les *"chouchous du public"* (grande hydroélectricité et PV sur les toits), les *"impasses"* (gaz et importations d'électricité), et le groupe *"controversé mais viable"* (technologies actuellement très débattues comme l'énergie éolienne, le PV en champ ouvert ou l'énergie nucléaire).

Troisièmement, le White Paper présente six exemples de recherche analysant des technologies spécifiques et différentes dimensions de l'acceptation. Ils montrent dans quelles conditions une forte acceptation socio-politique peut se traduire par des projets réussis (*acceptation communautaire*) ou des produits commercialisables (*acceptation marchande*).

Enfin, le White Paper formule cinq recommandations pour faciliter la mise en œuvre des technologies d'énergies renouvelables. Celles-ci s'adressent à tous les groupes de parties prenantes impliquées dans la transition vers des solutions énergétiques renouvelables, en particulier les porteurs de projets, les décideurs et décideuses politiques ainsi que les autorités aux niveaux cantonal et local. L'acceptation sociale ne relève pas de la responsabilité d'un seul groupe de parties prenantes. Pour favoriser l'acceptation de ces solutions, il est essentiel que tous les groupes de parties prenantes concernées prennent en compte ces recommandations selon leur perspective respective.

1. Les processus participatifs sont importants, mais un leadership local favorable est central : Les processus participatifs sont indispensables à la transition énergétique en Suisse. Cependant, pour mettre en avant les synergies plutôt que les antagonismes, il ne suffit pas d'une simple inclusion, mais il faut une véritable initiative locale ainsi que l'engagement de personnalités et d'acteurs locaux. Les projets photovoltaïques alpins en sont un exemple : lorsqu'ils sont portés par de grandes entreprises externes, ils risquent de susciter une "dynamique de veto", dans laquelle des acteurs influents s'opposent par

crainte d'une perte de contrôle ou d'une répartition inéquitable des bénéfices. Les communes ou les fournisseurs locaux d'électricité peuvent jouer ici le rôle d'"entrepreneur·e·s locaux·ales", en minimisant les compromis perçus, en mettant en avant les gains sociaux et les synergies, et ainsi favoriser l'acceptation.

2. Renforcer les dynamiques positives par les réseaux et la communication : Les défis liés à la mise en œuvre des énergies renouvelables tendent souvent à occulter les dynamiques sociales positives qui existent pourtant. Par exemple, le "Solar-Express" est fréquemment présenté sous l'angle de ses échecs, alors qu'une majorité des projets photovoltaïques alpins soumis à votation ont été soutenus par les communes concernées. Dans le domaine de l'éolien, il est également important de distinguer les votations sur les réglementations de celles sur les projets concrets, plutôt que de parler globalement d'une "chance à 50:50". L'acceptation sociopolitique large de la transition énergétique en Suisse offre une base solide que les communes et les porteurs de projets peuvent exploiter. Les débats publics et les votations en assemblées communales (plutôt que des scrutins secrets ou par correspondance) permettent de renforcer cette dynamique, à condition que l'atmosphère du groupe soit positive. De même, la création d'espaces d'échange au sein de réseaux personnels, comme des événements de quartier mettant en contact les premiers utilisateurs de photovoltaïque avec des personnes intéressées, s'avère efficace.

3. Créer la confiance – la base de l'acceptation : La confiance est la clé pour transformer l'acceptation sociopolitique en une acceptation concrète sur le marché et au niveau local. Les citoyennes et citoyens doivent faire confiance aux technologies, aux responsables et aux processus. Cette confiance permet de compenser les incertitudes qui accompagnent souvent les décisions relatives aux infrastructures. Elle se construit de multiples façons : les autorités locales, les décideurs et décideuses ou les porteurs de projets peuvent jouer un rôle crucial en tant qu'"entrepreneur·e·s locaux·ales", à condition d'être perçu·e·s comme compétent·e·s et crédibles, notamment grâce à des contacts personnels et à des échanges directs. Enfin, la confiance peut également être renforcée par des processus transparents ou par une véritable co-conception participative.

4. Mettre à disposition des structures d'incitation adaptées : Les décisions des acteurs clés dans le domaine des énergies renouvelables sont souvent influencées par des critères variés, parfois contradictoires. En l'absence d'incitations efficaces et transparentes, les objectifs en matière d'énergies renouvelables risquent d'être relégués au second plan, ce qui peut entraîner un manque d'investissements. Cela est particulièrement visible en ce qui concerne l'acceptation du marché : les incitations financières, par exemple pour des solutions intégrées telles que la combinaison de panneaux photovoltaïques avec des pompes à chaleur ou la mobilité électrique, sont essentielles pour rendre ces installations rentables aux yeux des utilisateur·rice·s potentiel·le·s. L'exemple de l'injection réseau-friendly le montre : les prosumer·e·s utilisent les incitations lorsqu'elles sont disponibles. Il revient donc aux décideurs et décideuses au niveau cantonal ou local de trouver des mesures pour encourager la diffusion de tels instruments parmi les gestionnaires de réseau. Des incitations institutionnelles au niveau cantonal, comme dans le cas de la réglementation éolienne, peuvent par ailleurs renforcer la sécurité de la planification et limiter l'influence des groupes d'opposition.

5. Anticiper les asymétries de mobilisation entre partisan·e·s et op-

posant·e·s dans les processus de mise en œuvre : Dans le contexte de la démocratie directe suisse, les campagnes et la participation citoyenne visent généralement à obtenir le soutien de la majorité. Cela semble logique, car de nombreux projets nécessitent l'approbation d'une majorité lors d'une votation. Pourtant, l'échec de la mise en œuvre ne tient pas toujours à un manque d'acceptation majoritaire, mais souvent au potentiel de mobilisation d'une minorité engagée. Les décideurs et décideuses au niveau cantonal ou local doivent donc anticiper dès le départ le type d'acceptation qui sera déterminant dans chaque cas. Il s'agit souvent d'éviter une opposition active. Les stratégies des acteurs obstructifs doivent être anticipées et contrées par des mesures ciblées.

Riassunto

La Svizzera si è impegnata a raggiungere gli obiettivi climatici internazionali, il cui conseguimento dipende in modo significativo dalla trasformazione del sistema energetico verso le energie rinnovabili e dall'abbandono dei combustibili fossili. Sebbene la popolazione svizzera abbia ripetutamente ribadito il proprio sostegno a questi obiettivi e alle energie rinnovabili, e nonostante le tecnologie necessarie come l'idroelettrico, il fotovoltaico (PV) o l'energia eolica siano disponibili, la realizzazione di progetti infrastrutturali corrispondenti rimane una sfida.

Questo White Paper affronta questo apparente paradosso basandosi sul concetto di *accettazione sociale*. Esso offre tre contributi:

In primo luogo, è necessaria una comprensione sfumata di quale tipo di accettazione sia richiesto, in quale situazione e da parte di chi, per implementare con successo soluzioni tecnologiche.

In secondo luogo, presenta nuovi dati sull'accettazione socio-politica di diverse fonti energetiche e dei principi fondamentali della politica energetica. Sebbene questa forma generale di accettazione sociale sia spesso insufficiente per attuare concretamente i progetti e le misure associati, essa rimane comunque indispensabile: Se manca l'accettazione già a questo livello astratto e ipotetico, una realizzazione concreta di successo sarà spesso impossibile. Sulla base di questi dati, è possibile distinguere tre gruppi di fonti energetiche: i *"preferiti dal pubblico"* (grande idroelettrico e fotovoltaico su tetto), i *"disperati"* (gas e importazioni di elettricità) e il gruppo *"controverso ma possibile"* (tecnologie molto dibattute come l'energia eolica, il fotovoltaico a terra o l'energia nucleare).

In terzo luogo, il White Paper presenta sei esempi di ricerca che analizzano tecnologie specifiche e diverse dimensioni dell'accettazione. Essi mostrano in quali condizioni un'elevata accettazione sociopolitica possa tradursi in progetti di successo (*accettazione comunitaria*) o in prodotti di mercato (*accettazione di mercato*).

Infine, il white paper formula cinque raccomandazioni al fine di facilitare l'implementazione delle tecnologie di energia rinnovabile. Queste raccomandazioni sono rivolte a tutti i gruppi di stakeholder coinvolti nella realizzazione di soluzioni energetiche rinnovabili, in particolare ai **portatori di progetto, ai decisori politici e alle autorità a livello cantonale e locale**. L'accettazione sociale non è compito di un singolo gruppo di stakeholder. Per promuovere l'accettazione sociale nella realizzazione di soluzioni energetiche rinnovabili, tutti i gruppi di stakeholder coinvolti dovrebbero invece considerare le cinque raccomandazioni dalla propria prospettiva.

1. I processi partecipativi sono importanti, ma una leadership locale favorevole è centrale: I processi partecipativi sono indispensabili per la transizione energetica in Svizzera. Tuttavia, per mettere in primo piano le sinergie piuttosto che gli antagonismi, non è sufficiente un semplice coinvolgimento, ma è necessaria un'iniziativa locale concreta e l'impegno di personalità e attori locali. I progetti fotovoltaici alpini ne sono un esempio: quando sono promossi da grandi aziende esterne, rischiano di innescare una "dinamica di veto", in cui gli attori influenti si oppongono per timore di perdere il controllo o di una distribuzione iniqua dei benefici. I comuni o i fornitori locali di energia elettrica possono svolgere

il ruolo di "imprenditori locali", minimizzando gli antagonismi percepiti, evidenziando i guadagni sociali e le sinergie e favorendo così l'accettazione.

