[Em]powering communities?
Explaining the changing role and nature of Costa Rica’s cooperatives from successful community-led electrification to failing community-led electricity generation

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Submitted May 16, 2017

Supervisor: David Harnesk, LUCSUS, Lund University
Für meine Oma

To my grandma
Abstract

Concerns about energy-related emissions and energy dependence and security while also achieving the SDGs are fuelling the rising interest in socio-technical transitions towards more sustainable energy systems. Community energy projects have been proposed as a tool for this transition to renewable energy, but little is known about its potential to foster the wider transformation of the energy system.

To comprehend the dynamics of system transformation, I use transition theory and conceptualize grassroots bottom-up groups as innovations in the electricity regime. Using Costa Rica as a case study, I study its community energy sector between the 1960s and today – as this is when its four cooperatives became active. This is a relevant case because Costa Rica is regarded as a success story for community energy: it has achieved almost universal electrification (with 99% of its electricity coming from renewables) with cooperatives playing a significant role in the electricity system. Considering this, I critically analyse the changing role and nature of Costa Rica’s cooperatives towards community-led transitions in both rural electrification and electricity generation, and towards what ends.

My findings demonstrate that:

(i) In the 1960s/70s the cooperative model of electrification emerged as grassroots community-led innovation within Costa Rica’s centralised electricity system. Cooperatives transformed not only the electricity distribution mode to realise rural electrification but subsequently also reconfigured the electricity generation system; cooperatives are nowadays part of the overall socio-technical electricity regime in Costa Rica;

(ii) Contrary to the assumption that cooperatives are working towards communitarian electricity generation, cooperatives are part of a regime that is encapsulated in large-scale hydropower to remain in control of centralized electricity generation and in the process curtails decentralized small-scale renewables.

These findings have two implications. Firstly, Costa Rica’s cooperatives have changed their nature and role in the electricity system - away from the communitarian discourse of energy community. Thus, they are failing to promote a transition to community-led electricity generation in Costa Rica. This changing nature also relates back to the question of how community energy should be defined. Secondly, considering the rising electricity demand coupled with social and environmental concerns about hydropower, I argue that community-led electricity generation could provide a holistic alternative. In the light of a highly centralised electricity regime, this would require transition management.

Key words: community energy, transition pathway, rural electrification, renewable energy, hydropower, sustainability science

Word count: 13 999
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it also made me cringe for about 3 months... Just that you know: I have spent a good time of my thesis procrastination on imagining our H2O2-commune – I’m ready!

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! 

Pictures from my field work in Costa Rica. Pictures were taken with consent of interviewees.
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**Abbreviations**

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<tr>
<td>AFP</td>
<td>Alliance for Progress</td>
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<td>ARESEP</td>
<td>Costa Rican Regulatory Agency</td>
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<td>Conelecricas</td>
<td>Consortium of Rural electrification cooperatives</td>
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<td>COP21</td>
<td>21st Conference of the Parties</td>
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<td>CNFL</td>
<td>National Power and Light Company</td>
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<tr>
<td>CUS</td>
<td>Centre for Urban Sustainability</td>
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<tr>
<td>DRE</td>
<td>Distributed renewable energy</td>
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<td>DSE</td>
<td>Costa Rican Energy department</td>
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<tr>
<td>FiT</td>
<td>Feed-in-Tariff</td>
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<tr>
<td>ICE</td>
<td>Costa Rican Electricity Institute</td>
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<td>MINAE</td>
<td>Ministry of Environment</td>
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<td>MLP</td>
<td>Multi-level perspective</td>
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<td>NRECA</td>
<td>National Rural Electric Cooperative Association</td>
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<td>RE</td>
<td>Renewable energy</td>
</tr>
<tr>
<td>RQ</td>
<td>Research question</td>
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<td>SDG</td>
<td>Sustainable Development Goal</td>
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1. Introduction

The composition of our energy supply is resulting in impacts that span across global to local levels: energy-related emissions account for 60% of greenhouse gases, affect air and water pollution, and geopolitical tensions relating to energy dependence and security are increasing (IPCC, 2012; UN, 2015). Simultaneously energy demand is rising rapidly, and the Sustainability Development Goals (SDGs) highlighted that 1.2 billion people lack access to modern electricity (IEA, 2015; UN, 2015). Altogether these concerns are fuelling the interest in socio-technical transitions towards more sustainable energy systems (Grin, Rotmans, & Schot, 2010; Rockström et al., 2009; Gill Seyfang & Haxeltine, 2012).

In this context, community-led energy projects have not only been acknowledged by COP21 but also by academia¹ as crucial for promoting this transition to renewable energy (RE) (IPCC, 2012; REN21, 2016; Seyfang, Hielscher, Hargreaves, Martiskainen, & Smith, 2014; Seyfang & Smith, 2007; UNFCCC, 2015; WCPC, 2016). Contrary to using large-scale RE to advance energy transitions, community energy promotes a more civil participatory, bottom-up understanding of producing, distributing and using electricity (Bomberg & McEwen, 2012; Meadowcroft, 2009; Gordon Walker, Devine-Wright, Hunter, High, & Evans, 2010). Apart from economic benefits for local communities, energy communities provide platforms for addressing environmental issues, can lower the vulnerability of centralised electricity systems and hence contribute to socio-political benefits such as energy security, access and reliability (Islar & Busch, 2016; Kunze & Becker, 2015; REN21, 2016).

To comprehend the dynamics of a system transition towards community energy, I use transition theory (Geels, 2002). I conduct a case study of Costa Rica’s cooperative between the 1960s and today – as this is when they became active. This is a relevant case because Costa Rica is regarded as a success story for community energy since it has achieved almost universal electrification (with 99% of its electricity coming from RE in 2014) with cooperatives playing a significant role in the electricity system (IEA, 2016; REN21, 2016). Considering this, I critically analyse the changing role and nature of Costa Rica’s cooperatives towards community-led transitions in both rural electrification and electricity generation, and towards what ends.

¹ Schumacher (1973) with his visionary work on “Small is beautiful” has given an important stimulus to the application in the energy context.
My thesis addresses two knowledge gaps in the existing literature: Firstly, while there has been a large academic debate about community energy in Europe (Islar & Busch, 2016; Seyfang, Jin, & Smith, 2013; Walker & Devine-Wright, 2008), little is known about Latin America. By using Costa Rica as a case study, my thesis fills this knowledge gap. Secondly, in the literature energy communities are novelties that are associated with decentralisation and bottom-up change (Seyfang et al., 2014) My thesis questions this tacit assumption that community energy truly ‘[em]powers’ communities and fosters bottom-up change and hence contributes to the debate on the role of community energy towards a more sustainable energy system.

As my research demonstrates, I claim that: (i) cooperatives were important community-led grassroots innovations to advance electrification and have successfully become regime actors, and (ii) contrary to the assumption that cooperatives are working towards communitarian electricity generation, they are part of a regime that is encapsulated in large-scale hydropower to remain in control of centralized electricity generation, and in the process curtailing small-scale renewables. Hence, Costa Rica is failing to pursue transition to community-led electricity generation.

1.1 Research aims and questions

In my research I adopt transition theory, thus conceptualizing Costa Rica’s electricity system as a socio-technical system in transition. As I want to explain in how far Costa Rica’s cooperatives have been pursuing a community-led transition in electricity distribution for rural electrification and electricity generation, I follow a two-fold approach of research aims:

First, I seek to explain which developments contributed to the emergence of cooperatives as grassroots niche-innovations; and how these facilitated a successful transition to community-led rural electrification between the 1960s and today.

Second, while Costa Rica produces predominately RE, two-thirds of electricity generation is derived from large-scale hydropower (IEA, 2016). Importantly, there is public dissatisfaction with the local impacts of hydropower, which coupled with water supply shortages and increasing electricity demand is putting pressure on this electricity generation mode (Fendt, 2015; Utgård & Forn, 2016). I see a need

2 Worldwide, there is no consensus on how to classify hydropower by project size, because of different policies in each country (IPCC, 2012). As no classification for Costa Rica was found, I use the REN21 (2016) classification where everything above 10MW is large-scale.
to apply a more critical lens on the current electricity system to talk about where it may move in the
future. Thus, I seek to understand how the current electricity regime is encapsulated in large-scale
hydropower as means to remain in control of centralised electricity generation and which mechanisms
the regime uses to maintain this stability.

To achieve these aims, I address three research questions (RQ):

   RQ1: Which developments, at what different levels of the electricity system, contributed to
the emergence of cooperatives as niche-innovations for a community-led model of
electrification?

   RQ2: How, and towards what end, have cooperatives transformed and reconfigured the
electricity regime since the 1960s?

   RQ3: How is the socio-technical development trajectory of the current electricity regime
perpetuating path dependence on centralised electricity generation and what are the
different mechanisms contributing to regime stability?

1.2 Contribution to sustainability science

My thesis addresses one of the core debates of sustainability science: how to operate within
sustainability challenges (Becker, 2014) – described by the nine planetary boundaries (Rockström et
al., 2009) – while at the same time considering basic human needs (Raworth, 2012). This means that
we have to meet “the needs of present and future generations while substantially reducing poverty
and conserving the planet’s life support system” (Kates, 2011, p. 19449). With its bottom-up,
decentralised and democratic characteristics, community energy could provide a holistic alternative
on how to meet the basic need of electrification and socio-economic development while respecting
the environment.

Sustainability science is an appropriate field to study energy challenges. Due to their complex
interdependence with – amongst others - political, social and economic levels, this challenge is
repeatedly being labelled as a “wicked” problem (Rittel & Webber, 1973, p.160). This interdependence
is complex because it is deeply embedded in societal structures and has co-evolved with them
(Verbong & Loorbach, 2012). Solving wicked problems demands not only a multi-level perspective, but
also integration across global and local scales, and temporal and spatial analysis (Jerneck et al., 2011;
Kates et al., 2001; Nastar, 2014).

