Instigating a post-growth transformation of the energy sector: the case of Greek energy communities

"Our task is to make trouble, to stir up potent response to devastating events, as well as to settle troubled waters and rebuild quiet places."

- ***Donna J. Haraway, Staying with the Trouble: Making Kin in the Chthulucene***

"We live in a world of [growth-based systems]. [Their] power seems inescapable. So did the divine right of kings. Any human power can be resisted and changed by human beings."

- ***Paraphrased from Ursula K. Le Guin***

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Energy is such a political, often contested social topic. Working in this sector, especially navigating the (mostly) uncharted waters of community renewable energy, I feel is the perfect embodiment of Donna Haraway's quote "*Staying with the Trouble*". And I cannot invoke this quote, without nodding at the person who taught it to me (and all that this entails): my mom, Nadja Argyropoulou.

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LIST OF ACRONYMS

EC(s) = Energy Community(ies)

CREI(s) = Community Renewable Energy Initiative(s)

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ABSTRACT

The growth-oriented, fossil-based energy system of today is undergoing a transformation towards renewable energies. However, a mere switch in technologies, without a thorough examination of underlying socio-economic relations and power structures, risks perpetuating the same crises of inequality and ecological degradation of the previous system. It follows then that a transformation in the energy system is required which enhances both social and ecological sustainability. The present research weaves together transformations and post-growth literature and constructs a qualitative analytical framework against which an initiative's post-growth transformative capacity can be tested. It then zooms back in to empirically test the framework on energy communities in Greece. Results show that Greek energy communities hold significant post-growth transformative capacity, in areas such as networking, actor empowerment and innovative learning, shared vision creation, alteration of resource flows and a reconfiguration of ownership and governance structures. The research concludes with some policy recommendations that could enhance the post-growth transformative capacity of Greek energy communities, such as the creation of a national federation of energy communities. The post-growth transformative capacity framework presented in this research could be used as a descriptive starting point, from which academics or practitioners can build on to explore post-growth futures and post-growth transformative capacity in other sectors (e.g., food or transportation) and contexts (e.g., Global South countries).

INTRODUCTION

Global energy and resource use far outstrips Earth's natural regenerative capacity (Hickel and Kallis, 2020), a trend that is driving the ongoing climate and ecological breakdown (Steffen et al., 2015). Zooming in on the energy sector, fossil energy production is responsible for up to 71% of global emissions since 1988 (Griffin, 2017). This often centralised form of energy production, despite being a top contributor to climate change (Griffin, 2017), is also failing to deliver adequate living standards with 7,6% of the total EU population facing energy poverty (EU Energy Poverty Observatory, 2020). Despite being discursively constructed as antidotes to these crises (Koch, 2020), promises of smart, inclusive and green growth have hitherto failed to materialize, with social, economic and carbon inequalities deepening further (Wiedmann et al., 2020; UNEP 2020).

It is doubtful that a large uptake of renewable energies will be able to address climate change, whilst increasing socio-economic equity. Historically, there haven't been any energy transitions, only energy additions (York and Bell, 2019). Slightly dented by the Covid-19 pandemic, but driven by expectations of continuous economic growth, global energy demand is projected to grow by 4-9% by 2030 (IEA, 2020). Due to a low energy return on energy invested compared to fossil fuels, renewable energies cannot displace fossil fuels whilst facilitating continuous economic growth (Mastini et al., 2021). Moreover, increased energy supply suppresses prices, effectively facilitating greater demand, productivism and economic growth (Gunderson et al., 2018). A growing economy necessitates increased energy consumption, as absolute, long-term decoupling of growth and energy is not feasible (Hickel and Kallis, 2020). Finally, the documented rampant social-ecological abuses along global renewable energy supply chains (Mastini et al., 2021), further bring into question the belief that a switch from fossil to renewable energy sources can be an effective transformational strategy.

A mere reform of the growth-oriented status quo, into a greener version, will likely push the Earth System beyond its safe operating space, whilst further exacerbating socioeconomic inequalities (Spash, 2020). Post-growth theory calls for a radical reconfiguration of socio-economic systems, away from the hegemonic pursuit of economic growth (Hickel, 2020). Without constructing a dogmatic set of rules and policies, post-growth calls for an equitable downscaling of the global economy, which enhances human well-being, but respects planetary

limits (Parrique, 2019). Despite their variability and multi-dimensionality, post-growth policies gravitate around three main axes according to a comprehensive review by Cosme et al (2017): (1) Reducing the ecological and climate impact of human activities; (2) "Redistributing income and wealth both within and between countries"; and (3) Replacing the culture of materialism and the practises that sustain it with convivial and participatory societal institutions.

Using energy communities as a case example, this thesis aims to explore the transformative capacities that niche initiatives should embody in order to navigate the current unsustainable energy system towards a system that enhances human well-being within planetary limits.

RESEARCH QUESTIONS

The overarching research question that this thesis seeks to address is "To what extent can Greek solar energy communities instigate a post-growth transformation of the energy sector?"
To answer this, I proceed in a stepwise fashion, following the sub-research questions listed below:

- *What is (post-growth) transformative capacity?*
  I answer this question through the conceptual development of the post-growth transformative capacity framework.
- *What is the post-growth transformative capacity of solar energy communities (ECs) in Greece?*
  I answer this question through an interview-based empirical study.
- *Which of the five elements could be leveraged to effect the largest change in total Post-Growth Transformative Capacity*?
  I answer this question based on the data derived from the previous research question.
- *What are the challenges and enabling conditions for solar energy communities in Greece to transform the energy sector?*
  I answer this question through an interview-based empirical study.

The thesis is structured as follows: In Section 1, the background is given of what a post-growth energy sector could look like, as well as what is the current Greek energy context. In Section 2 I begin by creating my own analytical framework, responding to an important identified gap in the literature: To my knowledge, to date there exists no framework that combines post-growth and (energy) transformations. I wove together transformations and post-growth literature to create the analytical framework of post-growth transformative capacity, which can be applied to niche initiatives in general. In Section 3, the methodology for data collection and analysis is detailed, explaining how the framework was applied specifically to Greek energy communities through a series of interviews with relevant stakeholders. In Section 4, the results are presented. In Section 5, I discuss the results' implications, and further elaborate how a policy proposal could address some of these implications. I then discuss research limitations and future prospects. Section 6 concludes with key insights and reemphasizes a policy proposal to further unlock the post-growth transformative capacity of Greek energy communities.

1. BACKGROUND

1.1 A Snapshot of a Post-Growth Energy Sector

Building on some general post-growth principles (Cosme et al, 2017; Parrique, 2019; Fitzpatrick et al, in press), a post-growth energy sector would ensure that renewable energy would be accessible to all, while consumption levels would remain at a level that simultaneously ensures human well-being, while respecting planetary limits. A provisional, empirically determined value for a safe and just energy consumption cap at the global level would be between 150-250 EJ yr-1 (i.e., 40-60% lower than current consumption) (Grubler *et al.*, 2018; Millward-Hopkins *et al.*, 2020)[1]. Renewable energy systems would largely operate at the local level through a diverse range of citizen renewable energy initiatives (CREIs) owned and governed by the members themselves through democratic processes (Kunze and Becker, 2015). These CREIs would be politically motivated and would challenge the idea of economic growth and instead pursue other social and ecological goals (Kunze and Becker, 2015). Any economic or productive surplus from the operation of the CREIs would be shared amongst the members and directed towards social-ecological purposes, as opposed to private profit, as in Hinton's (2020a) not-for-profit ideal type economy. Workers and communities affected by the energy transition, would be placed centerpiece in co-designing the transition in a just and sustainable way.

Renewable energy technologies would be sourced as locally and sustainably as possible with supply-chain transparency and democratic deliberation (Weiss and Cattaneo, 2017), ensuring that no country's energy transition outsources its impacts to others (Mastini et al., 2021). Renewable energy technologies would be appropriately integrated in local ecosystems, from a social-ecological perspective. Technology would be used in convivial ways that contribute to community cohesion and deepen human-nature relations. Technical capacity would be shared under a peer-to-peer, open commons access regime (Kostakis *et al.*, 2018; Giotitsas *et al.*, 2020).

[1] The Grubler et al (2018) scenario is the only 1.5ºC-aligned IPCC scenario that does not take into account negative emission technologies. It also significantly considers the potential of demand-side and decentralised interventions in the energy system. Traditional, solid biomass is phased out. Biomass and nuclear are mostly used for hydrogen fuel production, while solar and wind are the dominant clean energy sources. Millward-Hopkins et al (2020) further demonstrate how every person could achieve decent living standards within this minimum energy range.

This section outlined some general organizing principles for a post-growth energy sector, which still allow for a lot of diversity and pluralism and are by no means prescriptive. Having briefly mapped out what a post-growth energy sector could look like, the present research focuses on Greece as a case study for the potential of energy communities to bring about a post-growth transformation of the energy sector.

1.2 The Greek Context

Historically, Greece's energy sector had been under the monopolistic control of the State-owned Public Power Corporation (PPC), but the decade between 2003-2013 marked a significant shift towards liberalisation, driven by national private interests, the EU and a series of austerity-imposing memoranda (European Commission, 2012). As in other European countries, the liberalisation of the energy sector is also partly owed to growing consumer preference for individualization and flexibility (Wittmayer *et al.*, 2020). The government's announcement in 2019 for a coal phase-out at the latest by 2028, combined with a growing awareness around climate change and EU decarbonization policies, have led to coal's share in total energy supply to dwindle drastically over the last few years (MoEE, 2019). Across 2020, electricity generation stemmed from:

- Natural gas (~35%);
- Renewable Energy (~30%)[2];
- Imports (~20% - largely coal and nuclear);
- Lignite (~10%) and
- Hydro (~5%) (IPTO, 2021).