2. Rafforzare le dinamiche positive attraverso reti e comunicazione: Spesso, le sfide legate all'implementazione delle energie rinnovabili tendono a oscurare le dinamiche sociali positive che pure esistono. Ad esempio, il "Solar-Express" è spesso presentato come un fallimento, mentre la maggior parte dei progetti fotovoltaici alpini sottoposti a votazione ha ricevuto il sostegno dei comuni interessati. Anche per quanto riguarda l'energia eolica, è importante distinguere tra votazioni su regolamentazioni e progetti concreti, piuttosto che parlare genericamente di una "probabilità del 50:50". L'ampia accettazione sociopolitica della transizione energetica in Svizzera rappresenta una solida base che i comuni e i portatori di progetto possono sfruttare. Dibattiti pubblici e votazioni aperte in assemblee comunali (piuttosto che scrutini segreti o per corrispondenza) possono rafforzare questa dinamica, a condizione che la dinamica di gruppo sia positiva. Allo stesso modo, la creazione di spazi di scambio all'interno di reti personali, come gli eventi di quartiere che mettono in contatto i primi utilizzatori di fotovoltaico con le persone interessate, si è rivelata efficace.

3. Creare fiducia – la base dell'accettazione: La fiducia è la chiave per trasformare l'accettazione sociopolitica in un'accettazione concreta sul mercato e a livello locale. Le persone devono avere fiducia nelle tecnologie, nei responsabili e nei processi. Questa fiducia può compensare le incertezze che spesso accompagnano le decisioni infrastrutturali. La fiducia si costruisce in molti modi: le autorità locali, i decisori o i portatori di progetto possono svolgere un ruolo cruciale come "imprenditori locali", a condizione che siano percepiti come competenti e credibili, anche attraverso contatti personali e scambi diretti. Infine, la fiducia può essere rafforzata anche attraverso processi trasparenti o una vera co-progettazione partecipativa.

4. Mettere a disposizione strutture di incentivazione adeguate: Le decisioni degli attori chiave nel settore delle energie rinnovabili sono spesso influenzate da criteri vari e talvolta contraddittori. In assenza di incentivi efficaci e trasparenti, gli obiettivi di energia rinnovabile rischiano di passare in secondo piano, con il rischio di mancati investimenti. Ciò è particolarmente evidente nell'accettazione di mercato: gli incentivi finanziari, ad esempio per soluzioni integrate come la combinazione di fotovoltaico con pompe di calore o mobilità elettrica, sono essenziali per rendere questi impianti redditizi per gli utenti potenziali. L'esempio dell'immissione in rete "network-friendly" lo dimostra: i prosumer utilizzano gli incentivi quando sono disponibili. Spetta quindi ai decisori locali e cantonali trovare misure per promuovere la diffusione di tali strumenti tra i gestori di rete. Incentivi istituzionali a livello cantonale, come nel caso della regolamentazione eolica, possono inoltre aumentare la sicurezza della pianificazione e limitare l'influenza dei gruppi di opposizione.

5. Anticipare le asimmetrie di mobilitazione tra sostenitori e oppositori nei processi di implementazione: Nel contesto svizzero di democrazia partecipativa e diretta, le campagne e il coinvolgimento dei cittadini mirano generalmente a ottenere il sostegno della maggioranza. Questo sembra logico, dato che molti progetti richiedono l'approvazione della maggioranza in una votazione. Tuttavia, il fallimento dell'attuazione non dipende sempre dalla mancanza di accettazione da parte della maggioranza, ma spesso

dal potenziale di mobilitazione di una minoranza impegnata. I decisori devono quindi anticipare fin dall'inizio quale tipo di accettazione sarà determinante in ogni caso. Spesso si tratta di evitare un'opposizione attiva. Le strategie degli attori ostruzionisti devono essere previste e contrastate con misure mirate.

1 Introduction

Switzerland stands at a critical juncture in its energy transition. There is a broad societal consensus that shifting toward renewable energy is not only necessary but also desirable, both to mitigate climate change and to secure a sustainable energy future (Trutnevyte et al., 2024). This commitment is reflected at the ballot box, where Swiss citizens have consistently endorsed the energy transition with hydropower, solar PV and wind energy. In 2017, the Energy Strategy 2050—which included a gradual phase-out of nuclear power—was approved by 58.2% of voters. Five years later, 59.1% supported the Climate and Innovation Act, embracing the goal of net-zero emissions. Most recently, in 2024, over two-thirds of voters backed the new Electricity Act, designed to accelerate the deployment of renewable energy.[1] Yet, despite this widespread support in principle, the actual implementation of renewable energy infrastructure faces significant barriers. Wind turbines, solar parks, and hydropower expansions are frequently met with opposition by local communities or vested interests, which lead to implementation delays or the scrapping of projects. This seeming disconnect between stated preferences in favour of the energy transition and the acceptance of real-world implementation has led some to conclude as "inconsistent" or even paradoxical: people want renewable energy more generally, but are critical of implementation measures that bring us renewables.

This White Paper seeks to unpack this seeming inconsistency by exploring the multifaceted nature of what is termed the social acceptance of renewable energy technologies (Wüstenhagen et al., 2007). Social acceptance is not an easily definable object, but includes a dynamic interplay of political, community, market, and individual factors, each influenced by distinct actors, mechanisms, and contexts. Understanding this interplay is essential for anticipating and designing successful implementation processes.

Social acceptance is to be evaluated against the backdrop of an increasing political polarization regarding energy and climate issues in Switzerland, but also in many other countries (Lüth and Schaffer, 2022; Stadelmann-Steffen et al., 2026). Those issues increasingly carry real electoral risks (Bosetti et al., 2025; Stokes, 2016). In the unusual participatory context of Switzerland, the important role of the political process is even more obvious: Citizens have a direct say on energy policy decisions at the national but also cantonal and local level (Stadelmann-Steffen, 2011). Moreover, interest groups and individuals have many instruments at their disposal to intervene and block or delay implementation processes.

Thus, in many situations, political decisions required to implement the energy transition critically depend on gaining the "acceptance" of citizens, local authorities, or governments. In this context, it is important to note that opposition or a lack of acceptance can be legitimate and arise for good reasons, e.g., the project may not have been well developed (Dermont et al., 2017). Furthermore, taking legitimate project-specific concerns into account and integrating them is certainly beneficial for an eventual implementation of good projects. These considerations emphasise the importance of researchers, policymakers, project developers and investors understanding the mechanisms behind social acceptance and a lack thereof in renewable energy implementation.

[1] Parliament has further passed a permitting acceleration law in September 2025.

This White Paper aims to deepen this understanding by offering both conceptual and empirical insights into the social acceptance of renewable energy in Switzerland. First, to establish a conceptual foundation, the first part of the White Paper **clarifies the notion of social acceptance and situates it within the Swiss policymaking process**. Our analysis builds on the key distinctions between the socio-political, community, and market dimensions of social acceptance (Wüstenhagen et al., 2007), as well as the different types of acceptance in the political process, i.e., preferences, support, and acceptance (Dermont et al., 2017).

Secondly, the White Paper provides an **overview of the socio-political acceptance of renewable energy in Switzerland**, based on recent SWEET-consortium EDGE Survey I and II data, as well as SWEET-consortium SURE Survey data. We argue that this socio-political dimension, i.e., the degree to which Swiss citizens approve of renewable energy sources and the general principles of Swiss energy policy, is a crucial basis for more specific discussions about market and community acceptance. While high socio-political acceptance does not necessarily lead to the successful implementation and use of renewable energy technologies, i.e. to community and market acceptance, it seems reasonable to assume that socio-political acceptance is a prerequisite without which community and market acceptance will be even more difficult to achieve.

Third, the White Paper uses **concrete research examples** to demonstrate how and under what conditions high socio-political acceptance can translate into successful infrastructure projects (community acceptance) and market solutions (market acceptance). These examples reveal how acceptance patterns differ across technologies, stakeholder groups, and governance frameworks. Two examples presented in Section 4 concern alpine photovoltaic (PV) projects, which have become a politically salient issue in the context of the government's "Solar Express". Initially, in Subsection 4.1, we present an analysis of "true" community acceptance, namely on more than 40 municipal votes that have been held in Swiss municipalities on these projects. The following subsection 4.2 delves deeper into two case studies to show how participatory processes and local leadership have the potential to contribute to community acceptance. Section 5 presents two short analyses focusing on the social acceptance of wind energy. Subsection 5.1 compares municipal and cantonal as well as project-specific and policy voting-outcomes since 1998. In addition, Subsection 5.2 argues that it is also important to understand the strategies employed by those who actively try to undermine community acceptance in wind energy. Finally, two further examples illuminate the market acceptance dimension (Section 6). First, Subsection 6.1 discusses the role of incentives for grid-friendly behaviour of solar PV installations and maintains that distribution system operators (DSOs) have been hesitant to provide them. Lastly, subsection 6.2 provides a comparative perspective on adopters, likely adopters and likely non-adopters of rooftop PV to better understand how market acceptance of this popular energy source can expand beyond the early adopters.[2]

Finally, drawing on the conceptual discussion, the new survey findings, and the research examples, we develop recommendations for policymakers and project owners seeking to support the implementation of renewable energy projects.

[2]For questions on the different research examples, contact the following chapter leads. Community acceptance of alpine PV projects: Isabelle Stadelmann-Steffen for 4.1 and Claudia Binder for 4.2. Community acceptance of wind power: Jonas Schmid for 5.1 and Rolf Wüstenhagen for 5.2. Market acceptance: Christof Bucher for 6.1 and Maria Anna Hecher for 6.2.

2 What does social acceptance mean?

In recent decades, there has been a growing interest in the concept of social acceptance, particularly in relation to the transition of energy systems towards renewable sources. Acceptance has been studied from a variety of different perspectives and based on many different conceptualisations. This has introduced a risk that results are assembled from heterogeneous interpretations of acceptance and subsequently inappropriately generalized to additional domains (Dermont et al., 2017). It is therefore crucial to understand and define the type of "acceptance" that is relevant in a given situation, and whose acceptance is needed.