Using transition theory, I address the different levels of the electricity system in Costa Rica. Further, I
address how the global transition towards community-led transitions is working on a local level and
explain the change dynamics in Costa Rica’s electricity system since the 1960s. Additionally, I apply a critical lens on the Costa Rican electricity system and assess the problem structure of the current electricity regime in Costa Rica, but further also discuss how the system path dependence could be solved with community energy. Hence, my approach seeks to “combine critical thinking and problem-solving research” (Nastar, 2014, p. 8). Altogether, with my thesis I support action towards community-led energy transition, which I argue can guide “[nature-science] interactions along more sustainable trajectories” (Kates et al., 2001, p.641).

1.3 Thesis outline

To gain a better understanding of the theoretical lens and my RQs, I introduce the theoretical context of energy transitions (chapter 2), followed by my analytical framework, the multi-level perspective (MLP) and transition pathways (chapter 3). Then I provide more context information about my case study Costa Rica (chapter 4). In chapter 5 I outline my methodology for an enhanced understanding of the structure and methods used throughout this thesis. I answer my RQ1 and RQ2 in chapter 6, followed by RQ3 in chapter 7. Lastly, I discuss the implications of these findings and provide recommendations (chapter 8).
2. Theoretical context: transition towards a more sustainable energy system

2.1 Innovative niches for energy transitions

Scholars of innovation theory have embraced co-evolutionary models of socio-technical systems to understand how system-wide transition can be enabled (Geels, 2002; Grin et al., 2010). Transitions are defined as “transformation processes in which society changes in a fundamental way” (Rotmans, Kemp, & van Asselt, 2001, p.14). In the energy sphere, a transition describes the shift from one energy system to another (Sovacool, 2016). Here the socio-technical energy regime is conceptualised to remain in a “dynamic equilibrium” (Seyfang et al., 2014, p.23). As energy systems are interdependent with other technologies, infrastructure and institutions, they become resilient to change; this is referred to as path dependence (Seyfang et al., 2014; Shove, 2012).

Within this energy regime, change towards a more sustainable energy system happens incrementally. Usually, these adjustments have focused on the technological aspects of changing the “hardware” (Walker & Cass, 2007, p. 439), such as moving from fossil fuels to large-scale hydropower (Yüksel, 2007). These adjustments perpetuate pathways compatible with the system’s existing infrastructure: they focus on long-term transitions using large-scale projects (Bomberg & McEwen, 2012).

However, following a transition theory perspective, innovations that can overcome this path dependence must come from outside the incumbent regime (Geels, 2002; Schot & Geels, 2008). For this purpose, next I conceptualise energy communities as grassroots innovations within the current electricity regime.

2.2 Energy communities as grassroots innovations

A growing number of scholars have framed community-led action as grassroots innovations towards a more sustainable energy system (Dunn, 1978; Kunze & Becker, 2015; Lovins et al., 2002; Walker, 2008). According to Seyfang and Smith (2007) grassroots innovations are “networks of activists and organizations generating novel bottom-up solutions for sustainable development; solutions that respond to the local situation and the interests and values of the communities involved “(p.585). Community on the other hand is defined as “unified body of individuals”, “society at large” or “joint ownership and participation” (Merriam-Webster, 2017). This diverse range of definitions is also mirrored in the concept of community energy.
To understand the novelty of grassroots innovations, I use the distinction of hardware, the “engineered artefacts” that is used within the software of its “social organization” in socio-technical systems (Walker & Cass, 2007, p. 439). On hardware level, scholars agree that energy communities can be active in electricity generation, distribution and/or electrification (C4CE, 2015; REN21, 2016). On software level, diverging ideas of the implication of community energy relate to (i) the process dimension - who is developing and running the project (Kunze & Becker, 2015; Walker, Hunter, Devine-Wright, Evans, & Fay, 2007), which is interlinked with the definition of community as either geographical or interest-based societies (Hicks, Ison, Gilding, & Mey, 2014), or (ii) the outcome dimension - how communities organise the hardware within the socio-technical system and how benefits are distributed (Walker & Devine-Wright, 2008). Based on Walker and Devine-Wright (2008), figure 1 shows the different types of community energy. It illustrates that energy communities can be divided in type A, B and C, depending on their project process and outcome dimension.

![Diagram showing type A, B, and C energy communities](https://via.placeholder.com/150)

Figure 1. Considering community energy relative to project process and outcome dimensions (Walker & Devine-Wright, 2008, p.498). The zones indicate where the different understandings of community energy - divided into A, B and C - are located.

**Type A** communities highlight the importance of grassroots involvement of local people (Walker & Devine-Wright, 2008; Walker et al., 2007). This follows a communitarian discourse where the organizational structure incorporates democratic decision-making, collective legal ownership and sharing the benefits among associates equally (Kunze & Becker, 2015). Rather than driven by economic benefits, type A communities are interested in environmental and social aspects and have political aspirations. Here, community is perceived to be on a geographical and interest level. Associates go beyond being electricity consumers, but are also producers – making them *prosumers* (Schick &
Gsänger, 2016). This is also linked to normative principles of community empowerment, energy democracy and energy decentralization (Kunze & Becker, 2015; Walker & Cass, 2007).

For **Type B** communities, the outcome is the most important part of the project (Walker & Devine-Wright, 2008). Here community ownership and participation is periphery, it is rather important to whom the benefits are going (Roberts, Bodman, & Tybski, 2014). This opens the door for the involvement of e.g. municipalities, investors and private-public partnerships. Economic benefit for the community is usually the biggest driver and the community is understood as interest-based.

**Type C** communities demonstrate an even greater degree of flexibility and openness towards project process and outcome (Walker & Devine-Wright, 2008). Here, the most important aspect is that an energy-related project is actually realized. The driver can be either social, economic or environmental and the exact definition of community is secondary (Walker & Devine-Wright, 2008).

What emerges from the literature is depending on how community is defined, this has implications on what kind of projects are considered to be energy communities. Adding to Walker and Devine-Wright (2008), I want to highlight that these types are not static. Projects may shift between them – as I show how it can occur in the context of energy transitions.
3. Analytical framework

To understand how cooperatives emerged within Costa Rica’s electricity system, I use transition theory as an analytical framework, drawing upon the MLP and transition pathways. I use the MLP to understand and structure the interactions between the different levels in Costa Rica’s electricity system (RQ1). Then I build upon transition pathways to understand how cooperatives used the transformation and subsequently the reconfiguration pathway to become regime actors (RQ2). Returning to the MLP I explain how cooperatives are perpetuating the status quo and which mechanisms contribute to regime stability (RQ3).

3.1 Multi-level perspective

The MLP is characterized by interaction between the landscape (macro), regime (meso) and niche (micro) level (Geels, 2002, 2004, 2005; Geels & Schot, 2007). Figure 2 illustrates the “nested hierarchy” where niches are subject to socio-technical regimes which in turn are nested within a landscape (Geels, 2004, p. 913). Radical innovations evolve in niches. Each level has its inherent properties regarding stability, linkages, hardness, structure and actor relationship (Geels, 2002).

![Figure 2. Multiple levels as a nested hierarchy (Geels, 2004, p. 913)](image)

The landscape level provides the “exogenous environment” which is the overarching setting against which developments take place (Geels & Schot, 2007, p. 400). Because the landscape evolved over time, it contains a set of heterogeneous factors, related to politics, economy and culture. It structures
the interaction between various actors and is characterized by a “relative hardness” (Geels, 2004, p.913). Actors on regime and niche level can only influence this level marginally: without an external shock to the system, change occurs slowly (Geels, 2002).

Socio-technical regimes operate within this landscape. They create stability by their persistence, acting towards sustaining incumbent actors and structuring the scope for change. Change is geared towards “guid(ing) the innovate activity towards incremental improvements along trajectories” (Geels, 2002, p.1259). With these characteristics, regimes serve as a selection environment (Geels & Schot, 2007). Different mechanisms such as — among others — institutional rules and technological interconnectedness provide stability to socio-technical regimes (Araújo, 2014; Geels, 2004). This is also referred to as path dependence and relates to “inertia of prior choices constraining future pathways” (Araújo, 2014, p.118.)

Hence, radical innovations usually evolve in niches because they are “protected spaces” which promote learning (Geels, 2004, p. 912). Niches deviate from existing rules and there is no persistent role relationship between actors (Geels, 2004). Niches are important because they “provide the seeds for change” (Geels, 2002, p. 1261).

Change occurs through the interactions between the levels (Geels, 2002, 2004, 2005; Geels & Schot, 2007): (i) innovations are created in niches and develop internal momentum, e.g. through learning; (ii) tensions, e.g. in the form of exogenous shifts at landscape level put pressure on the socio-technical regime; (iii) this pressure destabilizes the regime and opens up a “window of opportunity” which may lead to a breakthrough for niche-innovations (Geels & Schot, 2007, p.400). Next, I discuss the different possible transition pathways.

3.2 Transition pathways

As innovations mature, the question arises how exactly they could influence the incumbent regime (Raven, 2012). Depending on the time and nature of niche-regime-landscape interaction, Geels and Schot (2007) have developed four transition pathways: transformation, reconfiguration, technological substitution, and de-alignment/re-alignment. Here I introduce the transformation and reconfiguration pathways, which I use to answer RQ2. Geels (2002) stresses that the success of niche-innovations is not only determined by the stabilization of niches but also by what is happening at the different levels of the MLP: “It is the alignment of developments which determine if a regime shift will occur” (Kemp
et al., 2001, p. 277). Given that socio-technical regimes are stable, it is difficult for innovations to challenge them; only if timing and nature is right, transitions can occur (Geels, 2004).