National electricity consumption stands at 56.89 TWh of energy per year, which translates to an average of 5,309 kWh per capita or 19 GJ of energy (WorldData, 2020). This figure is expected to grow to 57.93 TWh by 2030 (MoEE, 2019). Assuming that a fair share of energy per capita consumption for countries that have overshot their carbon budget is

[2] This can be further broken down into 57% wind, 26% PV, 3% roof PV, 4% small hydro, 3% biogas/mass, 7% cogeneration (DAPEEP, 2021). These figures are from November 2020, the latest available data.

15GJ/capita/year (Millward-Hopkins et al, 2020), the Greek average is already overshooting its fair share by ~27%, notwithstanding future energy demand projections. Moreover, energy consumption is not spread equally, with high income households consuming 34,1% more energy than low income households on an average monthly basis (ELSTAT, 2020). Socio-economic inequalities in energy consumption are further underscored by the significant level of energy poverty[3] that Greek households face, which stands at 22,7% compared with a 7,3% EU average (EU Energy Poverty Observatory, 2020).

A recent, rapid uptake of renewable energies, in line with national and EU climate targets (MoEE, 2019), has been met with fierce opposition from grassroots groups and civil society (Argenti and Knight, 2015). Large-scale, private renewable investments are discursively framed as another form of undemocratic, unecological, colonial extractivism (Argenti and Knight, 2015). But these overlapping socio-economic crises are also met with grassroots organizing centred around cooperative structures (Calvário et al, 2016). Covid-19, a crisis in its own right, is further accentuating calls for a green, inclusive and participatory energy model (Vardakoulias, 2020).

Situated between centralised fossil energy and large-scale private renewable energy investments, energy communities may offer a more democratic and just energy future. Through a 2018 revision of the Renewable Energy Directive II, the EU legally recognised renewable energy communities, i.e., cooperatives with the right to produce, consume, store and sell renewable energy (European Union, 2018). Greece was the first EU Member to transpose the directive into national law (Law 4513/2018) in 2018, explicitly framing ECs as part of the social and solidarity economy, and specifically as a tool to tackle energy poverty (Douvitsa, 2018). Additionally, in Not-for-Profit ECs, surplus distributions amongst the members is not permitted, and it should instead be distributed towards other, often social and environmental, purposes (Douvitsa, 2018). Because of these characteristics, ECs could prove to be suitable candidates to instigate a post-growth transformation of the Greek energy sector.

Despite more than 411 energy communities being registered in Greece (Vasilakis et al., 2020), a number of factors currently constrain their prospects of mainstream institutionalization. Therefore, the various characteristics that enable an initiative to push back against these various

[3] In the context of this thesis energy poverty is defined as the inability of an individual to adequately heat or cool their home.

constraints, break-out of the status-quo and contribute to a (post-growth) transformation, warrant closer examination. Addressing this knowledge gap is what this research seeks out to do.

2. THEORETICAL FOUNDATIONS

2.1 Post-growth Transformative Capacity

In the present research, the Greek energy sector is considered as a complex socio-technical system (Geels and Schot, 2007). Such systems are composed of 1) niches, i.e., ideas that exist at the margin of society, and present new ways of thinking, doing and organizing, 2) regimes, i.e., a "semi-coherent set of rules that orient and coordinate the activities of the social groups that reproduce the various elements of [the] system" (Geels, 2011) and 3) the landscape, i.e., the exogenous context, constituted by a set of "factors that change over the very long term, such as climate or topography" (Vandeventer et al, 2019). When a socio-technical system becomes untenable, i.e., it actively erodes human well-being and the environment, as is the case with the Greek energy sector (Papada and Kaliampakos, 2016), a transformation is needed. A transformation would entail the creation of new system components (e.g., shared visions, goals and technologies) and interactions (e.g., institutions, actors and power structures) (Westley et al, 2013; Schmid et al, 2016).

Solar energy communities are conceptualised as potentially transformative niche initiatives that may destabilise the dominant, growth-oriented fossil and renewable energy regime and radically reconfigure Greece's energy landscape in the direction of low-carbon, convivial lifestyles.

To develop the post-growth transformative capacity framework and thus answer RQ(i), I used a typical approach to theoretical synthesis (Jaakola, 2020). I began with a scoping study in order to map out the key concepts underpinning the relevant research areas (Arksey and O'Malley, 2005). This was necessary because "post-growth (energy) transformations" is a complex research area that has not been reviewed comprehensively before (Mays et al, 2001, p.194). Through this scoping study, I examined key transformations literature (e.g., Pereira *et al.*, 2018; Tuckey 2019, and Lam *et al*, 2020), key post-growth literature (e.g., Göpel, 2016; Rommel *et al.*, 2018; Parrique, 2019; Hickel, 2020; Hinton, 2020a; Mastini, et al, 2021) and literature on post-growth energy systems (Kunze and Becker, 2015; Alarcón Ferrari and Chartier, 2018; Tsagkari et al, in press). I then conceptually integrated some of the existing literature strands

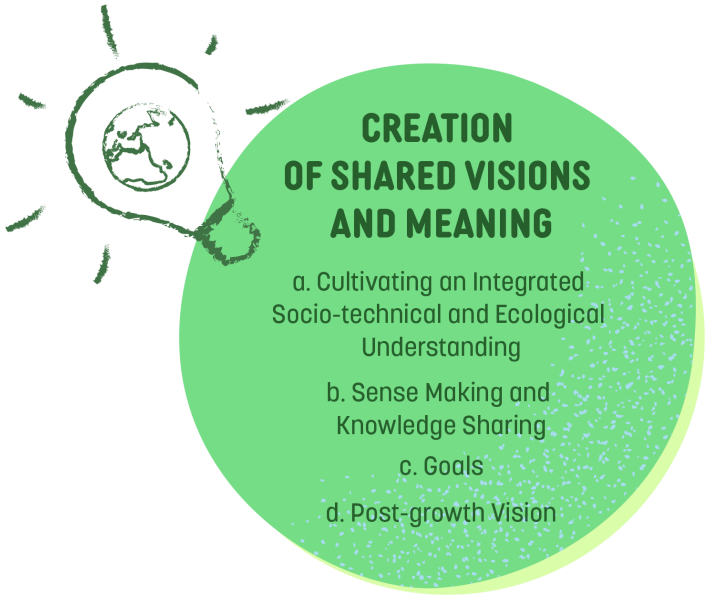
(Gilson and Goldberg, 2015), in order to develop an analytical framework on post-growth transformative capacity.

The framework uses elements that characterize transformative potential as a starting point (Tuckey, 2019), and subsequently uses sub-categories to unpack the post-growth components and relations of each element. As an example, 'actor empowerment' is a cornerstone of transformations literature (Tuckey, 2019; Lam et al, 2020), and 'political motivation' is considered important for post-growth transformations (Kunze and Becker, 2015). In the framework, these two examples are woven together into "politically motivated empowerment", whereby an initiative actively encourages and builds the capacity of its members to engage in political processes and the commons. Similarly, networking is often identified as a key element of transformative capacity (Westley et al, 2013; Tuckey, 2019). From a post-growth perspective, an emphasis is given to strategic networking to build independence from State influence and growth-focused socio-economic relations (D'Alisa et al, 2015). In the final framework, this feature is a sub-category under Transformative coalition building, described as strategic/politically motivated networking.

The final framework is presented in Figure 1 below. It consists of five elements building on Tuckey's (2019) framework on transformative capacity, while also being relevant from a post-growth perspective:

Figure 1: A Framework to Assess Post-growth Transformative Capacity, constituted of 5 key elements, each consisting of certain subcategories.

1. The Creation of Shared Visions and Meaning



The articulation of shared meaning by an initiative and its members helps formulate a coherent future vision, challenging the status quo and guiding the creation of goals and targets (Moore et al, 2014; Hermwille, 2016). An initiative's goals in turn define the boundaries of 'rational' policy making (Göpel, 2016). As such, the activities and policy actions of an initiative will all be driven by its goals. A post-growth transformative initiative cultivates a systemic and complex way of thinking, based on system embeddedness, amongst its members, employees, and the general public. It is forming new societal visions challenging the growth-based status quo and the dominant narratives that arise from it and sustain it (e.g., common goods like energy or water should be universally accessible). These visions are shared between the members of the initiative and the broader public and are prefigured through the establishment of short- and medium-term goals enshrining strong social and ecological sustainability. Navigating a transformation often entails compromise, vested-interest capture or adaptation based on changing contexts (e.g., economic hardship) (Wittmayer et al, 2020). Regardless of the circumstances, the initiative should try not to jeopardize its post-growth visions, values and goals (Strunz and Schindler, 2018).