Wüstenhagen et al. (2007) introduce a three-dimensional interdisciplinary framework to address the social acceptance of renewable energy technologies (RET) (see Figure 1). Firstly, **socio-political acceptance** is the most general dimension of social acceptance, concerning the perceptions of political stakeholders and the general public regarding policies and technologies. This level reflects the extent to which actors hold a generally positive orientation toward technologies, objectives, or policies in a more abstract, overarching sense. Secondly, **community acceptance** is relevant when implementing or constructing a specific RET project in a neighbourhood, focusing on gaining the support of local stakeholders, particularly residents (voters). This dimension of social acceptance describes the extent to which the local (affected) population or stakeholders support the construction of specific infrastructure projects or the implementation of concrete measures. Finally, **market acceptance** concerns the economic sphere and considers that novel technologies must be introduced by suppliers, adopted by consumers, and financed by investors. Therefore, it indicates whether technological solutions are successful in the market, i.e., whether they are purchased, distributed, used, applied, or invested

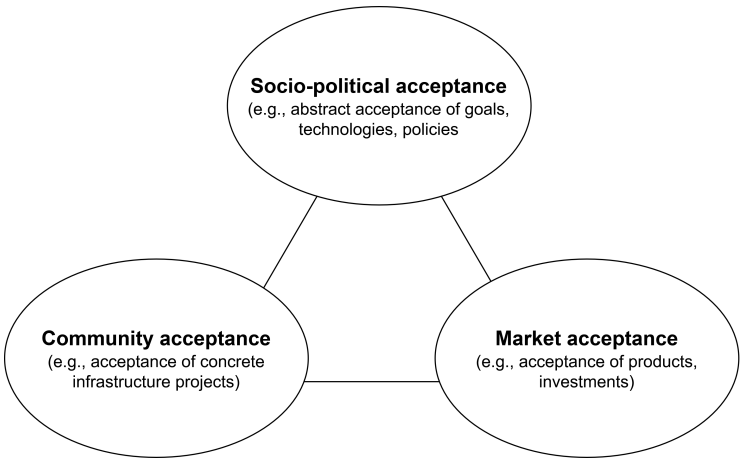


Figure 1: The three dimensions of social acceptance (Wüstenhagen et al., 2007).

Moreover, to account for the increasingly politicised context in which social acceptance works, Dermont et al. (2017) propose a social acceptance framework that specifically takes into account the policy-making process. Dermont et al. (2017) argue that depending on what exactly the object of acceptance is (e.g., a wind park, a PV installation or a smart meter tool) and where we are in the policy-making process (e.g., planning phase, decision phase or implementation phase), different processes of acceptance are triggered (see Figure 2). In each phase, acceptance means very different things, and is asked from and by different actors. i.e., preferences, support, and acceptance (Batel et al., 2013): In the planning phase, where multiple options remain under consideration, acceptance manifests as **preferences**, i.e., the comparative evaluation of available alternatives (Rijnsoever et al., 2015). **Support**, in contrast, is most closely aligned with the de facto decision or vote, i.e., the decision phase, particularly when an actor holds institutionalised power, such as veto players, who can directly influence or block outcomes (Tsebelis, 2000).[3] **Acceptance**, in turn, refers to tolerance towards implementation measures, a favourable evaluation of a project or a change in behavioural practice(Dermont et al., 2017).

To summarize, following Dermont et al. (2017), the specific type of acceptance that is of interest in a specific situation depends on

1. the **object** of interest (namely, the social acceptance dimension in line with Wüstenhagen et al. (2007), and the process stage),
2. the **relevant actors** (those who need to accept) and
3. these **actors' roles** (do they need to prefer, support or passively accept the object) (Dermont et al., 2017).

In the following sections, these insights will be applied to the case of renewable energy infrastructure in Switzerland to identify the relevant "acceptance patterns".

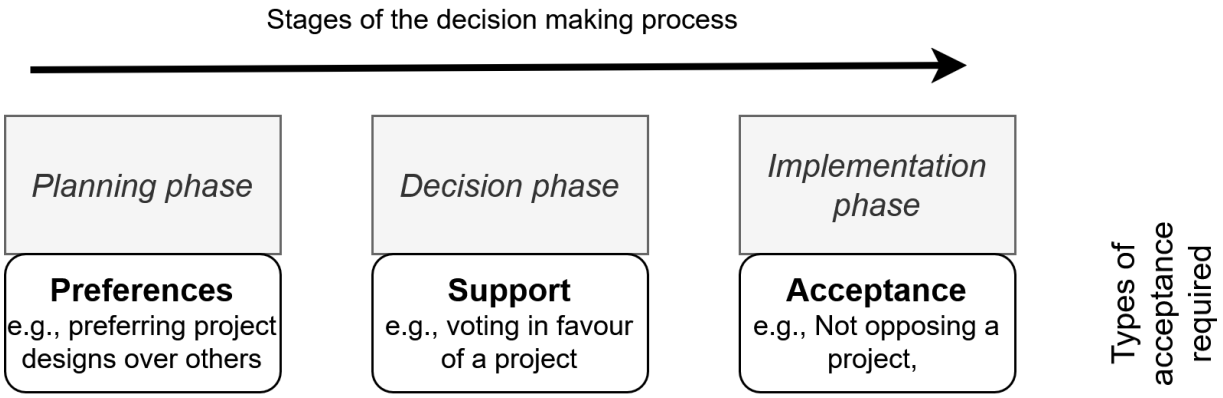


Figure 2: Different types of acceptance contingent on the stage of the decision process, own illustration based on (Dermont et al., 2017).

[3] A more passive form of acceptance applies to informal actors who, while lacking immediate power to block decisions, may still undermine successful outcomes by withholding cooperation or failing to comply with decisions.

3 Socio-political acceptance of renewable energy in Switzerland

This section focuses on the socio-political acceptance of renewable energy technologies and of energy policy principles in Switzerland, which forms the basis on which subsequent community (5), and market acceptance (6) can build. We present data from the SWEET-consortium EDGE surveys I (2022) and II (2025) and also include data from the SWEET-consortium SURE survey (2024), which enables us to analyse and illustrate most recent patterns and temporal trends.

3.1 Technology acceptance

Figure 3 documents which electricity sources the Swiss respondents want to be part of the future Swiss generation mix. This technology acceptance belongs to the socio-political acceptance dimension, as individuals express a general approval (or rejection) of technologies without relating their statement to the concrete implementation of these energy sources. For example, they can accept large hydropower at this abstract level, whereas this does not mean that they would approve a new hydropower dam in a specific place.

The highest socio-political acceptance can be observed for PV on buildings and large-scale hydropower. A very large majority of the population indicate that they want to rely on these two energy sources in the future Swiss energy mix — less than 10% of respondents do not agree on this. On the other side of the socio-political acceptance scale are electricity imports. In 2025, more than 70% of respondents did not want Switzerland to import more electricity. Similarly, gas-fired combined cycle power plants exhibit the second lowest socio-political acceptance, with a relative majority disliking this energy source. For all other technologies, socio-political acceptance is more divided: There are relevant shares of respondents both in favour and against using them and between 20% and 25% who are not sure.

Comparison over time generally documents high stability in technology preferences. This is especially true for the comparison between the years 2022 to 2024, where the preference order has remained (almost) identical (see also Liedekerke et al., 2025). Only with respect to open-space PV could a significant decrease in acceptance be observed, while socio-political acceptance of electricity imports has increased significantly.

However, considerably more movement can be observed in the most recent data for 2025. With regard to open-space PV, the decrease in socio-political acceptance between 2024 and 2025 is again statistically significant, meaning that we observe a continuing trend towards lower socio-political acceptance (the decrease is statistically significant between all three time points). For wind and geothermal energy, a significantly lower level of acceptance was found compared to 2024, while the opposite is the case for biomass. For imports, the most recent data document that the trend towards (slightly) more openness regarding electricity imports has not continued, but we see a movement back almost to the 2022 level. In 2025, similar to 2022, around three quarters of respondents (strongly) disagree with the use of imports in the Swiss energy mix. Finally, in two cases, the most recent data underline a latent trend from 2024: PV on buildings exhibits a significantly lower level of approval in 2025 compared to 2022, whereas the contrary is true for nuclear energy.

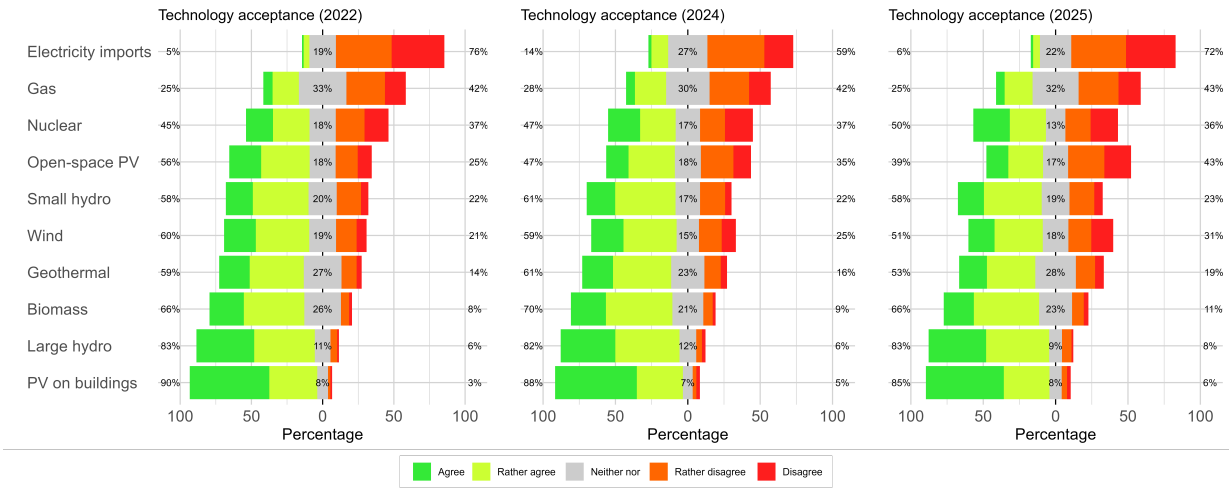


Figure 3: Socio-political acceptance of energy technologies. Note: Data for 2022 is from EDGE Survey I (N = 4897), data for 2024 is from SURE survey (N = 2049), data for 2025 is from EDGE Survey II (N = 1827). Based on Wilcoxon Rank Sum Tests, the difference between 2022 and 2024 is statistically significant for open-space PV and imports. The difference between 2022 and 2025 is significant for nuclear, building-level PV, open-space PV, geothermal, wind, biomass, and imports. The difference between 2024 and 2025 is significant for open-space PV, geothermal, wind, biomass, and imports.