### 3.2.1 Transformation pathway

Figure 3 depicts the transformation pathway: Here, niches become part of the incumbent regime with unchanged selection processes. Under moderate landscape change, symbiotic but not sufficiently developed niches may destabilise the existing regime (van der Vleuten & Högeselius, 2012). As niche-innovations are not sufficiently developed, they cannot fully exploit this disruption. Hence, they transform the development path of the existing regime (Geels & Schot, 2007). Through interaction that leads to “cumulative adjustments and reorientations”, niche actors may be added to the regime but without changing the fundamental architecture of the existing regime (Geels & Schot, 2007, p. 407).

![Transformation pathway](image)

**Figure 3. Transformation pathway (Geels & Schot, 2007, p. 407)**

### 3.2.2 Reconfiguration pathway

As figure 4 shows, in the reconfiguration pathway symbiotic innovations are initially absorbed by the regime to resolve local problems (van der Vleuten & Högeselius, 2012). Once adopted, niche-innovations interact with the regime, which may trigger more adjustments (Geels & Schot, 2007). Under sufficient landscape pressure, the regime may adopt more niche-elements, leading to
reconfiguration (Geels, 2002; Geels & Schot, 2007). Here the new regime develops out of the old one, but the reconfiguration pathway significantly changes the regimes’ architecture.

![Diagram of reconfiguration pathway](image-url)

**Figure 4.** Reconfiguration pathway (Geels & Schot, 2007, p.409)

### 3.3 Criticism

Transition theory has received several types of criticism — among others: Firstly, it has focused predominantly on technological innovation, disregarding not only social aspects of technology but also that social grassroots options can be an innovation in itself (such as the ones that I study)(Seyfang & Smith, 2007; Seyfang, Haxeltine, Hargreaves, & Longhurst, 2010). Secondly, transition theory underestimates the role of agency because the framework is too structured, “leaving room for greater analysis of agency” (Smith, Stirling, & Berkhout, 2005, p.1492). Responding to this, Geels (2011) argues that the MLP is “shot through with agency” (p.29), because the development trajectories are facilitated by social interactions.
4. Case study context: cooperatives in Costa Rica’s electricity system

4.1 The Costa Rican electricity system and its actors

To conduct my case study of Costa Rica’s cooperatives in the electricity system between the 1960s and today, I introduce the relevant actors of the electricity system: Ministry for Environment (MINAE), Regulatory Agency (ARESEP)\(^3\), Costa Rican Electricity Institute (ICE), and the cooperatives.

On state level MINAE is the country’s executive body that formulates energy policies and strategies and promotes electricity generation (MINAE, 2015). Since 1949 ICE has been the state-owned electricity and telecommunication provider and the main electricity actor (Law 449, 1949; Espinasa, Balza, Hinestrosa, & Sucre, 2013). Nowadays, ICE is responsible for approximately 80% of electricity generation capacity; the remaining are generated by private actors (14%) and cooperatives (6%) (ICE, n.d.). For current electricity distribution, ICE is responsible for 38% and its San José subsidiary National Power and Light Company (CNFL) for another 41% (ICE, n.d.). The remaining is distributed by two municipal enterprises and cooperatives, accounting for 12% and 9% respectively (Chavez, 2016). All actors active in electricity distribution finance their operation through tariff revenues. Tariffs are established by ARESEP, in charge of regulation to provide optimal cost, access and quality of electricity (Law 7593, 1996).

4.2 Rural electrification cooperatives

Costa Rica has four rural electrification cooperatives: Coopeguanacaste, Coopelesca, Coopesantos and Coopealfaroruiuz. They have their origins in pro-electrification groups in their respective areas which founded cooperatives in the 1960s/70s. Cooperatives became a formal legal figure with the cooperative law 4179 in 1968 (Law 4179, 1968). Since then the cooperatives have grown significantly: Nowadays they have more than 200,000 associates in total, provide electricity to approximately 40% of Costa Rica’s rural areas and have achieved almost universal electricity access in their concession areas (Conelectricas, 2014; Coopealfaroruiuz, 2016; Coopeguanacaste, 2015; Coopelesca, 2015; Coopesantos, 2016; Shaw, Aldred, Brander, & Romenteau, 2015).

\(^3\) Both ARESEP and MINAE had predecessors and grew out of internal restructuring: While Law 774 (1995) created MINAE in its current form (formerly MINAET), ARESEP was created by Law 7593 (1996), growing out of the National Electricity Service (SNE). For simplification I use their current name throughout my thesis.
While electricity distribution has been their core function, since the 1990s cooperatives have also become active in electricity generation (Chavez, 2016). For this purpose they jointly established a consortium, Conelectricas, in 1989, in charge of representing cooperative interests, advocating for policy changes and advancing joint electricity generation (Conelectricas, 2014). Nowadays Conelectricas owns three hydropower projects with a total installed capacity of 43MW (see appendix 1) (Conelectricas, 2014). Apart from that, Coopelesca, Coopesantos and Coopeguanacaste also have their own electricity generation projects (also see appendix 1). What the cooperatives manage on the grid that is not produced by themselves, they buy from ICE (Chavez, 2016). Figure 5 provides an overview of the cooperatives’ key statistics, including concession area, membership, installed capacity and how much this capacity covers of their electricity consumption.

Figure 5. Location of concession areas and key statistics of Coopeguanacaste, Coopealfaroruiiz, Coopelesca and Coopesantos. Sources: (Conelectricas, 2014; Coopealfaroruiiz, 2016; Coopeguanacaste, 2015; Coopelesca, 2015; Coopesantos, 2016; ICE, 2015). Base map: https://mapchart.net. Own illustration.
5. Methods and methodology

5.1 Ontological and epistemological considerations

I use a critical realist view of reality which offers an alternative to the philosophy of science of objectivism/positivism and relativism/constructivism (Sayer, 2000). Ontologically, critical realism advocates the existence of a world going beyond our knowledge (Nastar, 2014; Sayer, 2000). This distinction between real object and reality suggests that reality needs to be untangled by understanding the empirical, actual and real domain (Bhaskar, 1975; Sayer, 2000; Wynn & Williams, 2012). The empirical domain reflects our experiences with an issue, e.g. electrification. The actual domain deals with the mechanisms activating these empirical observations and experiences, e.g. the intertwined nature of the energy system with politics and international relations. The real incorporates the structures of reality and the causal events that shape them (Sayer, 2000).

Epistemologically, I view energy systems as intertwined with other systems, which are all shaped by social relations but conditioned by their surrounding biophysical realities; I agree with the critical realist vision of open social systems. In this, objects are part of structures, where structure inherits internally related objects “whose causal power, when combined are emergent from those of their constituents” (Sayer, 2000, p.11). Although I acknowledge that constituent features are crucial for this emergence, I reject positivism which directly associates causes and effects (Nastar, 2014). Instead I side with critical realism that causation is not related to how often we observe something happening; in open social systems, the identical causal power can trigger different outcomes (Sayer, 2000). As this means that events cannot be predetermined, I acknowledge an open future.

I use transition theory as my analytical framework which is open to a variety of ontologies, each having own implications for transitions (Geels, 2010). Applying a critical realist point of view on transition theory is valuable for one main reason: For transitions to work, the system needs to be (at least temporarily) open as the stability of a system is not derived by the system parts but by the interaction and linkages between heterogeneous elements (Geels, 2002). Hence, I am interested in developing in-depth explanations of the mechanisms that caused the following socio-technical phenomena:

- The emergence of cooperatives as grassroots innovations in Costa Rica’s socio-technical electricity system (RQ1)
- The transformation and reconfiguration pathway of these innovations (RQ2)
- The stability of the current socio-technical electricity system (RQ3)
Explaining the mechanisms contributing to the emergence of these phenomena allows me to go beyond the empirical domain and get deeper knowledge about the real world. This may provide insights on how to tackle similar challenges in Costa Rica and elsewhere in the future.

5.2 Case study design and unit of analysis

To study Costa Rica’s cooperatives “in depth and within its real-life context” (Yin 2003, p. 13), I employ a single case study design. As I aim at developing an in-depth explanation of their changing role and nature, these four cooperatives are my unit of analysis. This case study can considered to be what Flyvberg (2006) calls “critical”, as it challenges the tacit assumption that energy communities are part of overall communitarian discourse of decentralized, bottom-up electricity generation. Applying a critical lens is particularly important as Costa Rica is perceived as a pioneer in RE.

As Yin (2011) advocates, the unit of analysis is strongly related to contextual circumstances. Hence, to answer my RQs, I analyse cooperatives using the MLP. Although it is difficult to establish exact boundaries to the MLP (Geels, 2002), I set the following boundaries to keep the study manageable: (i) Central America has an integrated electricity system, but the study is limited to Costa Rica, (ii) I consider the time between the 1960s and today, as this is when the cooperatives became active, and (iii) I focus on the electricity sector, largely excluding the interlinked system dynamics with the transport sector.

I conceptualize the cooperatives as grassroots innovations within Costa Rica’s socio-technical electricity system that represent one form of community energy. I see cooperatives as innovation on the software side (Walker & Cass, 2007), because they have a technology-user relationship that is contrary with the existing socio-technical system. At the same time, I acknowledge the role nature of the cooperatives can change over time. I show how this occurs in the context of transitions to community energy.

5.3 Data collection

For my data collection, I used an iterative approach using triangulation. This method, conceptualized by Webb (1966) advocates the use of various methods in social research to crosscheck results of one method with using another method. I used literature review to gain knowledge about my theoretical and analytical framework. Based on this I applied triangulation (see figure 6): I first collected data via documents, which then informed my qualitative interviews and stakeholder mapping. To address the linearity of this approach, I iteratively returned to earlier steps of the research process. Applying this procedure enhances the internal validity of my thesis (Bryman, 2012).
5.3.1 Literature review

I did an extensive literature review to inform my theoretical context and analytical framework. To do so, I consulted the LUBsearch database and applied the key words “community energy”, “energy transition” and “transition theory” as my search strategy. Based on that, Geels (2002) and Walker and Devine-Wright’s (2008) papers turned out to be of specific importance and snow-balling method was applied to consult more literature.