This element could be further specified in the following categories:

a) **Cultivating an Integrated Socio-technical and Ecological Understanding**

Acknowledging the embeddedness of society and the economy within the biosphere is an important step towards setting societal limits against excessive resource consumption and environmental damage. Limits do not only relate to a stewardship of the environment and the commons, but also regenerative practices and intra- and intergenerational equity (Deriu, 2012). A post-growth transformative initiative could strive to educate its members and the public about this embeddedness and the systemic links between society-technology-environment in order to share and spread its visions and goals. Affective communication which includes arts, such as performative methods, can help one to dive deeper and more vividly into the lived experiences of post-growth social systems (Brossmann and Islar, 2020; Koch, 2020).

b) Sense Making and Knowledge Sharing

A post-growth initiative must challenge or critique pro-growth socio-economic systems and the economistic ideas that surround them, i.e. the pursuit of profit for the sake of private financial gain, that humans should only pursue their self-interest, that competition trumps cooperation, and that entrepreneurship, innovation and engagement in society are only driven by the intention of gain (Göpel, 2016, p126). A post-growth transformative initiative could therefore create spaces that foster 1) questioning of the dominant paradigm of growth and 2) experimentation, dialogue and sense-making amongst postgrowth initiative stakeholders (Gui and MacGill, 2018; Koch, 2020). These spaces should challenge the cultural hegemony of growth, whilst planting the seeds of alternative societal models, rooted in lived practices and experiences (D'Alisa and Kallis, 2020).These institutions and spaces can be physical (e.g., Peer to Peer labs or open workshops (Lange and Bürkner, 2018)), or generalized norms and routines that create alternatives to growth (Brossmann and Islar, 2020).

c) Social-Ecological Goals

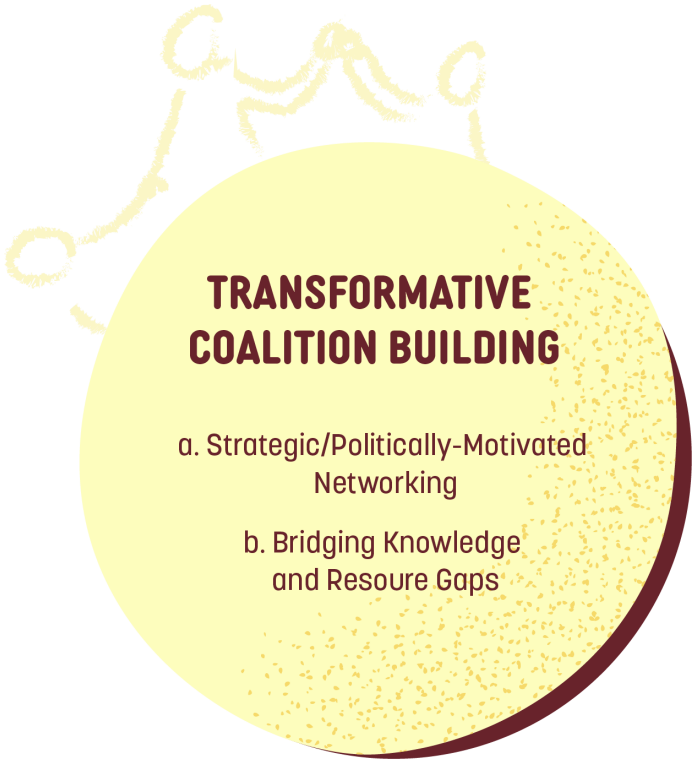
A post-growth transformative initiative could move beyond growth as a goal and actively pursue social-ecological goals that promote human well-being, without transgressing

ecological boundaries (Göpel, 2016, p134). Measuring progress towards the fulfillment of an initiative's goals, using specific indicators, ensures that the goals move from the conceptual/abstract realm, to applied, tangible results (O'Neill, 2012). The indicators themselves can function as educational tools about the importance of measuring (and prioritizing) a broader range of social-ecological benefits (e.g., energy poverty reduction, or CO2 sequestration). As Meadows, (1998) argues, "we measure what we care about [...and] we care about what we measure".

d) Post-growth Vision

Envisioning a world beyond the bounded rationality of growth-based systems opens up a wide range of possible futures. Emphasizing positive futures where humans and nature thrive together, employment is meaningful, and technology is used convivially, is an important prerequisite to unlocking our collective imaginaries and enacting transformative change (Pereira *et al.*, 2018; Pereira *et al.*, 2020). A post-growth transformative initiative could share these visions amongst its members and with the broader public, in an attempt to capture people's minds and hearts or "scale deep" (Moore et al, 2015). The most fundamental element for any successful post-growth transformation is scoping (and potentially changing) people's deepest values and most closely-held beliefs (Göpel, 2016). These guide the formulation of (new) system goals and in turn influence the structure, function, norms and procedures of any system.

2. Transformative Coalition Building



Networking is essential for niche initiatives (Pereira et al., 2018), as it allows them to collect the necessary resources in order to establish themselves and amplify their impact across different contexts (Moore et al, 2015; Lam et al, 2020). A transformative initiative forms networks with stakeholders that have similar and dissimilar goals and interests at the local and global levels. It forms mutual-support coalitions with other initiatives, and it nurtures the creation of new initiatives with similar goals. Intermediaries bridge knowledge and resource gaps, helping the initiative grow.

This element could be further specified in the following categories:

a) **Strategic/Politically-Motivated Networking**

Building networks of transformative initiatives allows for mutual support and the exchange of best practices, so that each initiative reaches its full transformative potential. Strategic actor networks can create resource redundancy, which in turn creates a degree of independence and resilience from capitalist/productivist social relations (D'Alisa et al,

2015; Grubačić and O'Hearn, 2016). Additionally, networking would entail bridging multiple governance scales, by working with a diverse range of powerful and niche actors. This is an important element for effecting transformative change (Moore et al, 2015). The garnering of support from powerful actors, like the State or the EU, is of special importance for post-growth niche initiatives, which require a favorable institutional (legal, financial, cultural) framework in order to compete with pro-growth initiatives (D'Alisa and Kallis, 2020).

b) Bridging Knowledge and Resource Gaps

The existence of individuals or groups that can facilitate the flow of information and resources, or create space for dialogue and conflict resolution, is key to enabling transformations (Westley et al., 2013). This becomes all the more important in the context of niche post-growth initiatives which may be fragmented from each other and operating under an uncertain/unstable institutional landscape (Enarsson, 2019).

3. Actor Empowerment and Innovative Learning

Innovation and adaptive experimentation are essential aspects of a healthy governance process (Chaffin et al., 2016; Fedele et al, 2019). The steady build-up of post-growth information and skills can be used by an initiative to empower its members, and workers, who can then themselves become agents of change (Tuckey, 2019). A transformative initiative as an entity participates in political processes, such as policy creation. Through ongoing practises of learning and experimentation, the initiative also adaptively responds to changing external conditions and the desires of local communities in the context(s) where it operates. Thus, it participates in an iterative process of responding to and actively changing institutional contexts towards the goal of post-growth transformation. These learning practises also manifest through skill and capacity building amongst the initiative's members, which are then also transferred to the public.

This element could be further specified in the following categories:

a) Capacity Building and Self-Sufficiency

A post-growth transformative initiative could teach its members, employees, and the public the necessary skills to manage/maintain/operate various technologies, to reduce reliance on external actors and dominant system structures (Kostakis *et al.*, 2018; Wittmayer *et al.*, 2020). More broadly, it could imbue its members and workers with the right skills so that they can provide for themselves and each other outside of the monetized sphere as much as possible, such as through practices of mutual aid, sharing, volunteering, and care-work (Johanisova et al, 2013). Through targeted capacity-building, a post-growth transformative initiative can empower its actors to replicate the initiative in other contexts (for example geographical or sectoral), thus amplifying overall societal impact (Scoones et al., 2020)

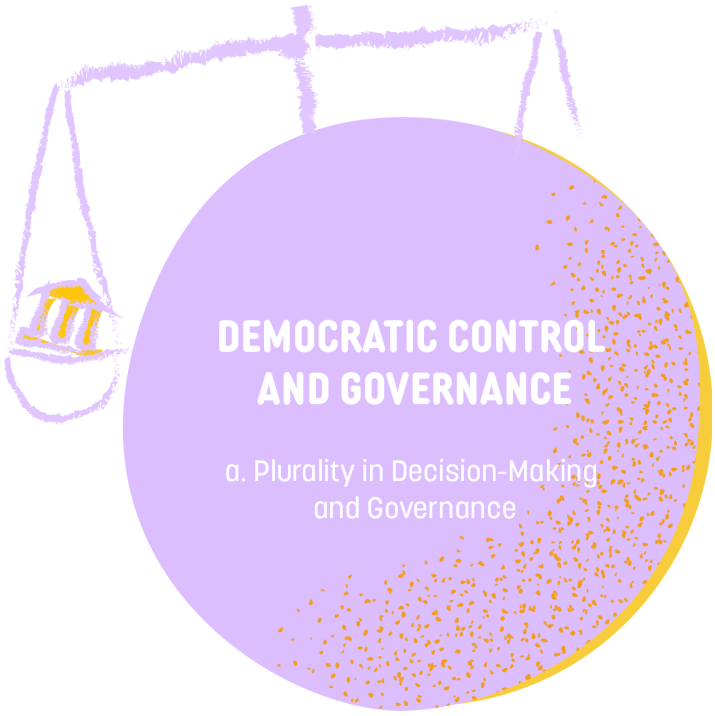
b) Politically-Motivated Empowerment

The postgrowth perspective views sustainability as a contested social arena where often opposing imaginaries strategically coordinate or compete in the struggle to capture the public's minds and hearts. Postgrowth in this sense is inherently political (Demaria *et al.*, 2013). A post-growth transformative initiative could participate in political processes as an entity, whilst empowering its individual members and workers to also take part in the polity, e.g. through citizen assemblies (Weiss and Cattaneo, 2017).

c) Experimenting and Dynamic Social Learning

Reconfiguring the structure of modern society, as well as our notions of what constitutes 'progress' and 'development' will require profound deliberation, across spatial and temporal scales. Especially when this deliberation occurs with direct, democratic processes, there are bound to be mistakes, conflicts and periods of instability. As communities experiment with their preferred post-growth futures (i.e., those most fitting to their specific needs and desires) risk-taking and dynamic changes will be essential aspects of a healthy transformative process (Fedele et al, 2019).