3.2 Energy policy principles

Figure 4 depicts public preferences related to energy independence and stronger collaboration with the EU to secure energy supply. These survey-items denote general policy principles, i.e., also belonging to the socio-political acceptance dimension, which might be relevant for the acceptance of more concrete infrastructure projects. Data from the two EDGE surveys demonstrate high temporal stability in the first place (see Liedekerke et al. (2025) for a comparison between 2022 and 2024). There is a statistically significant difference in the degree to which respondents agreed with the claim that Switzerland should be independent of other countries in terms of its energy supply, comparing data for 2022 and 2025. Although the large majority supports the claim that Switzerland should be energy independent, the share of individuals who disagreed with this notion has slightly but significantly increased in 2025.

No significant change in opinion can be observed with regard to EU collaboration in energy questions. This can be explained by the fact that this issue has been largely absent from public debate over the past years and is only about to receive higher attention in the context of the likely upcoming referendum vote on the new bilateral agreements with the EU, the electricity agreement being one part of it.

3.3 Summary: three groups of energy technologies

The analyses presented here categorise energy technologies into three groups based on their socio-political acceptance in Switzerland. First, large-scale hydropower and building-level PV form the **"Public Favourites"**. These technologies enjoy broad and stable public support, and are widely accepted as the backbones of Switzerland's energy transition (Trutnevyte et al., 2024). At the opposite end, electricity imports and gas-

fired combined cycle power plants constitute the **"Non-Starters"**, facing minimal socio-political acceptance. Especially the negative sentiment toward electricity imports is likely driven by the high value Swiss residents place on energy independence, as well as the moderate socio-political acceptance of cooperation with the EU. Most energy technologies, however, fall into the intermediate **"Debated but Viable"** group. This includes biomass, open-space PV, small hydropower, wind, geothermal energy, and nuclear energy. Although these technologies generally receive (relative) majority acceptance, significant minorities disagree or are uncertain about their inclusion in Switzerland's future energy mix.

Overall, at the socio-political level, all renewable energy technologies exhibit moderate to high acceptance. The key question, then, is how specific infrastructure projects or market solutions can leverage this socio-political foundation. The following sections of the White Paper draw on EDGE research to address this question, identifying the conditions and factors that foster community and market acceptance, as well as the barriers that may arise.

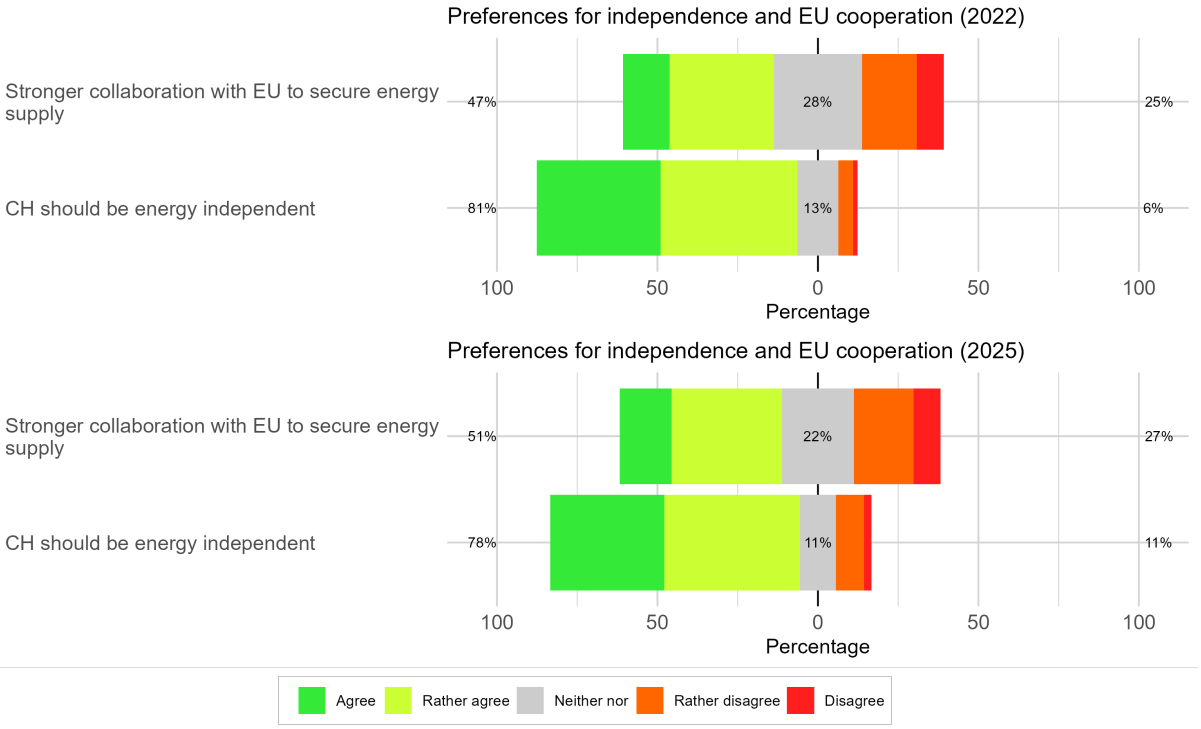


Figure 4: Preferences for energy independence and EU cooperation. Note: Data for 2022 is from EDGE Survey I (N = 4897), data for 2025 is from EDGE Survey II (N = 1827). Based on Wilcoxon Rank Sum Tests, the difference over time is statistically significant for energy independence but not for EU cooperation

4 Community acceptance of alpine PV projects

4.1 Example 1: Voting on alpine PV

In 2022, the Swiss parliament adopted the so-called "Solar Express" thereby deciding to incentivise the construction of large-scale PV plants with a one-time compensation up to 60% of the initial investment costs for installations meeting a minimum yearly electricity production of 10 GWh, and of which 500kWh/kWp are produced in winter. Especially alpine PV installations are considered eligible for remuneration due to their higher capacity to produce energy during the winter months, when the energy demand is high and PV production at the building level and in the Midlands is low (SFOE, 2023a).[4]

Despite these advantages and the positive evidence concerning the acceptance of solar PV (e.g., Vuichard et al., 2021), large-scale PV projects remain contested in the public (Hoesch et al., 2025; Späth, 2018). Often, these installations are located in remote areas or with high biodiversity value, causing conflict with nature and landscape conservation interests (Lamhamedi and de Vries, 2022; Stadelmann-Steffen and Dermont, 2021). At the same time, in the Swiss Federal system, municipalities enjoy high degrees of political autonomy, which includes their approval of alpine PV projects to be sited on municipal territory (Art. 71a, par. 3, EnG). While cantons or sometimes even municipalities can decide how municipal approval is organized, in many cases, this right is assigned to citizens, either in a citizen assembly (serving as the local legislative body) or in a referendum vote.

The social acceptance perspective

When municipalities need to approve an alpine PV project in a local vote, this corresponds to the "strongest" social acceptance requirement. The object of acceptance is a concrete alpine PV project. Because it is planned to be constructed on the territory of a specific municipality, this is about *community acceptance*. Since the municipal vote is binding and determines whether or not the project receives municipal approval, the vote is the*decision stage*. The relevant actors are the *local citizens*, who in their role as citizens need to show the strongest form of acceptance, namely an explicit "yes" at the ballot, i.e., *support*.

Why citizens (do not) support alpine PV projects in their municipality

Our data set contains 40 alpine PV projects that were subject to a direct democratic vote between June 2023 and December 2024 in the context of the national parliament's "Solar Express" (Stadelmann-Steffen et al., 2025b). Figure 5 illustrates that the level of community acceptance varies considerably between municipalities, ranging from 23% to 100%. However, in general, roughly two thirds of all local decisions were in favour of the projects. This is noteworthy, not only because explicit support is required on a concrete project but also because open-space PV exhibits rather moderate levels of socio-political acceptance (see Section 3).

[4]The analysis and core findings presented in this chapter are based on the following scientific article, which is currently under peer review: Stadelmann-Steffen et al. (2025a).

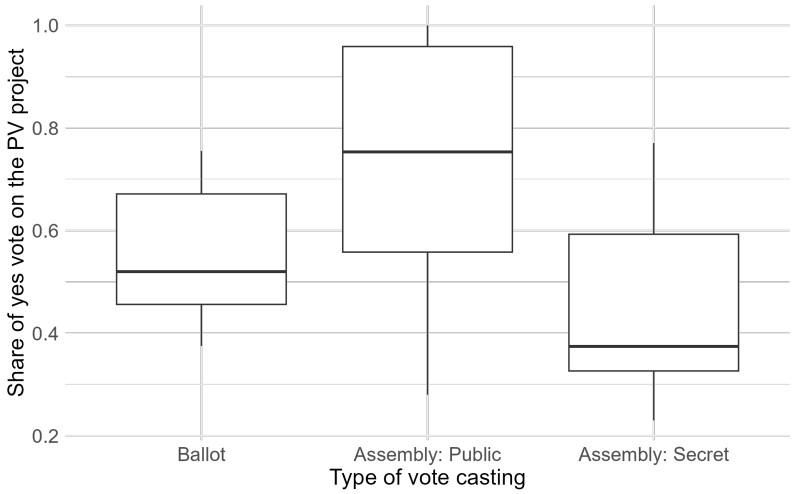


Figure 5: Community acceptance of alpine PV projects

The case of the 40 projects is one of the rare instances where we can analyse "true" community acceptance, i.e., real voting results, and systematically investigate the conditions that were associated with lower or higher support. Based on Bayesian regression models (full results are presented in Appendix 9, more detailed analyses and discussions can be found in Stadelmann-Steffen et al. (2025b)), several conditions can be identified that facilitate community acceptance.