5.3.2 Document review

I conducted a document review in form of a desktop study, as preparation for my field work. Two types of primary literature formed the backbone of the document review: Firstly, I used policies related to electrification, electricity generation and cooperatives. For this purpose, I identified the policies via the legislation policy database\(^4\) of the Energy Department (DSE). I created a database, using the software Microsoft excel (Appendix 2). I further reviewed the national development plans as they provide the guideline for long-term electricity development in Costa Rica (see appendix 3). Secondly, I reviewed the annual or anniversary report of three cooperatives (Coopealfaroruiuz had no material available) and Conelectricas, retrieved from their respective websites (see Appendix 4). In total I reviewed 60 policy

\(^{4}\) Available via http://www.dse.go.cr
documents and six cooperative documents to understand how cooperatives are situated in the policy framework and how they developed over the years. All documents were available in Spanish.

5.3.3 Qualitative Interviews

While documents provided a baseline to understand the role and development of cooperatives, they cannot explain the general institutional setting and greater context. Therefore, based on the document review, I conducted qualitative interviews. The interviews served to understand: (i) the relationship between cooperatives, ICE and ARESEP, and (ii) what role they play as regime actors.

As suggested by Kvale (2007), for incorporating interviews successfully into methodology, theoretical assumptions should be clear. I did this by using my epistemological and ontological views while developing my interview guide (see appendix 5, 6 and 7). Qualitative interviews were held in a semi-structured way, using the interview guide as a baseline, but adapting the questions to the background of the interviewee. As advocated by Bryman (2012), this flexibility is important to be responsive and to follow up on points the interviewee mentions. To ensure that my questions were understandable, my interview guide was proof-read by Spanish native speakers.

For obtaining my interview participants I contacted all cooperatives, Conelectricas, ARESEP, ICE as well as experts from the Centre for Urban Sustainability (CUS) via the contact forms on their websites. In total I conducted nine interviews during my field visit to Costa Rica (17.03. – 27.03.2017) (see appendix 8). These interviews took place in the interviewee’s main office, were formally arranged by appointment and recorded. Further, I received an audio recorded interview via email, that one interviewee arranged with her colleague to follow up on some questions. I kept interviewees anonymous, coded them and only listed their affiliation: I spoke to five cooperative representatives, two ARESEP representatives, one ICE representative and two energy experts. All interviews were conducted in Spanish.

5.3.1 Stakeholder network mapping

During my interviews, I used an adapted version of a toolbox to map out the relationship between the different actors in the electricity system (Schiffer & Peakes, 2009): e.g. my interviewees drew the relationship, provided me with maps or verbally explained them to me. This stakeholder network map helped me to understand the complex network, linkages between the different actors and hierarchy (Schiffer & Peakes, 2009). It also served to visualize and explain the different stages in the transition pathway (see figure 8, 11, 12).
5.4 Data analysis

For my data analysis, I used a qualitative content analysis, an approach to analysing documents by putting them into “predetermined categories (...) in a systematic and replicable manner” (Bryman, p. 290). According to Mayring (2007) this approach is rule-bound and determined by the theoretical underpinnings of its interpretation. Although bringing in theory into the material may be distortive, I agree with Mayring (2007) that theory is used as a system of principles for the case study. By applying the theoretical lens of transition theory to my data, I hence used the experience from others to “achieve an advancement in knowledge” (Mayring, 2007, p.59). Figure 7 depicts the different steps of my data analysis: Considering my RQs and theoretical context, I defined the category system based on transition theory. Then I defined the coding guidelines – which is a central process in content analysis and enhances intersubjectivity and repeatability. After a first run-through my material, I revised the coding guidelines, before finalising the analysis.

![Diagram of data analysis process]

Figure 7. Data analysis, using deductive category assignment. Adapted from Mayring (2007, p. 96)

To prepare the data for the content analysis, I screened the policy documents and selected policy papers referring to cooperatives or the role of ICE and ARESEP for my content analysis (bolded in appendix 2). The interviews were transcribed using a selective method (Bryman, 2012; Mayring, 2007). I only transcribed parts of the audio recording that I deemed relevant to answer my RQs. As all data was available in Spanish, I did the analysis in Spanish. I translated parts relevant for the thesis into English, preserving the content as much as possible. This qualitative content analysis was done using the coding software MaxQDA.
5.5 Reflexivity and limitations

Values have a large impact on social research (Bryman, 2012). Contrasting Durkheim’s view that social science should be value-free, there is a growing tendency to accept that researchers are defined by their values and background at the time and social space (Bryman, 2012; Yin, 2011). This makes it important to be reflexive of the implication of these values (Bryman, 2012). To address this potential bias, I follow Yin’s (2011) suggestion to reflect about my cultural background, physical appearance, personal motivation and access to my data and explain how these could be limitations.

Firstly, I am neither Costa Rican nor native Spanish speaker. These cultural differences may have caused some communication barriers and limited understanding of the country’s history and current political debates. Secondly, generally, foreigners are treated with great respect, but female researchers are uncommon. This caused some astonishment, expressed by my interviewees’ worry for my safety. Therefore, my physical attributes may have influenced my data collection. Thirdly, my personal motivation for this research derived from the fact that I have lived in Central America, contributing to a potential bias in case study selection. Lastly, my access to data was already explained in my policy document and interviewee selection (see 5.3.3).

Apart from Yin’s (2011) implications, my data collection had further limitations. While the policy documents promised to provide enough data for my research, I realized late in the data collection process that more hands-on data is needed. This meant that I could not prepare my interview guide thoroughly, which may have limited the depth of my results. Furthermore, I went into the field assuming that cooperatives in Costa Rica are currently type A energy communities (Walker & Devine-Wright, 2008). Only afterwards, I realised that nowadays this assumption is not true anymore. Therefore, in hindsight I would have liked to ask different questions. Apart from this, due to time constraints and non-responsiveness, I did not get the view from all cooperatives.

I applied critical realism, which also has limitations: I use my data - the empirical domain - to understand the mechanisms activating the actual domain. However, this data could have been perceived differently by someone else, which also relates to values, cultural background and physical appearance (Easton, 2010). Furthermore, I had to set boundaries for my study; I may have neglected mechanisms that contributed to the emergence of cooperatives.

Overall my reflexivity and limitations show the importance of triangulation, constant validation and an iterative research design (Webb, 1966).
6. Analysis Part 1: Cooperatives in rural electrification

To answer RQ1, here I explain which developments at the different levels contributed to the emergence of cooperatives as grassroots niche-innovations. I use the MLP and analyse the dynamics at regime (see 6.1), niche (see 6.2) and landscape (see 6.3) levels. Using critical realism, I acknowledge that developments at these three levels do not happen in isolation, but it is the interaction between the levels that facilitates the transition. Therefore, I seek to make linkages wherever possible.

6.1 Stable electricity regime in the 1960s

Figure 8 depicts a top-down, centralised electricity system of electricity distribution and generation. In the interest of advancing social and economic development, the ICE was created as the sole authority to produce and distribute electricity (Law 449, 1949). This mandate was institutionalised by MINAE’s policy framework and ARESEP’s regulatory structure. Hence, this centralisation was mirrored in the ICE’s objectives: To expand the country’s electricity generating capacity, the ICE prioritised large-scale hydropower development. The years following its creation, the ICE installed a variety of hydropower plants, which it controlled centrally (Barnes, 2005). Electricity was only distributed in the cities, as it was only economically viable in these areas (Barnes, 2005; Coopesantos, 2015). While universal urban electrification was achieved by the 1940s, rural areas lacked this access (Barnes, 2005).

Figure 8. Stakeholder mapping of the centralised electricity regime, beginning of 1960s. ICE is Costa Rica’s sole authority to generate, transmit and distribute electricity. Graphics from The-Noun-Project (2017). Own illustration.
ICE had the vision to tackle rural electrification after hydropower developments had matured. Therefore, when pro-electrification groups\(^5\) from Guanacaste, San Carlos and Los Santos demanded the ICE to electrify their areas in the early 1960s, ICE referred to this not being on its list of priorities and that it would be done after constructing hydropower plants (Coopesantos, 2015). Coopeguanacaste described that “when our people knocked at the governments and ICE’s door, they were not heard” (R9). This persistent centralized approach lead to the ICE not being interested in pursuing rural electrification. This demonstrates that rules manifested in the ICE law of creation and the ICE’s vision provided “stability by guiding perception and actions” (Geels, 2002, p.910).

6.2 Grassroots innovation for rural electrification

The community-led rural electrification model was facilitated by shared expectations about the benefits of rural electrification on social, economic and environmental level:

(i) Electrification was seen as social necessity to advance community development (Coopesantos, 2015) and to improve life quality (R3, R9, R10). My interviews stressed that electrification was based on solidarity – to bring electricity also to associates where it would not be viable in the economic sense (R1, R2, R3, R9). This confirms Geels (2004) argument that actors are supporting niches “because they have certain expectations” (p.914). This expectation supported an approach to electrification that deviated from the existing rules set by the ICE: Contrary to being centralized and top-down, this grassroots innovation had a bottom-up approach to electricity distribution for rural electrification (R1, R2, R3, R9).

(ii) These regions pushed for electrification to diversify their incomes. For example, Coopesantos, a coffee growing region, wanted reliable electricity access to process coffee beans to diversify income and create work opportunities (Coopesantos, 2015, 2016).

(iii) Electricity access provided a reliable and more environmentally-friendly alternative for cooking and light. Before electrification, people in the rural areas relied on to petrol and biomass for basic needs (R9).