4. Democratic Control and Governance



Reconfiguring ownership and governance structures can catalyze significant changes in an initiative's or a system's purpose, direction and practises, therefore enabling a transformative change (Strunz, 2014; Hinton and Maclurcan 2017). The initiative is owned and governed by its own members through democratic and transparent processes. Decision-making is informed by diverse knowledge systems and values the input of various stakeholders, regardless of their background.

This element could be further specified in the following categories:

a) Plurality in Decision-Making and Governance

The post-growth perspective calls for a more direct, open, voluntary, democratic and multi-stakeholder engagement of citizens in decision-making processes within any group context (Rommel *et al.*, 2018). Different stakeholders can offer new and different insights when it comes to understanding and managing socio-technical and ecological systems. A post-growth transformative initiative could strive to balance expert/academic knowledge with post-normal, multiple ways of knowing that are most attuned with the complexity

and lived realities of the local context (Tengö *et al.*, 2014; Alarcón Ferrari and Chartier, 2018). Indigenous and Global South perspectives can also guide balanced human-nature relations, better attuned to post-growth futures, such as *buen vivir* (Gudynas, 2015) or *Ubuntu* (Ramonas, 2015).

Specifically in relation to governance, initiatives that have private financial rights (i.e., privately-owned) are particularly geared towards productivist expansion and growth (Hinton, 2020b). Collectively owned and/or managed initiatives are better suited to instigate an equitable downscaling of operations, in line with planetary limits (Gunderson, 2018).

5. Transformation of Resource Flows

An important determinant of post-growth transformative capacity is the ability to deliberately alter resource flows in terms of the resources that come into the initiative, how those resources are used, and the impact of the initiative's resource use on the wider

social-ecological system (Tuckey, 2019; Lam et al, 2020). The initiative secures a steady flow of resources that stabilize and expand its operations to a desired and sustainable extent that meets the community's needs without exceeding environmental limits. The initiative channels its resources towards various social and ecological goals and openly shares them with others (to an extent possible without jeopardizing its operational stability), whilst educating its members and the general public about sustainable ways to manage energy and resource use (Göpel, 2016; O'Neill et al, 2018). The initiative adopts a multi-scale and system-wide perspective (Fedele et al, 2019), and tries to limit the impact of its operations on the environment, including through adopting a critical stance towards technology and profit-seeking (Schmid et al, 2016; Pansera et al, 2019).

This element could be further specified in the following categories:

a) **Surplus/Savings Management**

A post-growth transformative initiative could reinvest any financial surplus or savings into covering its operational costs (which can include expansion if necessary) and/or invest it into social-ecological purposes (e.g., energy poverty reduction or biodiversity protection) rather than distribute it to private owners (Hinton and Maclurcan, 2017). It could also try to (re)invest its surplus in the local community, aiming to ensure that resources stay within the locality and are not siphoned by powerful actors, such as corporations or private investors. This could contribute to local well-being and increased community cohesion (Tsagkari et al., in press). Along these lines, it could strive to reduce inequality amongst its members and at the broader societal level, which can inform how it uses financial surplus and savings. Inequality drives increased consumption due to the relational status effect (Parrique, 2019). This can create the perception of relational poverty, i.e., determining one's self-worth by comparing levels of possessed material goods with those of others. This in turn diminishes psychological well-being and underpins consumerist tendencies (Parrique, 2019). Societies that are more equal tend to exhibit higher levels of well-being (O'Neill *et al.*, 2018).

If an initiative's savings are reinvested into socio-ecologically harmful practises (e.g. encouraging excessive material consumption), then the original benefit brought about by the initiative's work is cancelled out, in what is also known as the rebound effect (Hickel and Kallis, 2020). It follows then that a post-growth transformative initiative should manage its investments and/or savings ethically, while striving to educate its members and the public about sustainable resource management.

b) Financing

A post-growth transformative initiative could work towards financial self-sufficiency, to achieve independence from pro-growth economic relations (Hinton, 2020a). When possible, it should seek funding from alternative sources, such as (member) crowdfunding, credit unions, or other types of not-for-profit banks (e.g., savings and loans associations and public banks)[4]. Resorting to traditional sources of financing (like for-profit banks with high interest-loans and short repayment timelines, or private return-seeking investors) may jeopardize an initiative's post-growth transformative potential. Both of these examples constitute forms of financing that can drive economic growth and inequality, and most likely perpetuate existing power structures (Hinton, 2020a; Hinton, 2020b).

c) Material and Energy Throughput

A post-growth transformative initiative could work towards equitably reducing absolute material and energy throughput to a sustainable level (Kunze and Becker, 2015). For energy, this would mean a nationally/regionally appropriately downscaled and operationalised value, drawing from Grubler et al., (2018) and Millward-Hopkins et al., (2020). Similarly, for general resource use this value could be determined with the benchmark of 50 billion tons of resource use per year at the global level (Bringezu, 2015).

d) Navigating the Impacts of Technological Systems

[4] In the Greek case a prominent example is the cooperative bank of Karditsa, some of whose main goals include to fund cooperatives, promote the social and solidarity economy in Greece, and generally aims to promote the cooperative model at the institutional level.

Under a growth-based system, technological progress is often underpinned by a drive for increased productivity and continuous economic growth (Vandeventer et al, 2019). Acquiring a holistic understanding of both technology's shortcomings and the opportunities to use it sustainably is an important prerequisite in order to enact a strong sustainability agenda that respects limits to "progress" (Giotitsas et al., 2020). A post-growth transformative initiative would push to minimize the negative impacts of technology on social-ecological systems. This would entail utilizing technologies that enhance human-nature relations, are appropriately integrated into the local social-ecological context, such as Do-It-Yourself small-scale wind turbines installed in non-agrarian land, are reusable and repairable, and whose materials and parts are sourced with minimum impact (Kerschner et al., 2018).

e) Transforming Employment Relations

Ensuring that people have universal access to meaningful jobs, which develop human potential, is an important aspect of post-growth transformations (O'Neill, 2012). Employment contributes to well-being, both physically (by providing access to materials that are essential to survival), and mentally (by contributing to an individual's sense of self-worth). Furthermore, jobs that deliver social and ecological benefits are in line with a post-growth vision regarding the future of work (Parrique, 2019). A post-growth transformative initiative could encourage work-sharing and overall work-time reduction (Cosme et al, 2017), to ensure that work is equitably distributed within a community.

The threat of "widespread unemployment" is often used by pro-growth advocates to propagandize against post-growth agendas. Creating the right conditions to ensure that no individual is left behind, prior to and during the postgrowth transition period (e.g. as the fossil fuel, car or marketing sectors degrow), is a key component of a fair and just post-growth strategy (Hickel, 2020). A post-growth transformative initiative could thus strive to create meaningful, regenerative jobs, with an emphasis on the inclusion of those left behind by the ecological transition.

2.2 Pathways to Transformative Change

Niche initiatives that are characterized by one or more of the aforementioned elements, can take advantage of systemic landscape pressures (windows of opportunity) to destabilize the dominant regime and contribute to the formation of a new socio-technical regime (Pereira *et al.*, 2018; Herrfahrdt-Pähle et al, 2020). In the context of the Greek energy sector, energy communities might take advantage of the combined landscape pressures (see Section 1.2), summarized in Figure 2 below:

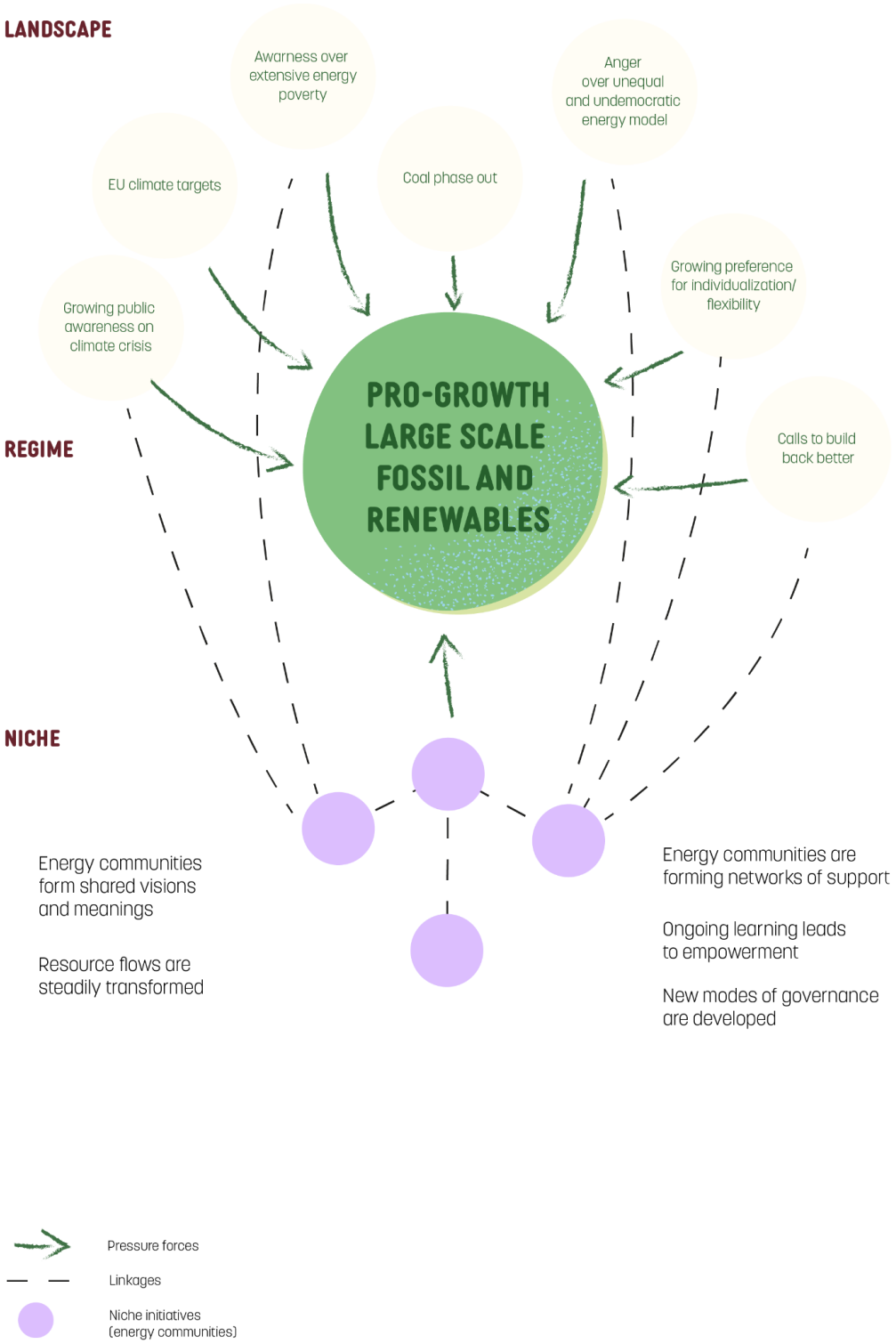


Figure 2: Illustrating the multiple pressures occurring in the Greek (energy) landscape that are converging to destabilise the dominant regime, concurrently with energy communities leveraging their post-growth transformative capacity at the niche level.