First, as Figure 5 documents, community acceptance is systematically more pronounced if the municipality decided in a public vote in the communal assembly and not in a secret vote (at the ballot or in an assembly). Public voting emphasises the collective good dimension of these projects, i.e., their contribution to the societal goal of a renewable energy system, and thus facilitates the success of these projects in local decisions. Second, community acceptance is systematically stronger if project owners include local actors such as the municipality or the local energy provider. The situation of large energy providers from the Midlands promoting an alpine PV project without local allies is associated with reduced community acceptance. Third, extensive land use, i.e., a stronger impact on nature, is related to lower community acceptance. Finally, municipalities that strongly approved the national referendum on the Electricity Act in June 2024, which explicitly targeted the acceleration of renewable energy deployment, exhibit systematically higher community acceptance of concrete alpine PV projects. This suggests that the socio-political acceptance of an accelerated energy transition in a municipality is a relevant predictor of the acceptance of alpine PV projects, i.e., their community acceptance.

What we can learn

- There is a promising potential even for the most demanding form of community acceptance: In a majority of cases, Swiss citizens voting on concrete alpine PV projects expressed support, especially in municipalities with high socio-political acceptance of the energy transition.
- Governance structures can facilitate community acceptance of alpine PV projects: External project proponents need to include local actors as co-owners, and local authorities should aim at a deliberative process and decision, emphasizing the collective nature of alpine PV projects.

4.2 Example 2: Participatory process and local leadership can enhance social acceptance

This section delves deeper into two alpine PV projects initiated as part of the "Solar Express" in the municipalities of the Canton of Grisons, Savognin and Sedrun. Both municipalities held a popular vote on large alpine PV projects planned in their respective community. The political processes that preceded the popular votes unfolded in a similar time frame (starting 6 months apart). The respective project was declined in the popular vote in Savognin and accepted in Sedrun.

Scholars have found that social acceptance and political debates on alpine PV projects often revolve around the perceived trade-offs and synergies with other societal objectives, such as biodiversity, landscape, agriculture, and economic issues (Feller Valero et al., 2025). A trade-off implies that enhancing one aspect positively may affect another negatively, while synergies may increase both (Bennett et al., 2009). Subjective perceptions of trade-offs are thus a key element in the formation of individual preferences and eventually the acceptance of renewable energy technologies Montfort et al. (2025b). Our study investigates how participatory procedures and local leadership shape perceptions of renewable energy trade-offs and synergies.[5]

The social acceptance perspective

As in Section 4.1, this example deals with the strongest *community acceptance* requirement, the active *support* of an alpine PV project in a local vote. We analyse the perception of trade-offs and synergies of *stakeholders* and their development over time and relate it to the final decision of the citizens – approval or rejection at the ballot.

Changes in perceived trade-offs during the project process

The study relies on semi-structured interviews with key stakeholders involved in the participatory policy processes. They were identified through an analysis of 20 national and regional newspaper articles (2022–2024) covering the alpine PV projects and stakeholders in both municipalities (Feller Valero et al., 2025). 11 in-person interviews with key stakeholders were conducted, four of them for the project in Sedrun and eight for Savognin, with one stakeholder responding for both projects. Three main topics were covered: (i) dynamics of the participatory process; (ii) perceived trade-offs at the start and at the end of the project; (iii) role of local involvement, trust, and factors affecting public and stakeholder acceptance.
The results presented in Figure 6 (Panel A) reveal that, in Savognin, stakeholders perceived the same synergies before and after the process. The normalized data show that stakeholders perceived 2.25 trade-offs at the beginning of the process, which increased by 11% at the end of the process. The increase was due to a newly perceived trade-off in energy supply security. In contrast, in Sedrun (Panel B), perceived synergies increased by 45% throughout the process, mostly in the areas of agriculture and biodiversity. The number of perceived trade-offs remained stable throughout the process.

[5]The analysis and core findings presented in this chapter are based on the following working paper: Feller Valero et al. (2025).

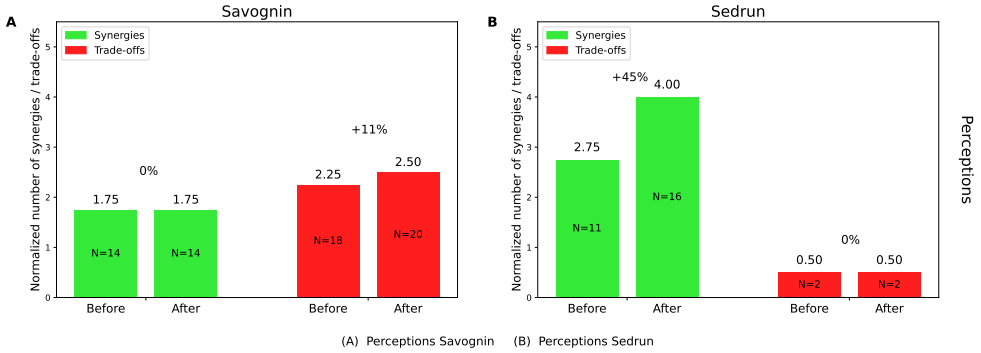


Figure 6: Perceived trade-offs and synergies at the beginning and the end of the participatory process. The data was normalized by the number of interviewees. A: Savognin, B: Sedrun.

The most mentioned trade-off relates to landscape impact. In Savognin, these are visual impacts for locals and tourists, and a fragmented arrangement of PV arrays that lack integration into the landscape, particularly due to the open terrain chamber setting. In Sedrun, landscape trade-offs were also most prominent, though they focused more narrowly on the visual impact of the array. This trade-off remained rather constant before and after the process for both communities.

Other important trade-offs included biodiversity and agriculture. In Savognin, biodiversity concerns focused on potential ecological disturbances in alpine terrain, while agricultural trade-offs centered on land use conflicts. In Sedrun, both were initially seen as neutral, but by the end, biodiversity was viewed as a synergy by most stakeholders—likely due to excluding ecologically sensitive areas. Agriculture remained largely neutral, although two stakeholders considered it a synergy after the adjustment of the water pipeline improved irrigation in dry zones.

What we can learn

We identified three factors decreasing perceived trade-offs and thus supporting the community acceptance of the alpine PV projects:

- High trust of stakeholders in the project and project leadership is associated with lower perceived trade-offs. Transparent communication, particularly regarding financial aspects, can help mitigate perceptions of trade-offs. Local leadership, thus, plays an important role and may influence stakeholders' perceptions (Feller Valero et al., 2025).

- Participatory processes are key to getting stakeholders on board (Montfort et al., 2025a). Responsiveness to stakeholder concerns can reduce perceived trade-offs and increase trust. For alpine PV, a critical aspect is the dual land use for agriculture and solar infrastructure. It is essential to find a way to create win-win situations for the involved stakeholders and show flexibility as a project leader (Feller Valero et al., 2025).

- Finally, timing, frequency, and formality of communication are critical. Informing all stakeholders about the plans at the project start avoids rumours, which may increase perceived trade-offs and mobilise counter coalitions. A mix between formal and informal communication, allowing the population to stay regularly informed, generates social proximity and trust (Binder et al., 2020; Feller Valero et al., 2025).

5 Community acceptance of wind power

5.1 Example 3: Popular votes on wind energy in Switzerland: A coin toss?

In international comparison, Swiss wind energy deployment has been particularly slow due to its cumbersome land-use planning and permitting procedure that requires extensive social acceptance, generates many opportunities for legal challenges, and represents a large effort of cross-government coordination (Schmid, 2024). While opponent groups have built up professionalised structures of dissent (see Subsection 5.2) and engage the topic on all levels of government and in all phases of the planning and permitting procedure, their main access point to produce dissent has been at the local level. On the local level, the formal action repertoire has focused on (1) refusing concrete projects by energising local communities to vote against a local land-use plan and (2) proposing and carrying-to-vote policy-rules that seek to make it impossible or at least discourage developers from considering a project in the first place. For example, they have formulated "model legislation" on minimal distance requirements that can be freely downloaded and entered into the local political process (FL St. Gallen, 2024). To deter developers, opponent groups also argue that social acceptance is generally low, but is this really the case?

To shed light on this question, this section presents descriptive evidence from municipal and cantonal popular votes from 01.01.1998–15.11.2025 on wind energy matters in Switzerland. The data are based on Schmid (2024) from 01.01.1998–31.12.2021 and have been collected for the present Subsection for 01.01.2022-15.11.2025 using the online news- and newspaper-archive *Swissdox*.[6]

The social acceptance perspective

In the present Chapter, social acceptance is understood as revealed preferences and measured as votes *in support of wind energy* on the local (*community acceptance*) and the cantonal level (*socio-political acceptance*, see Wüstenhagen et al. 2007). For present purposes, the distinction between the local *community* and the regional *socio-political acceptance* is one of personal affectedness, where the socio-political is understood more broadly as either setting general-abstract policies (policy-related) or having only a minority of directly affected voters in the voting district in directly project-related votes. Hence, broadly speaking, cantonal votes can be considered to measure *socio-political acceptance*, and municipal votes are understood to capture *community acceptance*. In terms of policy-making phase and the concept of acceptance applied, wind energy votes in Switzerland switch between policy-support and project-acceptance (implementation).

Is it really a coin toss?

Table 1 gives an overview of the number of votes and the success rates of all popular votes at the municipal and cantonal level in Switzerland on the topic of wind energy. Moreover, it shows the (relative)

[6]The query used to search the database was the following: (abstimm* OR abgestimm* OR Stimm* OR vot* OR scrutin) AND (Annahme OR Ablehnung OR acceptation OR refus) AND (Gemeinde OR Kanton OR municipalité OR communauté OR canton OR (conseil* municipal) OR (conseil* communal) OR (conseil* généra*) OR Gemeinderat OR Gemeinderät* OR Regierungsrat OR Staatsrat) AND (Windenergie OR Windkraft OR Windturbine OR éolien*). The search generated 2128 results from 173 sources.