\(^{5}\) Before their official creation, cooperatives referred to themselves as pro-electrification groups (Coopesantos, 2015).
These regions’ rural character provided protective spaces for the cooperative model of electrification (Geels, 2002). This kind of protection is referred to as “passive shielding” and describes “generic spaces that pre-exist deliberate mobilisation by advocates of specific innovations, but who exploit the shielding opportunities they provide” (Smith & Raven, 2012, p.1027). Thanks to their distance from San José, these rural areas could promote the cooperative model better than Costa Rica’s urban parts - which were already electrified (Feldman & Kogler, 2010; Oliver & Jackson, 1999).

Within these protective spaces, grassroots innovations could advance their electrification project thanks to learning and powerful external support. This contributed to building up “internal momentum” (Geels, 2014, p.23). Firstly, learning processes happened within each pro-electrification group and by learning from one another. For example, in the beginning of the 1960s, Coopesantos had regular assemblies where associates identified electrification strategies and evaluated what had happened since their last assembly (Coopesantos, 2015). As there had been some failed electrification projects in the region before, they also evaluated these past experiences to avoid making the same mistakes (Coopesantos, 2015, 2016). Simultaneously, representatives from each pro-electrification group met to share experiences (R9; Coopesantos, 2016). Thanks to these learning processes, they could attract a wider population to join their cause. Secondly, the grassroots innovations received powerful external support. When representatives from Los Santos and Guanacaste attended a meeting about electrification in Uruguay in 1963, they convinced the US Alliance for Progress (Afp)\(^6\) and the National Rural Electric Cooperative Association (NRECA)\(^7\) to come to Costa Rica (Coopesantos, 2015, 2016). On his visit, one NRECA representative mentioned that “if you [the grassroots innovations] maintain that firm decision to form an electrification cooperative the project will become a success” (Coopesantos, 2015, p.7) This NRECA visit did not only give the grassroots innovation credibility, boosting their membership but also secured them powerful support – putting pressure on ICE. These developments demonstrate the alignment of processes and actors at niche level.

\(^6\) With growing Cold War tensions, the USA feared Soviet influence in Latin America. To secure US interests, in 1961 President Kennedy established the Afp, providing development aid to Latin America in return for institutional reforms (US Department of State, n.d.)

\(^7\) Cooperatives – under the umbrella organisation NRECA – have been the successful driver of US electrification in the 1930s/40s (NRECA, 2017). In the 1960s NRECA International was to facilitate rural electrification in developing countries (NRECA International, 2017).
Altogether, I see this community-driven model of electrification as type A energy communities (Walker & Devine-Wright, 2008). Figure 9 illustrate where I located the cooperatives in Walker and Devine-Wrights’ (2008) graph. Here, the cooperatives’ model of electrification is a grassroots innovation within Costa Rica’s electricity system. Their electrification model deviated from ICE’s centralised approach. My interviews emphasise that this difference is manifested by (i) their drive to respond to social, economic and environmental needs for rural electrification, (ii) their governance model rooted in cooperative ownership, democratic decision-making and, (iii) their non-profit nature that went beyond economic viability, where they reinvest financial surplus in improving the quality and coverage of their electricity services (R1, R2, R3, R9).

![Cooperatives in electrification](image)

Figure 9. Situating the cooperatives in relation to project process and outcome dimensions. Adapted from Walker & Devine-Wright (2008, p.498).

### 6.3 Increasing landscape pressure

In the 1960s, changes at landscape level put pressure on the electricity system. As mentioned (see 4.1), at landscape level changes occur either slowly or due to external shocks. Next, I describe these two types of changes in the context of my case study.
6.3.1 Slow socio-political changes

Changes at political, economic and social level created an atmosphere where the issue of rural electrification became important: Firstly, by the 1960s Costa Rica was relatively politically stable. It abolished its army and developed a social democratic model that provided wide-spread education and health care access (R9; Cordero & Paus, 2008). Secondly, economic development also picked up, largely facilitated by the establishment of the Central American Common Market in the 1960s (Cordero & Paus, 2008). Lastly, on a social level the egalitarian tradition and cooperative movement gained importance, manifested e.g. in Art. 64 of the constitution (1949). Coopeguanacaste mentioned that the abolishment of the army was a sign that the state is putting more focus towards a civil state (R9). These long-term changes contributed to create an atmosphere where the by the 1960s rural electrification was discussed as a social and development issue.

6.3.2 External influence on the electricity system

My data collection suggests that rising Cold War tensions were a decisive factor for the establishment of the cooperatives: Coopeguanacaste stated that with rising leftist movements in neighbouring Nicaragua, there was the impression that the USA were interested in putting Costa Rica under its zone of influence (R9). This has also been reflected in the annual reports which suggested that improving Costa Rica’s socio-economic situation would contribute to solving tensions in Central America (Coopesantos, 2015). As the pro-electrification groups got in contact with the AfP and NRECA and secured their support, the USA were interested in advancing socio-economic development in Costa Rica via rural electrification (Coopesantos, 2015).

Altogether, to answer RQ1, I showed that an interplay of political and social changes, coupled with the need for rural electrification created what Geels (2002) calls a “window of opportunity” (p.1262). Next I explain how these developments contributed to cooperatives challenging the existing regime.

6.4 Pathways towards community-led electricity distribution

To answer RQ2, I conducted an in-depth study of the interactions between the different actors that caused the initial regime transformation and subsequent reconfiguration of the centralised electricity regime. For reference figure 10 visualises the key developments at policy and cooperative level and how the regime changed over the years – which I explain next.
Figure 10. Timeline of most important developments at policy and cooperative level. The three small pictures illustrate how the electricity system changed over time. Graphics from The-Noun-Project (2017). Own illustration.

6.4.1 Initial regime transformation

The developments at the different levels contributing towards the initial regime transformation were the following: (i) In the context of the ICE’s non-interest in pursuing rural electrification, outside criticism first came from pro-electrification grassroots groups. (ii) Grassroots innovations developed that had shared expectations and gained internal momentum via learning processes and external support, and (iii) In the light of socio-economic and political development, rural electrification needs became a contested topic on the national agenda. At the same time Cold War tensions increased the USA’s interest in securing its zone of influence in Latin America (Barnes, 2005). Hence, when the AF and NRECA agreed to support pro-electrification groups this put further pressure on the ICE. These developments changed the entire playing field, opening what Geels (2002) calls a “window of opportunity” for these grassroots innovations to challenge the existing centralised regime (p.1262).

According to my data collection the involvement of AF and NRECA was a key point in achieving a community-led electricity distribution for rural electrification: These two organisations agreed on financially supporting the grassroots groups to achieve rural electrification (Coopesantos, 2016). As
AfP guidelines require financial contributions of the receiving country, their support could only be secured if MINAE and/or ICE agreed to pay part of the expense (Coopesantos, 2016). Due to the increasing pressure, both MINAE and ICE agreed and modified its electrification path to include the cooperative model to advance rural electrification. This culminated in the cooperative law 4179 of 1968 which specified that the creation of cooperatives is in “public interest and (...) that it is one of the most efficient manners to achieve economic, social and cultural development” (Art. 1).

While the cooperative law (1968) legally established the cooperatives, I argue that regime transformation did not fully occur until the mid-1970s, after adoption of Law 5185 and Law 5513. By the 1970s, the expanding scale of cooperatives’ operation showed the ICE’s inflexibility: cooperatives bought all electricity that they distributed from ICE. With no tariff for rural electrification and a disproportionate amount of thermal tax burden, cooperatives were hindered to distribute electricity at an affordable price (Coopesantos, 2015, 2016). This condition has been referred to as “unjust” and ICE was against solving this issue (Coopesantos, 2015, p.66). Hence, Coopesantos and Coopeguanacaste became representatives in the National Union of Cooperatives and pushed for amendments of Law 4179. Negotiations and inter-institutional struggle between ICE and the cooperatives ensued. In the 1970s, growing demand for electrification and socio-economic development triggered the intervention of Costa Rica’s President Doubter – in favour of cooperatives. Law 5185 (1973) and Law 5513 (1974) offered cooperatives preferential tariffs for buying electricity from ICE, tariff exemptions for electricity-related equipment and rearrangement of thermal power costs.

This demonstrates a transformation path through ongoing struggles to achieve rural electrification. As figure 11 shows, cooperatives became part of the regime through its electricity distribution activities. However, the communitarian model of electricity distribution did not disrupt the core business of ICE. This relates to the timing and nature of the interaction between the niche-innovators and the existing electricity regime actors (Geels & Schot, 2007). When landscape changes increased, grassroots innovations were a local and relatively small phenomenon. Thus, they were not sufficiently developed to threaten neither the business model nor the core structure of the ICE. Furthermore, these grassroots innovations were regime symbiotic because they were only active in regions where ICE had neither economic interest nor capability to realise electrification. Cooperatives worked as a “competence-enhancing add-on” (Geels & Schot, 2007, p.406). They not only solved the local problem of rural electrification earlier than the ICE but also in a more efficient manner. Thus, they improved the country’s overall electrification rate. Consequently, cooperatives became regime actors in
electricity distribution; the current regime consisting out of the cooperatives and the ICE grew out of the old one, without altering the basic architecture of the regime.

![Figure 11. Stakeholder mapping of Costa Rica’s electricity system after regime transformation. Cooperatives are regime actors in electricity distribution after successful regime transformation in the 1970s. Graphics from The-Noun-Project (2017). Own illustration.](image)

### 6.4.2 Subsequent regime reconfiguration

Initially cooperatives were added to the existing regime to solve rural electrification: ICE and its subsidiaries remained in charge of distribution outside of the cooperatives’ concession areas and electricity was centrally generated by the ICE. However, interaction between the cooperatives and ICE triggered subsequent adjustments, resulting in regime reconfiguration. I demonstrate this regime reconfiguration using the example of the cooperatives becoming active in electricity generation in the late 1980s/early 1990s.