Having destabilised the regime and begun the process of institutionalization, Pereira et al (2018) propose three pathways to change that the niche might follow: It may be 1) rejected or co-opted by dominant actors or institutions, and thus fail to have a disruptive effect, 2) incorporated by the broader regime (growth-based economy) and thus only lead to partial reforms, 3) or it may create a completely new regime structure, guided by different values and upheld by new institutions.

The different pathways to change are outlined to provide a heuristic based on which I discuss the overarching research question of this thesis, i.e., “To what extent can Greek solar energy communities instigate a post-growth transformation of the energy sector?”. Having detailed the components of the post-growth transformative capacity, and outlined the different pathways to change that a niche initiative could follow, I move on to the methodology.

3. METHODOLOGY

3.1 Data Collection

To answer RQs: (ii), i.e., assessing overall post-growth transformative capacity, (iii) i.e., leveraging different post-growth transformative capacity elements, and (iv) i.e., assessing challenges and enabling conditions, I conducted seven structured, one-hour long interviews. I chose structured interviews as they provide a certain degree of access to in-depth, qualitative data, with the results being readily codeable for cross-case comparison (Matthews and Ross, 2010, p217). More than a questionnaire, this type of interview allows for the use of prompts and probes, encouraging the respondent to shortly expand on certain issues and details that may be important for answering the research questions (Matthews and Ross, 2010, p186). This approach allowed me to adhere to a structured format, building on the analytical framework from RQ(i), while still being able to capture some of the nuances in the interviewees' responses, and thus be able to distinguish whether certain responses and elements were pro-growth or post-growth.

I chose Greece as a case example because it has a well-developed legal framework for energy communities, the first of its kind at the EU level (Douvitsa, 2018). For each of the seven energy communities I interviewed either the president or a founding member that the community identified as a suitable spokesperson who can convey the vision of the group.

Table 1

Indicating the role of each of the seven interviewed stakeholders in their respective energy communities.

Interview Code Name	Role in the Community
I1	President
I2	Founding Member
I3	Founding Member

I4	Founding Member
I5	President
I6	President
I7	President

By opting to interview only one stakeholder per EC, I managed to reach out to more energy communities in total. However, ECs are cooperatives composed of members of plural backgrounds and values, some of which may not have been captured. Therefore, the sampling approach employed here can be considered as a balance between breadth and depth.

I identified the relevant energy community stakeholders through:

- Snowball sampling. It is important to note here that I myself am a member of an energy community in Greece, and I work with other communities towards advancing the cooperative movement in the country. To avoid sampling only stakeholders from energy communities that I already personally knew, or are quite well-known in general, and thus to limit sampling bias (Noy, 2008), I also identified stakeholders through;
- A comprehensive review of the national registry of energy communities where phones and/or e-mails of relevant stakeholders are available (Hellenic Business Registry, n/d).
- By reviewing gray literature (government white papers, NGO reports, media articles and social media) using search strings on the web such as “Greek energy communities” or “Greek cooperatives” and “citizen participation in the renewable energy sector”.

I specifically focused on ECs which utilize solar PV technology, with the latter being a mature and comparatively cheaper technology and thus the default go-to option for many community energy groups (IRENA, 2020a).

2.2 Data Analysis

Based on the analytical framework in RQ (i) created a set of 20 interview questions (Appendix I), to test whether energy communities in Greece have post-growth transformative capacity [RQ ii] and what enabling conditions and challenges they are facing in realising this potential [RQ iv]. Based on the interview questions, I then created a qualitative set of 30 codeable criteria (Appendix II), in the form of guiding questions answered through either 'Yes', 'No' or '0', which I used to tally a final quantitative score for the post-growth transformative capacity of each energy community. "0" was used when the answer was 1) either ambiguous, 2) when there was conflicting information, 3) where something hasn't been implemented yet (the EC is open to it, but it hasn't been formally discussed yet or it's beyond the EC's capacity to do it at this moment) and 4) where it was non-applicable. So, for example, a) if an energy community is promoting both pro-growth and post-growth financing models, the assigned score is 0. Additionally, if an EC would like to set up a fund to help create other ECs, but it doesn't have enough money/capacity to do that yet the assigned score is 0. The "0" category is functionally the same as "No" as it doesn't contribute to the total tally in the quantitative scoring. I've differentiated between "0" and "No" to qualitatively show that often there's more nuance in an answer, which might not be captured through a "Yes/No" categorization.

One strength of such a clear-cut scoring system is that the resulting data is easily comparable, but also potentially generalisable in the context of other studies (Braun and Clarke, 2006). It also speeds up the analytical process, allowing for the incorporation of greater amounts of data (Braun and Clarke, 2006). I reflect on the limitations of this approach in Section 5.4, *Research Limitations*.

Having created this post-interview scoring guide, I followed a very structured approach in how I analyzed and coded the data into different categories, including specific coding nodes for "Challenges" and "Enabling Conditions" related to RQ (iv). The structured approach allowed for a more seamless data comparison and standardization into thematic categories (Segal *et al.*, 2006). I coded all the data using NVivo, a computer analysis qualitative data analysis software

(Miles and Huberman, 1994) in order to systematically organize the data, and in turn streamline the analytical process.

To answer RQ(iii), i.e., “Which of the five elements could be leveraged to effect the largest change in total Post-Growth Transformative Capacity?” I used the scoring results from RQ(ii) and weighted x2 each of the 5 elements of the framework, in a stepwise fashion, to compare how altering the weighting of each element would affect the total post-growth transformative capacity averaged across all energy communities. This RQ allowed me to scope in which categories of post-growth transformative capacity Greek energy communities are lacking, and similarly which categories could be leveraged to further unlock this untapped potential. It also allows for a more nuanced analysis that can take different contexts and priorities into account.

To answer the overlaying research question of this dissertation, i.e., “To what extent can Greek solar energy communities instigate a post-growth transformation of the energy sector?” I consider the results from RQ(ii), RQ(iii) and RQ(iv). I use the ‘Seed Pathways to Transformative Change’ heuristic as a conceptual backbone to outline which pathway to change best describes Greek energy communities.

4. RESULTS

This section outlines the results for the different Research Questions, beginning with RQ (ii) i.e., "*What is the post-growth transformative capacity of solar energy communities in Greece?"* (Table 2). Results for this RQ are based on the set of codeable criteria (Appendix II). All percentages are rounded to two significant figures.

4.1 Assessing the overall post-growth transformative capacity of Greek ECs

Table 2

Presenting the results along the five categories of the analytical framework from RQ (i). Each category is weighted equally as a percentage (20% each to get to a 100%).

Interview Number	Creating Shared Visions and Meanings	Transformative Coalition Building	Actor Empowerment and Innovative Learning	Democratic Control and Governance	Transforming Resource Flows	Total Score and total post-growth transformative capacity (%)
I6	4/7	6/6	5/5	1/2	9/10	25/30 | 79%
I3	5/7	4/6	4/5	2/2	7/10	22/30 | 78%
I1	4/7	4/6	3/5	2/2	6/10	20/30 | 69%
I2	3/7	2/6	4/5	2/2	6/10	17/30 | 63%
I4	3/7	2/6	4/5	2/2	6/10	17/30 | 63%
I7	3/7	2/6	4/5	1/2	6/10	16/30 | 53%

I5	4/7	4/6	4/5	0/2	3/10	15/30 | 47%
Average Score	**53%**	**57%**	**80%**	**71%**	**61%**	**65%**

The seven interviewed ECs have an average score 65%. If 50% is considered the neutral midpoint, only one EC (I5) scored below that. It should be noted here again that this quantification, including the 50% midpoint cut, constitutes one way to analyse the data in an easily comparable and generalisable way, but this is not prescriptive or definitive. Actor Empowerment and Innovative Learning is the highest-scoring category on average and Creating Shared Visions and Meanings is the lowest scoring one. This answers RQ (ii) i.e., "What is the Post-Growth Transformative Capacity of Greek Solar Energy Communities?".

4.2 Leveraging different post-growth transformative capacity elements

I then move to RQ (iii), i.e., "Which of the five elements could be leveraged to effect the largest change in total Post-Growth Transformative Capacity?".

Table 3

Showing the average percentage difference on the total post-growth transformative capacity of all energy communities, after each respective category is weighted x2. A detailed breakdown of these results can be found in Appendix IV.