Table 1: Population votes on wind energy policies and projects on the municipal and cantonal levels, 01.01.1998–15.11.2025

	Level	All	Directly project-related	Policies (all)	Policies: minimal distance	Policies: other
No. of votes	Munic.	88	43	45	29	16
	Canton	5	1	4		4
	Total	93	44	49	29	20
No. of votes favouring wind energy (WE)	Munic.	45	31	14	10	4
	Canton	5	1	4		4
	Total	50	32	18	10	8
% of no. of votes favouring WE	Munic.	51.13	72.09	31.11	34.48	25
	Canton	100	100	100		100
	Total	53.76	72.72	36.73	34.48	42.86
Arithmetic mean of vote shares favouring WE	Munic.	50.09	61.19	37.08	40.93	31.93
	Canton	62.81	66	62.01		62.01
	Total	50.87	61.31	39.63	40.93	38.27
Probability of WE-favoring outcome in %	Munic.	50.2	71.23	27.09	30.15	22.36
	Canton	99.73		99.36		99.36
	Total	51.6	71.9	31.56	30.15	31.56

number of those votes that turned out in favour of wind energy, the mean vote share in favour and — under the assumption of a normal distribution of the vote shares — the probability of a wind energy-favouring outcome in %.

If all votes were put together, thereby inadmissibly putting policy- and project-votes as well as cantonal and municipal votes together, column *All* shows a mean vote share favouring wind energy of 50.87%. The probability that such a vote passes in favour of wind energy is 51.6% and thus an almost perfect coin flip.

However, there are relevant distinctions to be made: As mentioned, those votes that are specific to projects need to be distinguished from those that seek a decision on a general-abstract policy-rule. This is because most project-based votes are triggered by the planning and permitting procedure, and most policy-votes are initiated by opponents (with some exceptions). There is a striking difference between the two: 72.72% of all project-related votes have been popularly decided in favour of wind energy projects, and only 36.73% of policy-votes have resulted in the same outcome. This negative strength is entirely driven by votes on the municipal level, not on the cantonal level. The success rate on the municipal level regarding policies is 31.11% (in favour of wind energy) and becomes even smaller if "other" policies, meaning all policy-votes that are not on minimal distance requirements, are being investigated.

Let's consider the difference of the mean vote share favouring wind energy and the probability of an outcome in favour of wind energy. Here, one should again

distinguish between policies and project-related votes. Whereas looking at "all" votes equals a probability of only 51.6%, there is a striking difference between project-related and policy-votes, as well as the municipal vs. the cantonal level. Whereas on the municipal level, project-related votes have a probability of 71.23% to turn out in favour of a project, the probability for policies passing in favour of wind energy on the same level is at 27.09%. This is in contrast to the almost certain wind energy-favouring outcome of a cantonal vote (given the limited cantonal experiences available).

Overall, the data suggest that the overall "coin flip" on wind energy matters in Switzerland is primarily driven by policy-decisions on the municipal level, and to much lesser extent by project-specific votes on the same level. Cantonal votes in general have much higher success rates and probabilities, for both policy and projects. However, given the limited number of votes on this matter, this should only be interpreted with caution.

Further Limits to Interpretation

While the data are encompassing, there are certain limits to interpretation: First, there are only very few cantonal votes, and hence the certainty estimates might be misleading. Second, for example, in the Romandie, there is a strong tradition of municipal parliaments, and in the German-speaking part, municipal legislatures are often popular assemblies (see e.g., Vatter 2020). As table 1 only includes *popular* votes, the data are skewed towards the Swiss German municipal decisions. Third, and more specifically, the concrete project-votes lump *general* land-use plan changes and *special* land-use plan changes together (there is no case, in which there were votes on both instruments in the same municipality, and on the same project). The project-votes interpretation is further limited by the fact that such votes can only happen if there is no previous policy-vote that would have forbidden the development of a concrete-project (possibility of selection bias). Moreover, even though utmost care has been applied, there might have been some popular votes that we didn't catch with the media scraping method.

What we can learn

- Opponents are much less successful in project-related popular votes than in policy-votes. Whereas 72% of project-related (number of) votes on the municipal level have had a pro-wind energy outcome, only 31.1% of (the number of) policy-votes on the municipal level have had such an outcome.
- The success of cantonal project- and policy-votes in favour of wind energy is staggering, although the very few number of votes on this level might lend a false impression of precision. Time and again, this corroborates evidence for the hypothesis that the *socio-political acceptance* of wind energy in Switzerland is much less contested than often claimed.
- The social acceptance of wind energy can only be considered to be a coin toss if one does not differentiate between project- and policy-related votes. Such an overall mean support rate (the only point of reference in the public debate on wind energy) masks the high support rate for project-related votes and is driven by opponent-initiated policy-votes that disproportionately favour opponents. This finding also generates the hypothesis that policy-votes against wind energy are disproportionately sought in those municipalities that have a high probability of accepting them.

5.2 Example 4: "Getting to no" – Guerilla de-marketing and obstructional entrepreneurship

The literature on social acceptance of wind energy has traditionally focused on factors that explain positive acceptance, with the aim of giving recommendations to policymakers and developers who would like to get projects done. In a world of perfect symmetry, this would also explain why some projects do not get done. However, as we know from the literature about negotiation strategies (Fischer and Ury, 1981) and political campaigning (Lovett, 2023), the world of collective decision-making is not symmetrical. "Getting to yes" requires a different set of ingredients than "getting to no". To better understand why Switzerland lags behind almost any other European country with regard to wind power installations (Hälg and Nipkow, 2024), it is useful to shed light on a hitherto underresearched phenomenon: the rise of obstructional entrepreneurship.

The social acceptance perspective

Wind energy projects enjoy high *sociopolitical acceptance*, but are often contested on the level of *community acceptance*. This section argues that this phenomenon is best understood by changing perspective and focusing on actors that actively work against wind projects throughout all the stages of the decision-making process outlined in Figure 1.

The rise of obstructional entrepreneurship

The aim of obstructional entrepreneurs in the wind sector is to prevent projects from being implemented. Similar to other entrepreneurs, they are creative and dedicated individuals, skilled at mobilising resources to have a significant impact and make seemingly impossible things happen (Sarasvathy, 2001; Handy, 2001). To achieve their goals, obstructional entrepreneurs can either act solo or team up with others to pursue more institutionalised strategies. Their communication strategies can be referred to as "guerilla de-marketing", combining elements of guerilla marketing (Levinson, 1984) and de-marketing (Kotler and Levy, 1971). Guerilla marketing, borrowing from the Spanish term for "small war", refers to a set of unconventional marketing strategies. Similar to how in guerilla warfare small groups of rebels or partisans fight against conventional military or police forces, marketeers apply guerilla tactics to surprise incumbent players and their customers. De-marketing means discouraging demand for a product or service, for example in cases where there is a shortage of supply. In the context of wind energy projects, obstructional entrepreneurs apply guerilla de-marketing to discourage social acceptance and ultimately prevent the implementation of those projects.

A range of mechanisms and tactics are applied by obstructional entrepreneurs in the context of Swiss wind power:

1. Agile forms of organising: In line with modern principles of organising in the corporate world (Warnecke, 1993) and in other areas (Dilger, 1997; Hassan and De Filippi, 2021), obstructional entrepreneurs combine elements of hierarchical organisations with decentralised network structures. In the Swiss wind sector, Paysage Libre represents an umbrella organisation for wind energy opponents that provides local opposition groups with tried and tested frames to support their fight against specific projects. In fact, Switzerland is perhaps one of the few countries in the world where the number of local opposition groups equals the number of installed

wind turbines (N=50). The names and websites of these groups convey a local touch and feel, but they share strikingly similar talking points and strategies.

2. Initiate popular votes: In Switzerland's direct democracy, anyone who collects a sufficient number of signatures can initiate a referendum on local, cantonal and federal levels. While in principle, this tool is open to both supporters and opponents of wind projects, it is used disproportionally often to fight against wind projects. Obstructional entrepreneurs use their creativity to come up with voting proposals that strike the right balance between having good chances of finding a majority at the ballot and effectively creating stumbling blocks for wind projects. Examples include local referenda to introduce a minimum distance of 500 m (Au SG) or 1'000 m (Wetzikon ZH) between planned wind turbines and the nearest building, or the recently introduced dual popular initiatives on "forest protection" and "community protection" at the federal level, aimed at preventing wind turbines from being built in or near forests, and allowing municipalities to overrule cantonal planning schemes and vote on projects proposed inside or in some cases even outside their geographical borders. While such popular initiatives often struggle to succeed in winning a majority at the ballot, they tend to polarise public opinion and often slow down the decision process about specific wind projects.

3. Focus communication strategies on weak points: A common practice in negative campaigning is to identify a few points that will be interpreted by undecided voters as weaknesses of a proposed project and then focus communication campaigns on those points ("Schwachstellen-Kommunikation") (see also Stadelmann-Steffen, 2019). Prominent examples in the context of Swiss energy and climate policy include the successful campaign against the 2021 Climate Law that was fought with the catchy phrase "expensive, useless, unfair" (Rothenbeger, 2021), or the 2016 popular vote on a proposed nuclear phase-out where the no-campaign warned against imports of dirty coal power from Germany (Rinscheid and Wüstenhagen, 2018). In the wind context, a common focus is on landscape change, potential impacts on birds (Vuichard et al., 2022), and noise concerns (Dällenbach and Wüstenhagen, 2022).

4. Leverage the power of emotional polarisation: Political campaigns are not just about facts and figures. Emotions are more effective in mobilising voters. Obstructional entrepreneurs can leverage the power of negative emotions like anger and fear by evoking strong imagery. It may be tempting for some to exaggerate or even make claims that are not factual (e.g. "wind turbines are loud as a chain saw", "wind turbines cause cancer"), following a "win pretty or lose ugly" approach.