By the late 1980s it had become evident that the cooperatives also wanted to contribute to electricity generation. This clashed with the centralised electricity generation promoted by the ICE. As Law 449 (1949) stated, ICE was established as the country’s sole electricity generation actor. However, pressure was increasing: economic development staggered as GDP declined, inflation increased and currency suffered exchange loss (Espinasa et al., 2013). Simultaneously electricity prices rose, causing great popular discontent and protests.
Under these circumstances, the cooperatives developed the vision to become active in cooperative electricity generation, thus challenging ICE’s centralised electricity generation (Conelectricas, 2014). My data reflects that this decision was mainly driven by the desire to be more independent from ICE’s prices and to provide better and more reliable prices for their associates (Conelectricas, 2014; Coopesantos, 2015, 2016; R9, R10). Coopeguanacaste mention that this was a “large legal process because we only had a concession to distribute electricity, not for generating (...) it was a great political fight” (R9). To advance cooperative electricity generation, the four cooperative joint forces and established Conelectricas as a consortium of the cooperatives in 1989 (Conelectricas, 2014, R10). Conelectricas mentioned this was driven by the idea that “there were four cooperatives fighting for the same thing. It was better to join forces and work together. (...) The cooperatives are practically sisters” (R3). Conelectricas also highlighted the valuable support by NRECA (R3). This triggered MINAE’s support – also illustrated by the fact that Conelectricas was founded on MINAE’s premises (R3).

In this light, the cooperative model of electricity generation presented a solution to the electricity crisis. In 1990, Law 7200 changed the centralised electricity generation. It defined autonomous or parallel generation “as the energy produced by power plants of limited capacity [note: up to 20MW], belonging to private companies or cooperatives that can be integrated into the national electricity system.” (Art.1, Law 7200, 1990). Following this change, Conelectricas built the 17MW hydropower plant San Lorenzo which was connected to the grid in 1997 (Conelectricas, 2014).

While Law 7200 allowed the cooperatives to participate in electricity generation, it did not achieve the cooperatives’ core goal to become more independent from the ICE and lower electricity prices. The ICE had been assigned to have the “competence to purchase the electricity from the cooperatives” (Art.3, DE-24866, 1996). This implied that instead of distributing their generated electricity directly to their associates, cooperatives had to sell their electricity to ICE, to rebuy it again. “Although we were happy to get our first hydropower plant in operation, we did not approve of this practice” (Conelectricas, 2014, p.3). While further amendments and specification to Law 7200 (Law 7508 and DE-24866) made private actor participation easier, it did not ease participation of the cooperatives. As ICE mentioned: “everything that gives less competences to ICE and more to other actors is not seen with good eyes” (R8). The negotiating power of Conelectricas was seen as crucial to change Law 7200 (R9, R10): Law 8345 declared “the activities of generation, distribution and commercialization of the electricity carried out by the cooperatives of public interest” (Art.3, Law 8345, 2003). This implied that cooperatives could construct power plants up to 60MW without a concession – if compatible with the national plan -, could trade their surplus among themselves or sell it to ICE (Art. 4,6,9, Law 8345, 2003).
This demonstrates that subsequent reconfiguration occurred after transformation. Initially cooperatives were added-on and by the 1970s had become electricity distribution regime actors (Geels and Schot, 2007). Rising prices and socio-economic tensions asserted pressure on ICE and created the opportunity for subsequent regime changes. This reconfiguration was not driven by one single change, but by a “sequences of multiple components” (Geels and Schot, 2007, p. 413). In this case, the multiple components are the creation of Conelectricas, Law 7200 and 8345.

Consequently, by the early 2000s cooperatives not only altered the electrification, but also the generation part of the electricity system. The communitarian model was initially adopted to “solve particular problems” but subsequently “enabled major changes in the basic architecture” (Geels and Schot, 2007, p.413). Figure 12 shows the electricity system after regime reconfiguration. While ICE is still the central part of the regime, it has lost its solely centralised role that was originally anticipated for it in Law 449 (1949). The fact that cooperatives are nowadays an integral part of the electricity regime has been mirrored by my data collection: Coopealfarorui referred to cooperatives as the “decentralised part of the government” and the “ICE as the father with kids [note: cooperatives are the kids] (R1). Conelectricas sees that cooperatives have an “important part in the electricity model” (R3). This was also reinforced by ICE which mentioned that cooperatives have an “important and integral function (...), are established in the national system (...) and they could not just disappear” (R8). ARESEP added that they are “more than just rural electrification cooperatives” (R4).
Summarising, to answer RQ2, cooperatives succeeded to not only become part of the electricity distribution regime but also subsequently reconfigured the electricity generation system and are nowadays an integral part of the overall socio-technical electricity regime in Costa Rica. Interestingly, while the cooperatives gained the right to generate electricity, no efforts were made to introduce more community-led electricity generation that would be compatible with Walker and Devine-Wright’s (2008) type A classification. Cooperatives did not challenge the electricity generation mode put forward by ICE, because they were also interested in large-scale hydropower – which I discuss in the following.
7. Analysis Part 2: A failing transition towards community-led electricity generation

In this second part of the analysis I look at the failing transition towards more community-led electricity production. One could assume that the cooperative’s regime reconfiguration would facilitate a transition towards more communitarian electricity production - compatible with type A energy communities (Walker & Devine-Wright, 2008) (see 2.2). However, I demonstrate that this assumption cannot be confirmed. To answer RQ3 I explain that: (i) despite growing pressure, currently the electricity regime pursues large-scale hydropower development to maintain its central control of electricity generation, and in the process curtails DRE; and (ii) there is an interplay of mechanisms providing stability to this centralised regime.

7.1 Increasing pressure on the current electricity regime

Despite energy efficiency measures, electricity demand in Costa Rica is increasing steadily. Not only did it grow five-fold between 1970s and today (IEA, 2014), but it is also expected to further increase at a rate of 5.3% annually (MINAE, 2015a). This can mainly be attributed to improving electrification rates and higher electricity demand of the residential and industrial sector. R4, R5 and R8 also mentioned that demand may even accelerate if electric vehicle penetration to reduce the fossil fuels dependency in the transport sector is successful (DE-29399, 2001).

Climate change and social concerns are putting pressure on the large-scale hydropower development trajectory: firstly, climate change is causing hydropower reliability problems. For example, in 2014 Costa Rica experienced water supply shortages and depleted hydropower reservoirs (Fendt, 2015). My interviewees had diverging opinions about hydropower problems connected to climate change. While ARESEP saw it as a “great risk” in the future (R4, R5), Coopealfororuitz believed that “we will always have water” (R1, R2) and ICE regarded that “climate change has actually resulted in more water” (R8). This shows that among my interviewees, there is no consensus on how climate change may change hydropower reliability. Also the policy documents acknowledge the existence of climate change, but argue that there is no proof of its effects. Resulting from this, addressing potential hydropower vulnerability in the future electricity development is not deemed necessary (ICE, 2014).

Secondly, due to its local impacts, hydropower is increasingly met with resistance. This is linked to its environmental impacts on flora and fauna (Anderson, Pringle, & Rojas, 2006), and the effect on livelihood of local, often indigenous, communities – e.g. the Diquís hydropower project, where a lack
of involvement of affected indigenous tribes has been reported (Berger & Nassar, 2011; Schertow, 2008; Vaage, 2011). In Pacuare a planned hydropower project was not only clashing with indigenous rights but also with the community’s economic interests in wild water rafting (Kahler, 2015). This was also reflected by my interviewees. Everyone mentioned that hydropower development has become contested, especially by some environmental groups. CUS reported that protests arise, leading to a wider national discussion “every time a new hydropower project is planned” (R6) and ICE said that “at the moment it is easier to construct a thermal power plant than a hydropower plant” (R8).

Thus, growing electricity demand and increasing environmental and social problems about large-scale hydropower are putting pressure on the current electricity regime.

7.2 Electricity development trajectory of the current electricity regime

Despite increasing pressure, the current regime is convinced that it can solve these problems using its existing tools and knowledge: cooperatives and ICE are pursuing large-scale hydropower to satisfy growing demand and curtail DRE in the process.

7.2.1 Perpetuating large-scale hydropower projects

Currently Costa Rica derives two-thirds of its electricity from hydropower; to meet future demand hydropower is to be expanded (IRENA, 2016; REN21, 2016). Figure 13 shows Costa Rica’s current electricity matrix on the left and illustrates the break-down of ICE’s future projects until 2030 on the right (ICE, 2014). This demonstrates that to satisfy increasing demand, ICE has a variety of large-scale projects in the pipeline, and 75% of these hydropower (ICE, 2014). The majority of these projects are well above 50MW, among them the 623MW el Diquis hydropower plant, that is planned to go online in 2025 (ICE, 2014) Also cooperatives perpetuate this pathway: as of 2017, the cooperatives and Conelectricas operated 17 hydropower plants, ranging between 5 and 29MW and have further hydropower projects in the pipeline (see appendix 1). The importance of hydropower has also been highlighted by Coopealfaroruzi whose vision is to operate its own hydropower plant (R2). This shows that cooperatives and ICE are committed to pursuing large-scale hydropower in the future.
7.2.2 Curtailing distributed renewable energy (DRE)

With their focus on centralised and large-scale hydropower to maintain control over the electricity grid, cooperatives and ICE have joint efforts to curtail DRE. Under pressure to satisfy national electricity demand, in 2010 MINAE pushed for a pilot project in which 366 participants received DRE systems, predominantly solar PV (MINAE, 2015b). Participants were allowed to sell electricity to the grid, similar to a Feed-in-Tariff. This aimed at “studying the effects it would have on the distribution nets” (MINAE, 2015, p.32). Despite vast interest, the pilot project was not turned into legislation. My data demonstrates that this was due to the joint opposition of ICE and cooperatives. Both had concerns about the effects of DRE on their electricity grids. Coopealfaroruzi mentioned that “if they leave the grid open, then for us, it is not [economically] viable anymore. Because we need to ensure that you always have light, even if your system fails, like stand-by (...), like this, it does not work” (R2). This problem was also highlighted by ICE: “if it is one, nothing happens, but if it is 100 [note: DRE systems] (...) then for me, this is a problem.” (R8). These concerns about DRE technologies were also reflected in the VII National Plan (2015): “sun and wind suffer considerable variations (...). One disadvantage of solar PV is that the sun does not shine during the night” (p.50).
As a result, in 2015 Law 39220 established that while DRE is “considered to be of national interest”, it is for self-consumption only (Art.1, DE 39220, 2015). If DRE owners chose to be connected to the grid, they “may deposit electricity to the grid that they did not consume and have the right to withdraw up to 49% of the total electricity generated to be used in the following months” (Art.23, DE-39220, 2015). Effectively this means that they cannot sell electricity to the grid, but rather trade it up to a certain extent. Cooperatives and ICE are content with this law: Conelectricas highlighted that “we won” (R3) and Coopealfaroruzi mentioned that “the new law is very good for us, as security” (R1).