Category	**Average Percentage Difference across all energy communities in Total Post-growth Transformative Capacity, after each respective category is weighted x2**
Creating Shared Visions and Meanings	+ 0.71%

Transformative Coalition Building	- 1.3%
Actor Empowerment and Innovative Learning	+ 2.8%
Democratic Control and Governance	+ 2%
Transforming Resource Flows	+ 0.71%

Weighting the Actor Empowerment and Innovative Learning category x2 seems to be producing the strongest impact on the total post-growth transformative capacity of the studied energy communities. Conversely, once the Transformative Coalition Building category is weighted x2, an average 1.3% decrease is observed in terms of the total post-growth transformative capacity of all the ECs. This just shows, based on these initiatives, what the differences could be and results may be very different in another analysis. One could also perform a different percentage weighting for each category (eg. X2 for visions, X1,5 for coalitions and X0,5 for learning). As the framework is empirically tested in different cases, the relative contribution can be refined, but this is proof of concept.

4.3 Challenges and Enabling Conditions

Finally, I delve into the RQ(iv), i.e., "What are the challenges and enabling conditions for solar energy communities in Greece to transform the energy sector?". A consolidated summary of these results can be found in Appendix V.

Changing mindsets through education and outreach was generally characterised as a powerful tool towards instigating and consolidating a transformation of the energy sector and society more broadly. In fact, cultivating an awareness about collective structures and energy communities is framed both as a challenge (I1, I2, I3, I4, I7) and as an important enabling condition (I1, I2, I3, I4). As one interviewee put it:

> *"if ECs manage to convince people that they are valuable, as places to discuss, as places to experiment, as places to pool money and invest in common causes, as places to organize and*

exert collective pressure, as opposed to seeing ECs as nuisances, then this could be a big catalyst to change. This is why it's important to do this right, everything hangs in this balance." (I1).

One reason why ECs have hitherto mostly failed to break into mainstream consciousness is the lack of successful, established examples of energy communities. This is framed both as a challenge (I1, I2, I3, I4, I7) and as an untapped opportunity (I1, I2, I6).

All 7 ECs identified strategic networking as a vital enabling condition for their future development. In the words of one EC stakeholder:

"Without networking nothing can be done. Without it, ECs can't oppose, they can't even survive and become sustainable compared to private initiatives. There must absolutely be networking. At the EU level as well." (I7).

Importantly, networking is also framed as a tool to leverage institutional pressure:

"We need to get some or all the ECs to pool together their capacity, so that we can negotiate as a group and finally gain access to the grid. As a networked team of not-for-profit ECs, we'll come into contact with the relevant actors to push for the inclusion of funding for energy communities in the Just Transition and Development Fund for our region." (I6).

Therefore strategic networking becomes all the more important, considering that all 7 ECs identified an unstable, unfriendly and narrow institutional framework, as a key challenge. Conversely, an enabling institutional framework with simplified bureaucratic procedures (I1, I4, I5) was identified as an important enabling condition. Similarly, broader financial hardship and the lack of institutional financing mechanisms are identified by most ECs (I1, I2, I3, I4, I5, I7) as another important hindrance to their development. An enabling institutional framework that creates financial support schemes (for example, feed-in tariffs or guarantees) was similarly identified as an important enabling condition (I1, I2, I3, I6, I7).

Competition with powerful actors in the energy system, and cooptation through the establishment of "shell" energy communities[5], are also framed as important challenges (I1, I3, I4, I6, I7). This again highlights the need for a supportive institutional framework that positions ECs at a level playing field with more powerful actors.

Keeping members engaged in the process of setting up and running an energy community is identified as a significant challenge (I2, I3, I4, I7), especially considering the various bureaucratic and technocratic barriers inherent in these processes (I3, I5, I6, I7). The need for unanimity in decision-making is also leading to slow-paced internal processes (I2, I3, I4, I7).

> *"Collective initiatives are like snails, you know the snail from the movements in Mexico. We move slowly and steadily so progress is something different for us" (I4).*

Finally, the business model of an energy community (be it for-profit or not-for-profit) has very marginal returns on investment (I2, I3, I4, I5, I7), thus efforts to achieve financial sustainability might be prioritized over investments in various socio-ecological purposes. A similar pattern is observed in relation to work-creation, as one interviewee observes that "paid jobs result in more operational expenses" (I1), which are difficult to shoulder because most ECs "are already marginal in terms of financial sustainability" (I1).

[5] This describes a phenomenon whereby large-scale private investors set up fake energy communities only to reap the relative benefits, such as priority access to the grid and guaranteed feed-in-premiums, but without delivering any of the social benefits of an authentic energy community.

5. DISCUSSION

5.1 Empirically Assessing Post-Growth Transformative Capacity

The seven interviewed ECs have an average score of 65%, indicating that they broadly have considerable post-growth transformative capacity. The "Creating Shared Visions and Meanings" category observed the lowest average score. Post-growth theorists usually consider a change in deeply-held values and beliefs as a key prerequisite for post-growth transformations (Göpel, 2016; Koch, 2020). Despite all studied energy communities having visions and goals that align with a post-growth transformation, they are held back by other factors, such as the lack of emotive educational practises, or a failure to challenge growth-oriented narratives in public fora (Appendix III).

Although the interviewed ECs on average scored high in other categories, such as in Actor Empowerment and Innovative Learning, and Democratic Control and Governance, a failure to capture people's minds and hearts and instill a post-growth understanding of the world to their audience, might jeopardize their overall post-growth transformative capacity.

5.2 Leveraging the Different Elements of Post-Growth Transformative Capacity

Actor empowerment and innovative learning was the element with the highest score across all categories (80%), which -at least partly- explains why weighing it x2 produces the highest increase in average post-growth transformative capacity (+2.8%). From a post-growth point of view cultivating new skills can empower individuals to become more self-sufficient and resist pro-growth commodity-relations, such as by producing their own energy (Johanisova et al, 2013; D'Alisa et al, 2015). It follows then, that Greek energy communities can be 'cells' of experimentation, capacity building and innovation.

All ECs interviewed in this thesis identified strategic networking as a key enabling condition for their development. A result which aligns with the findings by Tuckey (2019), who showed that networking is a necessary element for transformative capacity. Increasing the weight of the Transformative Coalition Building category however leads to a 1.2% average decrease across all

energy communities, with some observing a decrease of up to 5% in their total post-growth transformative capacity (Appendix IV). This indicates that Greek ECs are failing to form the right coalitions and/or are not adequately leveraging resources from their networks, and thus the Transformative Coalition Building category holds untapped potential.

I specifically elaborate on the importance of networking because it might embody the uncaptured benefits of the Creating Shared Visions and Meanings and Actor Empowerment and Innovative Learning categories, since it may catalyze their development (Tuckey, 2019). One example could be networking with the goal of creating Peer to Peer, skill sharing spaces (Giotitsas et al, 2020), or more broadly spaces of dialogue to challenge the dominant paradigm of growth (Koch, 2020).

5.3 Pathways to Post-Growth Transformative Change

The interviewed energy communities discursively frame the climate crisis, the extensive levels of energy poverty, the socio-economic inequalities of the centralised energy oligopoly and the covid crisis as windows of opportunity to create a new socio-ecologically sustainable energy system:

"Through covid, which really is a tragic situation, but through tragic periods in history, it has been shown that there's a lot of change." (I3).

And this extends to the ensuing financial crisis associated with the pandemic:

"The whole covid crisis and ensuing general crisis, I think encourages people to come together." (I4).

However, the messaging is not articulated in an antagonistic tone, whereby these opportunities should be seized to displace power holders such as Big-Energy actors. Instead, energy communities use positive messaging, emphasising processes of impact amplification (Lam et al, 2020). In parallel, ECs seem to be quite dependent on a favourable institutional framework. This goes beyond expecting a framework that creates a level playing field with other market actors, and speaks to a broader expectation that the government will nurture and protect ECs, as niche

actors that deserve special legal and financial provisions. The very bottom-line of an energy community in the majority of cases depends on the existence of feed-in-tariffs or premiums, because as demonstrated through this research, its financial surplus is significantly marginal. This expectation of external assistance is partly expected and justified, as ECs deliver a multitude of social and ecological benefits, which should be acknowledged and valued by governments (IRENA, 2020b).

However, this considerable reliance of ECs on the State *brings into question their post-growth transformative capacity*. State policies are deeply entrenched within and are influenced by the dominant regime, therefore the State is unlikely to create a policy framework that radically reconfigures power relations and resource flows, to enable a post-growth transformation (Proka, 2021). Like a "wolf protecting the sheep" we observe an oxymoron whereby "the more radical the niche innovation, the more constraints it faces in its attempts for expansion, the more protection it needs, the less it receives" (Proka, 2021).

With the above considerations in mind I deduce that the pathway to change that best describes Greek ECs is *incorporation into the dominant regime and reformism from within* (Pereira, et al 2018). Energy communities may continue existing in parallel with growth-oriented fossil and renewable actors and infrastructures, embodying a convincing third alternative, but not being influential enough to become mainstream. In fact, recent developments have shown that dominant market actors can reflexively appropriate certain aspects from energy communities, thus further entrenching their competitive market advantage[6].