5. Take legal action: Another element of the obstructional entrepreneur's toolbox is to take proposed projects to court. While legal action is costly and outcomes are uncertain, court cases represent an effective means to at least delay projects for opponents who are willing and able to afford the financial implications. The Swiss federal legal system offers additional opportunities, because projects can not only be sued against on one level, but instead taken to local, cantonal and federal courts, implying years of delay on each of those levels. There are several examples of wind projects that had to go through all three levels before they ultimately got the green light, and chances are that by the time a developer finally wins the case in the federal court, their patience and the financial viability of the project will have been put to a serious test. Obstructional entrepreneurs can also make

use of ambiguities in permitting processes to identify promising opportunities for painful interventions. An example is the recent case of a wind farm planned by BKW in Tramelan, where the developer thought they had received all necessary permits and started building the project, only to see the process come to a sudden and costly standstill when an opposition group convinced the cantonal authorities that the permit for clearing trees in a particular area was missing.

6. Buy property: A sixth tactic for obstructional entrepreneurs is to increase their influence by buying property close to a planned wind project. In the permitting process, people directly impacted by a project have more rights than those living further away. As an example, the Swiss wind energy opposition group Paysage Libre has acquired a hotel in close vicinity to a planned project, allowing them to more effectively obstruct construction of the wind farm. Similar to taking legal action, this strategy is somewhat limited to wealthy obstructional entrepreneurs or those who are able to mobilise networks of interest to contribute the necessary resources.

What we can learn

- Switzerland's federalist governance system creates ample opportunities for creative and dedicated opponents to prevent changes from the status quo (Jegen, 2015). Further research on obstructional entrepreneurship and guerilla demarketing will help to gain a more comprehensive understanding of social acceptance.
- Appreciating that "getting to yes" is different from "getting to no", and more fully taking into account the strategies and tactics of those individuals and groups who pursue the latter objective is an important complement to prior research in the domain of social acceptance of wind energy.

6 Market acceptance

6.1 Example 5: Incentives for grid-supportive operation of photovoltaic systems

Compared to their energy yield, PV systems have high power peaks. For this reason, PV systems can place greater strain on the grids than other power plants. At the same time, these power peaks can also be easily managed (Bucher et al., 2024). They can be compensated locally (self-consumption or storage) and, if this is not possible, they can be curtailed. However, curtailment, in particular, seems an unattractive strategy for prosumers who want to feed-in as much electricity as possible into the grid. Therefore, they will likely only adopt grid-friendly behavior if appropriate incentives are provided. Although incentives promoting self-consumption have long been common practice, only in the early 2020s did the first distribution system operators (DSOs) introduce mechanisms that reward prosumers for grid-supportive behavior (Bucher, 2025).

The social acceptance perspective

Our focus here is on the social acceptance of incentive models designed to promote grid-friendly operations of PV plants. Since market participants are the ones who need to introduce and adopt these measures, this aspect is related to *market acceptance*.

Market acceptance is required at two levels. First, the strongest form of acceptance, namely *support*, is needed by the DSOs. Considering the decision making process, DSOs need to make the explicit *decision* to introduce such a mechanism. Second, *market acceptance* by prosumers becomes relevant in the subsequent *implementation phase*. They must show a more *passive acceptance*, which means that they must perceive the mechanism positively and actually use the new model (Freiamt, 2025; Jegenstorf, 2024).

Market acceptance of grid-friendly mechanisms by DSOs and prosumers

In Switzerland, two incentive models have been developed (as of the end of 2025): 1) *TOP-40*, initiated by Elektra Jegenstorf. PV systems that do not feed in the top 40% of their output receive 8% higher feed in tariffs. 2) *FlexPV*: Similar to the *TOP-40 model*, *FlexPV* provides remuneration for feed-in energy when peak power is not injected into the grid. In its initial release, FlexPV developers introduced two variants: *FlexPV50* and *FlexPV60*. These allow up to 50% and 60% respectively of the DC power to be fed into the grid. Hence, the main difference between the two models is how the prices are set. Moreover, in both models, the loss of yield is usually small or zero as electricity that is not fed into the grid can be consumed or stored on site.

Even though it is widely accepted that these mechanisms can contribute to grid stability and reduce the need for grid improvement, Figure 7 illustrates that by April 2025 very few DSOs had introduced such a mechanism. At the same time, Figure 8 documents that within a few months the number of DSOs offering an incentive model has increased substantially. These data suggest that market acceptance of grid-friendly mechanisms by DSOs has been relatively low, with the large majority not offering according incentives. However, recent dynamics may announce an accelerated trend towards grid-friendly feed-in incentives. This pattern indicates that the limited diffusion

is not necessarily "non-acceptance", but rather DSOs only start to recognize the necessity of offering such incentives or to rank them as a priority.

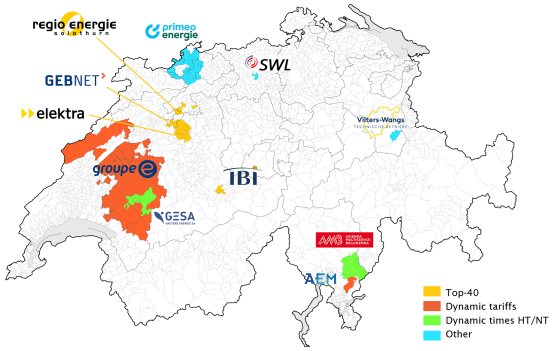


Figure 7: Overview of network operators offering incentives for grid-friendly feed-in, April 2025.

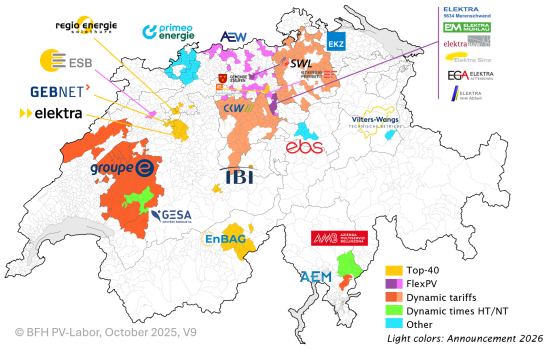


Figure 8: Overview of network operators offering incentives for grid-friendly feed-in, October 2025.

What about market acceptance by prosumers? Although existing grid-friendly mechanisms have only been introduced recently, and as new incentives often need some time to become effective, available data suggest that these incentive mechanisms are well accepted and thus used by prosumers. Introduced by Elektra Jegenstorf in January 2024, after just under two years, around 10% of all systems in the supply area are connected under the framework of *TOP-40* (including installations built already before the introduction of the incentive scheme). Although Elektra no longer actively advertises the product, around 25% of all new systems are connected to *TOP-40* with this proportion trending upward.[7]. However, the decisive factor is not the owners of the PV system, but the installers, who promote the solution to their customers. It is also advantageous that installers are now familiar with *TOP-40* and its peculiarities. *FlexPV* was introduced by SWL Energie AG in autumn 2024. In the first year of implementation, around 15% of all PV systems in the SWL grid were equipped with the *FlexPV50* configuration, the more advanced of the two FlexPV variants. If systems that have already been approved but not yet built are included, the figure rises to 20%. Since then, SWL has integrated *FlexPV* into its standard grid connection procedures. For each new grid connection request, customers are explicitly asked whether they wish to implement one of the *FlexPV* options. As of late 2025, more than 50% of all new grid connection permits include a *FlexPV* configuration.[8]

What we can learn

- Feed-in incentives designed to foster grid-friendly behaviour serve as an example of "private policies" supporting grid-stability in a renewable energy system.
- The challenge of market acceptance for grid-friendly feed-in mechanisms appears to primarily relate to DSOs, who have only recently started to provide these mechanisms to their customers. When available, such mechanisms seem well-accepted by prosumers.

[7]Data provided by Jan Giger, Genossenschaft Elektra, Jegenstorf, October 2025.
[8]Data as of October 2025, provided by Lars Huber, Leiter Systemtechnik, SWL Energie AG.

6.2 Example 6: Differentiating intent and action in Swiss residential solar PV adoption

To meet the national goal of generating over 40% of Swiss electricity from solar PV by 2050, production must increase strongly (SFOE, 2023b). Most of this growth is likely to originate from residential installations, given the limited availability of land and the higher socio-political acceptance of installations on buildings compared to open-space projects (see Chapter 3). Given this imperative role in achieving carbon neutrality, it is essential to understand the factors determining the uptake of residential solar PV.[9]

The social acceptance perspective

This example, therefore, addresses the dimension of *market acceptance* focusing on *Swiss residents'* solar PV adoption (Wüstenhagen et al., 2007). The main objective is to analyse the determinants of adoption intention and adoption behaviour, addressing the widely observed attitude-behaviour gap (Park and Lin, 2020; Owens and Driffill, 2008; Kollmuss and Agyeman, 2002) and the scarcity of empirical studies distinguishing between adoption stages (Hecher et al., 2025; Duygan et al., 2023; Ruokamo et al., 2023; Duygan et al., 2025). This delivers a more nuanced understanding of why different societal groups do or do not adopt PV systems despite this technology's high *socio-political acceptance*. In particular, to generate sustained PV growth, it is crucial to learn more not only about those who have already adopted PV but also those who are potentially willing to do so.

Adoption intention and adoption behaviour for residential solar PV

The adoption of an innovative technology is a complex social process that is influenced by a variety of factors. Drawing on key adoption theories (Straub, 2009), we collected data across five dimensions - socio-demographics, contextual factors including housing infrastructure and institutional environment, psychosocial characteristics, perceived attributes of solar PV, as well as information and social influence - in the EDGE 2022 survey with Swiss households (N = 4'909).

The survey reveals that 18% of our sample are early adopters, with non-adopters constituting the clear majority (82%). We segmented this majority into potential adopters (39%), who express being very or rather likely to adopt PV within the next five years, and unlikely adopters (43%), who state they are very or rather unlikely to do so.