The initial introduction of DRE can be seen as an incremental adjustment of the regime to increasing landscape pressure (Geels, 2002, 2010). However, when cooperatives and ICE realised that this interferes with their core business of maintaining a stable electricity system, regime actors withdrew the protection for DRE. This results in a stable “selection environment”(Schot & Geels, 2008, p. 539): de juro DRE is still possible, but de facto heavily regulated; only limited amounts are accepted to the grid and high installation costs and little economic return make it unattractive.

Altogether, this demonstrates that despite growing electricity demand and social and environmental problems connected to large-scale hydropower, cooperatives and ICE continue with their trajectory in the future. In the process they have been limiting DRE to maintain in control over the electricity grid. Next I explain the different mechanisms that contribute to reinforcing regime stability (path dependence).

### 7.3 Mechanisms of regime stability

The different mechanisms contributing to regime stability can be categorized into institutional, technological, social and economic mechanisms. As according to critical realism, the stability of the current regime cannot be explained by the individual mechanisms but by interaction between them, I make referrals where deemed necessary.

#### 7.3.1 Institutional mechanisms: rules

The current regime has formed an interdependent network, resistant to change its electricity development trajectory. On institutional level this is manifested by formal/regulative, normative and cognitive rules.

**Formal and regulative rules.** In Costa Rica the electricity system is characterised by an elaborated policy framework and market access barriers for electricity generation. MINAE’s policy framework and
ARESEP’s strict regulations hinder the involvement of DRE actors: to connect to the grid, DRE technologies need to meet technical standards and obtain permissions (DE-39220, 2015; Norm Poasen, 2015). ARESEP also reflects that “Costa Rica has a lot of regulation, an awful lot of laws (...) there is not much flexibility” (R5). Coopervalfaroiz mentioned that participating in electricity generation is a “very bureaucratic process” (R1). These market access barriers not only make participation in the market difficult, they also establish “the rules of the game” (Seyfang & Smith, 2007, p. 595). If these rules are not respected, sanctions may occur. Coopeguanacaste summarises: “if we provide a service in a zone that is not ours, we lose our concession” (R9). This implies that these formal and regulative rules “constrain behaviour and regulate interaction” (Geels, 2004, p. 904) and thus make participation of DRE actors difficult.

**Normative rules.** Regime stability is maintained by good relationships between regime actors whereby they ultimately establish a form of electricity cartel. My data showed that regime actors reinforce each other’s importance: ICE highlights that cooperatives are “an integral part” (R8). Cooperatives on the other hand perceive the ICE as “father” (R1), as “leading role” (R9) and as “ally” (R3). All interviewees emphasised their cordial relationship. ARESEP reflected on their “constant communication, almost every day” and the fact that cooperatives have representatives at both ICE and ARESEP (R4, R5). This shows that not only regime actors reinforce each other’s role in the system but also have clear expectations of their respective roles in the system.

**Cognitive rules.** ICE and cooperatives have also shared value and expectation system because they agree on the importance of hydropower for future development. Simultaneously, MINAE and ARESEP underpin this vision: MINAE’S national plans reinforce hydropower development (MINAE, 2011, 2015) and ARESEP provides the regulatory framework which is limiting DRE (Norm Poasen, 2015). Thus the policy and regulatory framework perpetuate large-scale hydropower development in the future. While my data shows that the problems of hydropower are known, this does not change the regime’s development trajectory. My interviewees highlight the importance of hydropower for the country’s electricity matrix and claim that impact studies sufficiently address environmental concerns. ICE argues: “what we are saying is: well, perfect, we will respect everything [note: all environmental and social concerns]. But then how will we satisfy the demand?” (R8). This notion has also been confirmed by Coopeguanacaste: “We respect the environmentalists. But we do not agree with them (...) We will continue with hydropower” (R9). This shows that despite awareness of the problems, regime actors share a common vision of the role of hydropower in the present and future.

Altogether these regime rules reiterate the importance of future hydropower development as a way to centrally control electricity generation. Because regime actors have a common vision of
hydropower, an interest in maintaining the status quo, they can rely and trust each other. These rules are important for regime stability, what Geels (2004, p. 904) calls “stability by guiding perceptions and actions”. As rules “do not exist as autonomous entities but are linked together”, they interact and interplay and form an “organisational capital” (Geels, 2004, p. 904). This constitutes the “deep structure” of the new electricity regime and is slow to change (Geels, 2004, p. 904).

7.3.2 Technological mechanisms

Technological mechanisms are supporting the cooperatives and ICE to ensure that the future socio-technical regime is centrally controlled by them. Hydropower has been Costa Rica’s main electricity generation mode since the 1940s and future development perpetuates this pathway: ICE and cooperatives want to continue with few but large projects to satisfy national demand (ICE, 2014). Hydropower plants are not only well integrated into the country’s electricity infrastructure but also have been predominantly controlled by the ICE or cooperatives. These hardware characteristics of hydropower have been utilised to strengthen this control in the future. My interviewees stressed hydropower’s inherent characteristic of reliability: thanks to damming, water can be released when electricity is needed: “we need hydropower as firm energy, as back-up” (R8). This is also reflected in policy documents: “hydropower, with reservoirs for regulation, is the most adequate technology” (ICE, 2014). In this context Coopealfarouiz stressed the challenges that DRE would pose because they are unreliable and can mess up the system (R1, R2). Thus, the hardware characteristics of hydropower being reliable are utilised to justify further centralised large-scale hydropower plants in the future; in the process DRE are curtailed. Hence, hydropower is encapsulated in a regime that wants to remain in control in the future.

7.3.3 Social mechanisms

The centralised role of the current regime is also stabilised because it is not only embedded in a top-down governance system but also in Costa Rica’s society and value system. While there is growing discontent with hydropower, generally there is a sense that the state is pursuing electricity development to provide for the people. My interviewees mentioned that in the wider society the state is perceived as father figure (R1, R2, R9). A picture is drawn of the state that provides for advancing development to improve the life of its citizens. ICE – and cooperatives in their respective concession areas – are seen as a “decentralised part of the government” (R8). Therefore, it is assumed that they act in the best of interest for advancing the country’s development. Thanks to these socio-technical interlinkages, change becomes “nearly unthinkable” (Geels, 2004).
7.3.4 Economic mechanisms

Regime stability is also enhanced by the cost efficiency of large-scale hydropower and market barriers for DRE. As Costa Rica has been employing large-scale hydropower since the 1940s, my interviewees stressed that ICE and cooperatives are “experts” (R8) and have “great experience” with hydropower (R7). Thanks to this expertise, cooperatives and ICE reported that they can build hydropower plants cost-efficiently, making it the cheapest option for new projects. This cost-efficiency establishes market barriers that impede market entry for alternative technologies.

Apart from that, high investment costs provide bottlenecks for DRE. My data demonstrated that there is no tax exemption for e.g. solar PV equipment. This financial burden of DRE has also been reflected by my interviewees: Coopealfaroruiz mentioned that “it is a high investment, not every associate has the money” (R1) and ARESEP mentioned that “you need a certain financial background” (R5). Due to lacking economic incentives DRE is only viable for consumers with a relatively high consumption.

Summarising, to answer RQ3, I demonstrated that large-scale hydropower plants are encapsulated in a regime that wants to remain in control of electricity development in the future. There are several interconnected mechanisms that enhance regime stability: (i) institutional rules manifest a centralised system which is run in a cartel-like manner and has established market entry barriers, (ii) on technology side, the hardware characteristics of large-scale hydropower is used to centrally control future development, (iii) on a social level, idealisation of the state contributes to public inertia towards the existing regime, and (iv) not only is hydropower the cheapest electricity source for future developments, but also DRE technologies are experiencing economic bottlenecks. Thus these different interconnected mechanisms contribute to path dependence of the current electricity regime: the regime is so encapsulated in hydropower that this is constraining future alternative pathways.
8. Discussion

Two main themes emerged from my findings:

(i) In the 1960/70s the cooperative model emerged as grassroots community-led innovation within Costa Rica’s centralised electricity system. Cooperatives not only transformed electricity distribution to realise rural electrification but subsequently also reconfigured the electricity generation mode; cooperatives are nowadays part of the socio-technical electricity regime;

(ii) contrary to the assumption that cooperatives are working towards communitarian electricity generation, cooperatives are part of a regime that is encapsulated in large-scale hydropower to remain in control of centralized electricity generation and in the process curtails DRE.