Building on the above but diverging from the prescribed three pathways to change presented in Section 2.2 (Pereira et al, 2018), Greek energy communities do not aspire to create an overlaying, dominant regime, even through gradual reformism from within. Rather, their visions seek to empower and cooperate with other energy communities and niche initiatives, and instill cooperative visions and practises to the general public. This speaks to a fourth pathway to change, which conceptualises transformative change as a less antagonistic (or capitalistic)

[6] A notable example is a recent initiative by the third largest electrical utility in Greece, Heron. The 'ENA' programme allows for citizens to invest in renewable energy electricity projects and thus reduce their electricity bills, but without (co-)ownership or governance rights for the projects: https://www.heron.gr/en/ena/

process, whereby a plurality of niches co-exist and sometimes cooperate (Vandeventer et al, 2019). These findings contribute to an emerging, yet nascent discussion related to broadening our understanding of sustainability transformations.

5.4 A Policy Proposal to Nurture Post-growth Transformations in the Greek Energy Sector

In the interest of being proactive and building on the actionable research of this thesis, I propose the development of a national federation of energy communities in Greece. A policy which draws inspiration from the existing European federation of energy cooperatives (REScoop.eu, n/d) and is specifically designed to:

- Address some of the challenges and nurture some of the enabling conditions identified by the interviewed energy communities.
- Reduce the reliance of energy communities on the State and other powerful actors, through strategically pooling resources and capacities (D'Alisa et al, 2015). Energy communities could 'escape' from their current reformism trajectory, and instead pursue more radical socio-technical, post-growth transformations (D'Alissa and Kallis, 2020).

I use the analytical framework from RQ (i) to dissect how such a policy could scale the impact of ECs and contribute to enhancing their post-growth transformative capacity. I fold the categories Transformative Coalition Building, Transformation of Resource Flows, and Actor Empowerment and Innovative Learning, due to perceived overlap in how they could relate to the federation.

Creating Shared Visions and Meanings

Cultivating new values and awareness around collective structures was identified by most EC stakeholders as an important enabling condition. The lack of emotive components in the ECs' educational work undermines their overall post-growth transformative capacity. Emphasizing positive post-growth futures can awaken people's capacities in creative thinking, and this shouldn't be done just through the regular routes of workshops or lectures. Instead, performative methods, such as theatre, filming, story-telling can instill a necessary component of fun and curiosity to people interested in post-growth ideas (Brossmann and Islar, 2020; Koch, 2020). A

federation of ECs could work towards integrating these alternative educational components into its scholarly initiatives.

Transformative Coalition Building / A Transformation of Resource Flows / Actor Empowerment and Innovative Learning

To garner resources and institutional influence, and to be able to withstand the explicit and implicit influence of dominant actors (such as market competition), post-growth initiatives cannot retreat to the 'local' or the 'island' (D'Alisa and Kallis, 2020). This federation could ensure that ECs have a stronger, collective voice that could leverage its power to influence institutional actors (Moore et al, 2015), such as Big Energy actors, banks, the State and the EU. Through strategic networking, the federation can establish relationships of mutual support between its members, with the aim of bypassing obstacles such as the lack of institutional financial mechanisms, and limiting competition with established market actors. Networking could extend to other multi-sectoral (transport, food, housing) grassroots initiatives in Greece and abroad (Gorissen et al. 2017), especially those born in response to the financial crisis, which are largely politically-minded (Calvário et al, 2016).

This policy addresses a significant gap that the interviewed ECs of this research highlighted: despite unanimously identifying networking as a key enabling condition to their development, most ECs face difficulties in mobilizing resources from their networks. This is partly owed to the fact that most Greek ECs are still young in age and are operating with very limited funds and capacities (Vasilakis et al, 2020).

The lack of successful, established examples of energy communities is identified as an important challenge by some of the interviewees, often leaving nascent initiatives alone to navigate the various bureaucratic, financial and cultural obstacles of setting up a new energy community. The federation could provide various forms of support (capacity, information, financing) to their member ECs to help them realise their goals.

In terms of work creation, the federation could encourage significant investment in local communities, to foster the creation of decent jobs that deliver multiple social-ecological benefits and enhance community cohesion (Tsagkari et al, in press). It should further facilitate partnerships between ECs operating in coal-transition areas, and ECs from the rest of the country, thus helping to facilitate work towards a national, just transition.

To tackle 'shell' energy communities and other forms of co-optation by dominant market actors, a set of requirements could be created by the federation to strictly define (and audit) what constitutes an energy community. Such a requirement could be a commitment to a Not-(only)-for-profit business model, which could ensure that energy communities do not shift their normative orientation as they grow, as has been observed in other cases across Europe (Kunze and Becker, 2015; Bauwens, 2016; Brown et al, 2020).

Democratic Control and Governance

Responding to the challenges posed by the requirement of unanimity in decision-making, the federation could promote more efficient ways of democratic decision-making, such as Sociocracy, based on consent, rather than unanimity, and with a clearer demarcation and sub-division of responsibilities (Leafe-Christian, 2007).

5.5 Research Limitations

Strictly categorizing the energy communities' responses into a "Yes" and "No" binary doesn't necessarily capture the nuances and context-specific considerations of each answer. For example, an energy community might be temporarily relying on pro-growth actors, such as traditional banks, but in the future could aim to be independent and self-sufficient. The somehow-rigid quantitative approach could be complemented with qualitative analysis methods.

Five of the seven interviewed ECs are still in the planning or early stages of development. Despite their far-reaching goals and plans, it remains to be seen whether they will actually

materialise their visions and realise their post-growth transformative capacity. This shouldn't however breed skepticism, rather stoutly cautious optimism. Additionally, the seven ECs that were interviewed were already quite outspoken, established, and largely composed of politically-minded individuals eager to relay the cooperative experience. This raises the question of potential sampling bias, associated with snowball sampling, despite efforts to limit this (Noy, 2007). In a survey of publicly available data of 409 energy communities in Greece, Vasilakis et al (2020), found that 42% of energy communities have no women members. Through a more comprehensive questionnaire-based follow-up survey, Vasilakis et al (2020) found that from a sample of 32 energy communities, profit was the primary motive driving the establishment of the community. They further found that 16 (or 50%) of the surveyed energy communities were not open to including members other than friends and family (Vasilakis et al, 2020). These results paint a significantly different picture from those of this research, contrasting ideas such as non-discriminatory participation, post-growth social-ecological goals, and openness to networking. This discrepancy between the findings of the present research and that of Vasilakis et al (2020), might be due to the inclusion of many shell communities in the latter research. This relates back to the point about the urgent need to set up stricter auditing procedures and standards on what constitutes an energy community.

5.6 Future Research Considerations

I echo Tuckey (2019) in that more research is required on what elements constitute transformative capacity, and on how such elements could potentially be ranked against each other. Under different contexts and empirical settings, researchers and practitioners could weigh respective elements equally or as some being more important than others.

The analytical framework of post-growth transformative capacity presented in this research should not be viewed as exhaustive or prescriptive. Despite it being an innovative addition to sustainability literature, this framework should be regarded as an explanatory, descriptive starting point, that can be expanded or adapted to explore post-growth futures and post-growth transformative capacity in other sectors (e.g., food or transportation) and contexts (e.g., Global South countries). This is a call both to academics seeking to expand the niche interface between

transformations and post-growth, as well as to activists and practitioners seeking to affect institutional change, through everyday practises of living post-growth lifestyles (Brossmann and Islar, 2020; D'Alisa and Kallis, 2020).

6. CONCLUSION

Socio-economic systems based on continuous growth are driving an ongoing ecological breakdown and rising inequalities. A transformation to 'greener' alternatives that does not question the fundamental underlying paradigms of growth, will not suffice. By weaving together transformations and post-growth literature, the present research created a novel analytical framework for post-growth transformative capacity, which was empirically tested against energy communities in Greece. Energy communities were chosen exactly because they do not embody a mere transition to renewables, but rather a deeper reconfiguration of mindsets, institutions, ownership structures, and everyday practises.

The results show that energy communities empirically indicated considerable post-growth transformative capacity. However, due to various challenges that they face, and a strong reliance on the State and other powerful actors, I deduce that energy communities are currently on a reformism trajectory. I propose that a national federation of energy communities could strategically leverage transformative capacities, and pool resources and negotiating power, to genuinely challenge the dominant Greek energy regime, and instigate a post-growth transformation. Finally, despite focusing on the energy sector in the context of this thesis, the analytical framework of post-growth transformative capacity created in this research, could be built-on and expanded to other sectors and contexts, functioning as a nexus between academia and activist practise.

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LIST OF APPENDICES

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Appendix I

Ethics Review: Post-Research Reflections

An important issue that arose during the preparation of this research was to ensure that all stakeholders knew of my participation in an energy community from the very start of my communication with them. After informing them both through the informed consent and verbally prior to the beginning of each interview, no issue arose, as I explained that there isn't a conflict of interest.

Another issue that arose was data anonymity since I had initially planned to keep the names of the different energy communities public. I finally decided to anonymize this data as well, as the interviewed stakeholders were cognizant of the fact that energy communities are diverse structures, composed of members with different motivations and beliefs. Therefore, to not create any intra-community conflict, the data was anonymized.

Finally, having now finished the research, I will work towards making the key research conclusions, and policy implications/recommendations (such as the creation of a federation of energy communities) available to the relevant stakeholders.

Appendix II

The interview questionnaire.

Interview Questions
Does your EC run educational programs/campaigns/initiatives? If so, can you briefly describe these?
Is your EC in communication with other ECs and relevant stakeholders? And if so, how do you manage information sharing with them?

What are the goals of your EC? What are the ways with which your EC measures progress towards its goals? Would you still pursue these goals despite changes in external circumstances?
How do you envision your energy community in its mature form? What are the main enabling conditions for your EC to get there? What are the main obstacles or barriers?
How does decision-making work in your energy community? What forms of knowledge are taken into account during decision-making processes in the community?
How does the EC finance its activities? What are the conditions/obligations on that financing (e.g., what interest rate and timeline for debt-based financing; what kind of expectation for a return on investment for equity-based financing).