The large group of unlikely adopters are predominantly characterized by structural barriers such as a lack of homeownership and lower economic stability. This represents the core discrepancy between high socio-political support for solar PV and low market uptake. The analysis confirms this structural gap: compared to unlikely adopters, the odds of being a potential adopter are nearly 3.5 times higher for homeowners, strongly magnified by prior investments like owning an electric car, and are higher for families with children. Furthermore, unlikely adopters demonstrate significantly less support for pro-PV policies, which reinforces the depth of the structural and

[9] The analysis and core findings presented in this chapter are based on the following scientific article, which is currently under peer review: (Duygan et al., 2025)

attitudinal barriers that distinguish this group.

Potential and early adopters were found to be more similar to each other, particularly in their socio-demographic and psychosocial characteristics. Their primary differences, and thus the bottlenecks closing the attitude-behaviour gap, lie in contextual factors, perceived attributes of solar PV, and information exchange. Early adopters are a cohort largely composed of homeowners mostly residing in single-family homes, which is a significant enabler for action. Furthermore, PV adoption is highly concentrated among those who have already co-adopted low-carbon technologies. Owning an electric car or a heat pump more than doubles the odds of being an early adopter. While local subsidies do not create intent (i.e., becoming a likely adopter), they go hand in hand with stronger actual PV adoption for those who already have the intention to adopt. Crucially, potential adopters are significantly less optimistic about the perceived attributes of solar PV than early adopters. They rate economic viability and the ease of use lower. Finally, potential adopters tend to have fewer exchanges in their personal networks about solar PV than early adopters.

What we can learn

Promoting residential solar PV in Switzerland necessitates a targeted policy strategy that treats non-adopters as distinct groups, segmenting interventions designed to create intent from those designed to trigger action of installing solar PV. From current research, we can learn the following:

- To build intent among the large group of unlikely adopters, policy must confront the structural barrier of homeownership. Offering new schemes for tenants and multi-family settings (e.g., tenant-landlord PV investment models) is essential. These models can provide direct structural access to those lacking property rights (Domenig et al., 2024; Castellazzi et al., 2017), regulate or incentivise landlords' investment as tenants increasingly value energy-related features in apartment choices (Reidl and Wüstenhagen, 2025), or promote PV community projects as viable alternative (Brückmann et al., 2024).
- For potential adopters, co-adoption strategies for low-carbon technologies offer a promising path forward. For homeowners in single-family homes, we can learn that coupling PV with other technologies, supported by targeted subsidies, can foster the transition to sustainable housing on a larger scale. This approach can potentially initiate positive tipping points in the residential building sector (Alkemade et al., 2025; Hecher et al., 2023; Plananska and Gamma, 2022; Priessner and Hampl, 2020).
- And finally, establishing settings for trustful knowledge exchange is an essential entry point to strengthen intentions. For example, community-led demonstration events where early adopters share their experiences can activate social and spatial proximity effects confirmed across numerous studies, while simultaneously addressing knowledge gaps and possible misconceptions about the benefits and economic viability of solar PV and enhancing self-efficacy (Hecher et al., 2025; Serra-Coch et al., 2023; Curtius et al., 2018; Fry and Thieme, 2019; Graziano et al., 2019; Graziano and Gillingham, 2015; Petrovich et al., 2019; Bollinger and Gillingham, 2012).

7 Conclusion

The main challenge of increasing renewable energy production to meet the set energy and climate goals is societal rather than technical. The necessary technologies are available, and research has provided valuable insights into how and where to optimise renewable energy production. However, these technical solutions will only contribute to energy targets if they are implemented and built, used or invested in. This White Paper focuses on this issue, introducing the social acceptance framework and applying it to the Swiss context. It uses examples from solar PV and wind energy to illustrate the different types of social acceptance required for the successful expansion of renewable energy and the varying dynamics at play.

Two main conclusions can be drawn from the insights presented in the White Paper. First, what type of social acceptance is required and by whom depends on the topic, technology and policy-making stage: Social acceptance patterns and dynamics differ depending on whether the goal is to get the approval by municipalities for an alpine PV project, reduce opposition for a wind turbine or motivate investors to go for grid-friendly solutions. Hence, it is highly relevant for policymakers and project owners to consider who the relevant actors are, and what the relevant type of acceptance is, as this may affect how to design successful implementation processes. Second, more abstract socio-political acceptance is generally given for all renewable energy sources in Switzerland. While broad socio-political acceptance is typically not associated with the same (but a lower) level of community or market acceptance during implementation, this most abstract type of social acceptance can nevertheless be seen as a basic prerequisite for successful implementation processes. This makes implementing technologies with only moderate levels of socio-political acceptance, i.e., the "debated but viable" technologies (see 3), such as open-space PV or wind power, a particularly challenging endeavour.

While these conclusions imply that the success factors for implementation are very much case-specific, the different examples presented in this White Paper nevertheless identify some commonalities. As social acceptance requires the constructive collaboration of many private and public stakeholders across multiple levels of government and economic sectors, single stakeholders cannot be "tasked" with generating social acceptance, as this represents a collective effort. Therefore, the following recommendations address all stakeholder groups involved in the implementation of renewable energy solutions, particularly project promoters as well as political decision-makers and authorities at the cantonal and local levels. To promote social acceptance in the implementation of renewable energy solutions, all involved stakeholder groups should consider the five recommendations from their respective perspectives:

1. Participatory processes are important, but encouraging local leadership is key: Participatory processes are indispensable for the energy transition in Switzerland. However, to bring synergies rather than trade-offs to the fore, more than mere inclusion is needed: genuine local initiative and the commitment of local personalities and actors are required. Alpine PV projects serve as an example: when driven by large external companies, they risk triggering a "veto player dynamic", in which influential actors resist out of concern for loss of control

or unequal distribution of benefits. Municipalities or local electricity providers can act as "local entrepreneurs" here, minimizing perceived trade-offs, emphasizing societal gains and synergies, and thus fostering acceptance.

2. Leveraging positive social dynamics through networks and communication: The challenges of implementing renewable energy often overshadow the positive social dynamics that do exist. For instance, the "Solar Express" is frequently presented in terms of its failures, while two-thirds of alpine PV projects put to a vote have been supported by the affected municipalities. In the field of wind energy, it is also important to distinguish between votes on regulations and those on specific projects, rather than speaking generally of a "50:50 chance". The broad sociopolitical acceptance of the energy transition in Switzerland provides a solid foundation that municipalities and project promoters can leverage. Public debates and open votes in municipal assemblies (rather than secret or postal ballots) can reinforce this dynamic, provided the group dynamic is positive. Similarly, creating opportunities for exchange within personal networks, such as neighbourhood events that bring together early adopters of PV with interested parties, proves effective.

3. Build trust: Trust is key to translating sociopolitical acceptance into concrete market and local acceptance. People must be able to trust the technologies, those responsible, and the processes. This trust can compensate for the uncertainties that often surround infrastructure decisions. Trust is built in many ways: local authorities, decision-makers, or project promoters can play a crucial role as "local entrepreneurs", provided they are perceived as competent and credible, especially through personal contacts and direct exchange. Finally, trust can also be strengthened through transparent processes or genuine participatory co-design.

4. Suitable incentive structures need to be put in place: The decisions of key actors in renewable energy processes are often influenced by various, sometimes conflicting criteria. Without effective, transparent incentives, renewable energy goals are unlikely to be prioritized, which can lead to a lack of investment. This is particularly evident in market acceptance: financial incentives, for example for integrated solutions such as combining PV with heat pumps or e-mobility, are important for making these installations profitable for "likely adopters". The example of grid-friendly feed-in shows: prosumers use incentives when they are available. It is therefore up to decision-makers at the local and cantonal levels to find measures that encourage the spread of such instruments among grid operators. Institutional incentives at the cantonal level, as in the case of wind regulation, can simplify implementation processes, increase the security of investors' expectations and reduce the "hijacking" potential of institutional access points for opponent groups

5. Anticipate mobilization asymmetries between opponents and proponents in implementation processes: In the Swiss participatory and direct democratic context, campaigns and citizen involvement generally aim to secure majority support. This seems logical, as many projects require majority approval in a vote. However, implementation often fails not due to a lack of majority acceptance, but because of the mobilization potential of a committed minority. Cantonal and local decision-makers must therefore anticipate early on what type of acceptance will be decisive in each case. Often, it is about preventing active resistance. The strategies of obstructive actors must be anticipated and countered with targeted measures.

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Appendix

8.1 Additional information Section 4.1

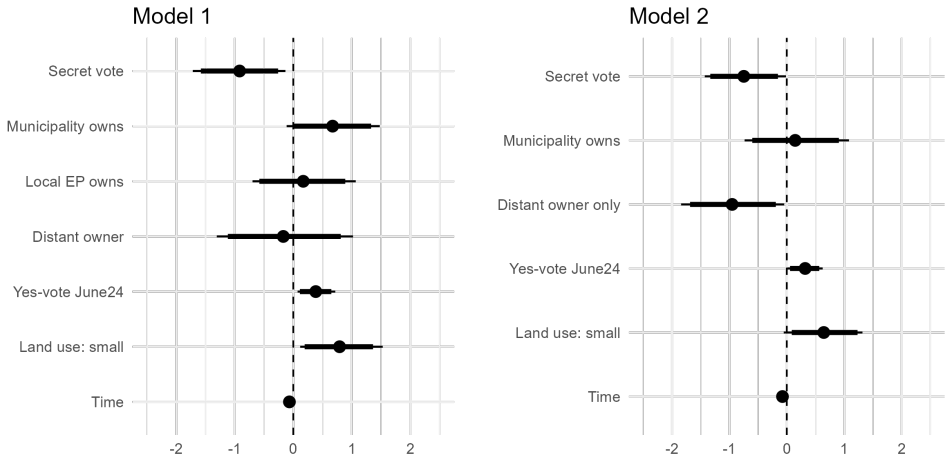


Figure 9: Explaining community acceptance of alpine PV projects; posterior distributions of Bayesian beta regression models.