Where does the EC and its individual members channel any of the financial surplus that occurs from the provision of services and/or the savings that occur through reduced energy bills?
How does the EC manage energy (and material) use?
How does your EC navigate the impacts of renewable energy systems?
Is your EC creating new paid-work opportunities? And if so, can you briefly describe what those are?

Does the EC engage with political processes? And if so, how?
Does the EC change or adapt to changing conditions over time? And if so, how?
Is your EC teaching its members new technical (and non-technical) skills? And if so, what are those?

Is your EC engaged in networking activities/part of any networks? If so, could you describe these?

What are the outcomes of your participation in these networks?

Appendix III

Table 4

Showing how each EC scored against each interview question along with a guiding tool that helps explain how responses to each question were rated. The results have been colour coded with "Yes" being signified by green, "No" by red, and "0" by yellow.

Post-growth Transformative Capacity Element	Codeable Criteria	EC1	EC2	EC3	EC4	EC5	EC6	EC7
The Creation of Shared Visions and Meaning	Do the goals include broad social and environmental considerations?							
The Creation of Shared Visions and Meaning	Does the EC use different value-metrics and/or indicators (beyond GDP) to measure progress towards its goals?							
The Creation of Shared Visions and Meaning	Does the EC remain faithful to its (post-growth transformative) goals, despite potential changes							

	in circumstances or external hardship?							
Democratic Control and Governance	Does the EC have established protocols/rules to ensure that participation, governance and decision-making is horizontal and non-discriminatory?							
Democratic Control and Governance	When it comes to actions and planning, is the EC balancing "expert" + technocratic views, with other more diverse views, including for example those of marginalized social groups (e.g., across income, education, or ethnic lines)?							

The Creation of Shared Visions and Meaning	Does the EC help educate its members and the broader public about the links between society, technology and the environment?							
The Creation of Shared Visions and Meaning	Do these educational practices include an emotive aspect that may enhance a systemic, convivial understanding of social-ecological and technological connections?							
A Transformation of Resource Flows	Does the EC openly share knowledge, skills and other tools with other ECs and relevant stakeholders?							
A Transformation of Resource Flows	Does the financing model align with a							

	post-growth transformation, despite all conditions or obligations tied to this financing mechanism?							
A Transformation of Resource Flows	Does the EC work towards finding and utilizing new and/or promote existing, alternative (post-growth aligned) financial models?							
A Transformation of Resource Flows	Does the EC actively strive to invest any savings or broader financial resources into social-ecological purposes, including investing in the local community where it operates?							

A Transformation of Resource Flows	Are there awareness raising efforts addressed to the members towards ethical/sustainable management of savings?							
A Transformation of Resource Flows	Is the EC adopting a critical stance towards energy and material use and is it taking measures to reduce the energy (and material) use of its members?							
A Transformation of Resource Flows	Is the EC adopting a critical stance on the relative impacts of different renewable energy technologies?							
A Transformation of Resource Flows	Does the EC take any steps to minimize the impact of renewable energy							

	systems on the environment and local communities? (Some indicative examples: planning to recycle/reuse/upcycle old/expired technologies and parts // working to integrate renewable systems to the local environment // working with eco-certified suppliers etc)							
A Transformation of Resource Flows	Is the EC creating jobs that deliver broader social-ecological benefits?							
A Transformation of Resource Flows	Is the EC helping to facilitate a just transition? (e.g., by employing workers or investing in							

	communities from the North of Greece where coal mines are shutting down)							
Actor Empowerment and Innovative Learning	Is the EC teaching its members (and external actors) new skills, to promote leadership, innovation and self-sufficiency?							
Actor Empowerment and Innovative Learning	Does the EC promote alternative forms of economic activity? E.g., bartering, gifting, reciprocity, redistribution, householding (non-monetized production for own-use), P2P trading (e.g. of electricity), volunteering,							

	informal activity, sharing)							
Actor Empowerment and Innovative Learning	Is the EC cultivating interpersonal relations and a sense of community between its members?							
Actor Empowerment and Innovative Learning	Does the EC encourage and foster experimentation? (This could be in areas like testing new technologies, new organizational structures or new finance-raising tools.)							
Actor Empowerment and Innovative Learning	Is the EC participating in larger political processes? And is it encouraging its members to							

	engage in the commons/polity?							
Transformative Coalition Building	Has the EC already established / is trying to establish links with actors from other ECs or other, cross-sectoral (e.g., transport or agriculture) groups with similar goals?							
Transformative Coalition Building	Has the EC already established / is trying to establish links with larger institutions / power-holders / influential actors (e.g., Government, the EU etc.)?							
Transformative Coalition Building	Are these networks able to mobilize local and regional resources							

	which help to sustain and/or expand the EC's operation?							
Transformative Coalition Building	Are these networks able to mobilize global resources which help to sustain and/or expand the EC's operation? (e.g., Rescoop)							
Transformative Coalition Building	Is the EC helping create new or expand existing ECs? (scaling out)							
Transformative Coalition Building	Are there intermediaries that bridge relevant gaps in networks and resource flows?							
The Creation of Shared Visions and Meaning	Does the EC create open spaces for dialogue and information sharing between energy							

	community stakeholders, (and other relevant actors), in which energy communities are presented as a challenge to the dominant pro-growth discourses around energy as a commodity?							
The Creation of Shared Visions and Meaning	Does the EC's vision align with a post-growth future?							
Final Tally (out of 30)		20	18	24	19	15	26	16

Appendix IV:

Comparing the Impact of Different Post-Growth Transformative Capacity Elements

Table 5

Showing the post-growth transformative capacity scores for each EC, specifically after weighting networking x2.

Interview Number	Total Post Growth Transformative Capacity Score, when Transformative Coalition Building is weighted x2	Percentage difference
I6	**83%**	**+ 4%**
I3	**76%**	**- 2%**
I1	**69%**	**0%**
I4	**58%**	**- 5%**
I2	**58%**	**- 5%**
I5	**50%**	**+ 3%**
I7	**49%**	**- 4%**

Table 6

Showing the post-growth transformative capacity scores for each EC, specifically after weighting the “Creating Shared Visions and Meanings” category x2.

Interview Number	Total Post Growth Transformative Capacity	Percentage difference

	Score, when Creating Shared Visions and Meanings is weighted x2	
I6	**77%**	**- 2%**
I3	**77%**	**- 1%**
I1	**67%**	**- 2%**
I4	**61%**	**- 2%**
I2	**61%**	**- 2%**
I7	**53%**	**0%**
I5	**49%**	**+ 2%**

Table 7

Showing the post-growth transformative capacity scores for each EC, specifically after weighting the "Actor Empowerment and Innovative Learning" category x2.

Interview Number	Total Post Growth Transformative Capacity Score, when Actor Empowerment and Innovative Learning is weighted x2	Percentage difference
I6	**84%**	**+ 5%**
I3	**78%**	**0%**

I1	**68%**	**- 1%**
I4	**66%**	**+ 3%**
I2	**66%**	**+ 3%**
I7	**58%**	**+ 5%**
I5	**52%**	**+ 5%**

Table 8

Showing the post-growth transformative capacity scores for each EC, specifically after weighting the "Democratic Control and Governance" category x2.

Interview Number	**Total Post Growth Transformative Capacity Score, when Democratic Control and Governance is weighted x2**	**Percentage difference**
I6	**76%**	**- 3%**
I3	**82%**	**+ 4%**
I1	**74%**	**+ 5%**
I4	**70%**	**+ 7%**
I2	**70%**	**+ 7%**
I7	**54%**	**+ 1%**

I5	**40%**	**- 7%**

Table 9

Showing the post-growth transformative capacity scores for each EC, specifically after weighting the "Transforming Resource Flows" category x2.

Interview Number	Total Post Growth Transformative Capacity Score, when Transforming Resource Flows is weighted x2	Percentage difference
I6	**83%**	**+ 4%**
I3	**77%**	**- 1%**
I1	**68%**	**- 1%**
I4	**64%**	**+ 1%**
I2	**64%**	**+ 1%**
I7	**56%**	**+ 3%**
I5	**45%**	**- 2%**

Appendix V

Challenges and Enabling Conditions

Table 10

Challenges that ECs face, identified through the interviews, ranked by frequency.

Challenges	Frequency by number of ECs
Unstable, unfriendly and narrow institutional framework	1, 2, 3, 4, 5, 6, 7
Lack of funding and broader financial hardship	1, 2, 3, 4, 5, 7
Cooptation by and competition with powerful actors (e.g., "shell" energy communities)	1, 3, 4, 6, 7
Marginal returns on investment	2, 3, 4, 5, 7
Lack of awareness and experience on cooperative models and lack of established role models	1, 2, 3, 4, 7
Lack of Best Practise Examples / Lighthouse Projects	1, 2, 3, 4, 7
Navigating bureaucratic procedures	3, 5, 6, 7

Difficulty in keeping members engaged	2, 3, 4, 7
Slow-paced internal processes (voluntarism and need for unanimity in decision-making)	2, 3, 4, 7
Lack of Alternative Indicators	1

Table 11

Enabling conditions for ECs, identified through the interviews and through the scoping literature study, ranked by frequency

Enabling Conditions	**Frequency by number of ECs**
Strategic networking	1, 2, 3, 4, 5, 6, 7
Establishing new financial support schemes (for example, feed-in tariffs or guarantees)	1, 2, 3, 6, 7
Cultivating new values, narratives and broader awareness around cooperative structures	1, 2, 3, 4
Enabling institutional framework and simplified bureaucratic procedures	1, 4, 5

Becoming (themselves) or identifying best practise examples	1, 2, 6