This changing nature and role of cooperatives in Costa Rica’s electricity system has two main implications: Firstly, cooperatives are failing to promote a transition to community-led electricity generation in Costa Rica, also relating back to how community energy should be defined. Secondly, in the light of rising electricity demand and increasing problems with hydropower, community energy could provide a holistic alternative. Next I discuss these implications.

8.1 Community energy: a question of definition?

Cooperatives in Costa Rica are failing to push for a transition to community-led electricity generation; this is related to their changing nature and role in the electricity system. While cooperatives in Costa Rica could be classified as type A energy communities in the 1960s/70s, I argue that nowadays they are not part of this communitarian discourse anymore; instead they can be classified as type B communities (Walker & Devine-Wright, 2008) (see 2.2). This shift is depicted in figure 14 and put into context of Walker and Devine-Wright’s (2008) graph. To recap, for type B communities, ownership and participation are secondary; it is rather important that the economic benefits are going to the community (Walker & Devine-Wright, 2008). This shift of the cooperatives’ nature is due to three main reasons: Firstly, their focus on pursuing more large-scale hydropower and in the process hindering DRE is contrary to the principle of decentralisation which is inherent to type A communities (Kunze & Becker, 2015; Walker & Cass, 2007). Although the cooperatives are investing also in solar PV and wind, these plants are also large-scale and their main future focus is on large-scale hydropower. They have no interest in changing this situation – demonstrated by their effort to curtail DRE.
Secondly, the cooperatives’ local participation element has become questionable. Cooperatives are seen as a decentralised part of the government – and state idealisation has contributed towards public inertia. This has been mirrored by cooperatives themselves who complain about lacking involvement of their associates (R1, R2, R9). Thus, while ownership still remains cooperative, de facto decisions are taken in a centralised manner, by a few associates that are running the cooperative.

Thirdly, cooperatives are nowadays predominantly based on economic interests. While in the 1960s/70s cooperatives were largely founded on social interests of electrification and livelihood improvement, nowadays they are driven by their economic performance. ICE and ARESEP mentioned that “they are de facto businesses” (R4, R8). My data shows that cooperatives are proud to provide their associates with the lowest tariffs in Costa Rica and strive towards maintaining low tariffs in the future (R1, R2, R3, R9, R10). This is also interlinked with their interest in perpetuating large-scale hydropower in the future: they regard this to be the cheapest and most reliable energy form and hope to translate this into an economic benefit – in the form of lower tariffs – to their associates. Thus, nowadays associates of the cooperatives are hence constituting an interest-based community, with the main interest being cheap electricity tariffs.

![Diagram](image)

Figure 14. Situating the cooperatives in relation to project process and outcome dimensions: electrification vs. electricity generation. The arrow depicts the changing nature of the cooperatives that I studied. Adapted from Walker & Devine-Wright (2008, p.498)
This changing nature and role of Costa Rica’s cooperatives relates back to the different types of community energy and the importance of an universal definition of community energy (Walker et al., 2007). As discussed (see 2.2), there is consensus on what energy communities do on a hardware level, but diverging opinions on the software of social organisation. However, I want to open up this debate; I argue that it is not only important how but also what kind of RE projects energy communities pursue. As my case study has shown, Costa Rica’s cooperatives employ RE, but this is (mainly) large-scale hydropower. Thus, what kind of technologies energy communities are pursuing matters – they should be small-scale to be compatible with the notion of decentralisation. Typically, energy communities have employed solar PV, or to a lesser extent wind (REN21, 2016; Roberts et al., 2014). Furthermore, on the project and outcome dimension, disagreement on the definition of community energy leads to the fact that completely different ownership and participation models – ranging from single households, public-private partnerships to citizen initiatives are all somewhere floating under the umbrella of community energy. This may open the door for misusing the word community energy: as the importance of community energy has been highlighted by e.g. COP21 and the SDGs, policy makers are putting more focus on this issue. In this context it is important to ensure that community energy is not applied for projects where community ownership and participation are de facto periphery.

To facilitate a global transition towards a more sustainable energy system using community energy, I argue the definition has to be closer to type A community (Walker & Devine-Wright, 2008). Only this type of community energy can incorporate a sustainability science perspective to overcome the complex and “wicked” energy problem (Rittel & Webber, 1973, p.160): In line with the objectives of sustainability science, type A energy communities envision change to happen at several levels of the electricity system and the systems interconnected with it, involving various actors which facilitate to guide human-nature interaction towards sustainability (Kates, 2011; Kates et al., 2001). Considering the need to facilitate a type A definition of energy community, I argue that sustainability science is an appropriate field for not only initiating this discussion but also implementing it in academia, politics and economic.

### 8.2 Costa Rica at a crossroads

My findings suggest that the current electricity regime is encapsulated in hydropower and different interconnected mechanisms contribute to path dependence that is constraining future alternative pathways. This brings Costa Rica at a “crossroads” – something needs to change (R7).
That change is needed has also been demonstrated by challenges connected to geothermal development: R4, R5 and R8 mentioned that hydropower is valued for its grid stability; the only other possibility would be geothermal which currently constitutes only 8% of Costa Rica’s electricity supply (IRENA, 2016). Law 5961 (1976) established national interest in geothermal energy, following the establishment of some plants. However, the highest geothermal potential is around volcanoes, which are located in national parks; thus, geothermal development is restricted. ICE pushed for opening up national parks for development (Bill 16137, 2006), but this was sacked in Congress – fuelled by the fear that one exemption might lead to further development (Guido-Sequeira, 2015). This demonstrates that using geothermal as an alternative to reinforce centralised large-scale generation is hindered by legal bottlenecks.

Considering this, I argue that Type A energy communities could provide a holistic alternative to tackle Costa Rica’s increasing electricity problems. Considering transition theory this would require community-led electricity generation to develop as a radical alternative (Geels, 2002). There some actors are fighting to implement community energy models of electricity generation; e.g. CUS (R6, R7). Interest in energy communities is present in Costa Rica: this has not only been mirrored by the interest in the 2010 DRE pilot programme (MINAE, 2015) but also confirmed by a small survey conducted by CUS (Utgård & Forn, 2016). This niche would need to gain “internal momentum” which coupled with some landscape pressure could destabilise the existing regime. (Geels, 2014, p.23). However, as my analysis suggests, the current electricity regime is stable, making it difficult for this niche-innovation to gain ground.

Changes on national and international level could change the vision of Costa Rica’s electricity system. Currently, MINAE shares a common vision with ICE and the cooperatives about how electricity development is to be pursued in the future. This could change: ARESEP mentioned that in the upcoming presidential elections the running candidates have different visions about Costa Rica’s future electricity system (R4). If a new government has a different idea of how electricity development is to be pursued in the future, then MINAE may provide a new policy framework and ARESEP a different regulatory framework. This could put pressure on the existing electricity regime and foster change towards more community energy in the electricity system. Also at international level community energy is becoming more prevalent: As COP21, the SDGs and the upcoming RE conference MEXIREC\(^8\)

\(^8\) The Mexican RE Conference (MEXIREC) is part of an international conference series. This year for the first time, focus is given to community energy (REN21, 2017).
demonstrate, community energy is turning into a global debate topic (IPCC, 2012; REN21, 2017; UN, 2015). This in turn could put pressure on the political level as well as the electricity regime.

Considering these developments, the question arises what role the Costa Rican state-government (and MINAE) should take in a transition towards more community energy. Scholars have long debated about the role of the state for enabling transitions: for example Hildingsson (2014) sees the state as the central role in transitions; Rosenau (2004) criticizes the dominant role of the state due to its implied power relations and Rotmans et al (2001) argue that not one actor can solely push for transitions which requires a steering and managing role of the state.

Therefore, I argue that in the face of overall strong state presence in Costa Rica, the state-government should be steering and managing the transition towards more community energy (Rotmans et al., 2001). As my findings suggest, civil society perceives the state as a father figure (R1, R2, R9). Within this value system, the state could encourage the participation of multiple actors (Rotmans et al., 2001) and be a crucial motivators for niches to shape and transform the system (Markantoni, 2016).

8.3 Pathways forward – policy recommendations

Based on Rotman’s et al (2001) here I make some recommendations how the state could facilitate transition management towards community energy:

(i) Integrate long-term thinking into national plans. Currently national plans cover the upcoming 10-15 years (MINAE, 2011, 2015), but they focus on the role of large-scale technologies (mainly hydropower, see 7.2.1). To account for problems of climate change and increasing electricity demand, national plans should also assign a strategy for community energy using small-scale technologies;

(ii) This also links to integrate multi-domain, multi-actor and multi-level thinking in planning. Currently the regime is only focused on solving increasing problems within its centralised electricity system. With their participatory, bottom-up approach, type A energy communities could integrate not only more actors into the system (Walker et al., 2010), but also advance socio-economic development in vulnerable, predominantly rural regions (Roberts et al., 2014). Thus, community energy can provide a holistic alternative to address the interconnectedness in Costa Rica’s complex electricity system.

(iii) Improve the current electricity system. Currently, hydropower developments neglects social and environmental concerns (R6, R7). This system could be improved by enhancing
public participation among affected communities and improving environmental assessments and feasibility studies.

(iv) Promote energy communities as *system innovations*. For energy communities to develop as niche-innovations, they would require not only a stable policy environment and regulatory framework but also direct/indirect support (REN21, 2016). This could e.g. take the form of Feed-in-Tariffs, which have proven to be effective in Germany (Couture & Gagnon, 2010; Lesser & Su, 2008); or community energy quotas, similar to RE quotas (Ringel, 2006) or financial support for capital investments.
9. Conclusions

In the context of rising concerns about our energy system, community energy has been proposed as a holistic alternative that can enable socio-technical transitions to RE. To understand the dynamics of transformation to more community-led energy systems, I conducted an in-depth case study of Costa Rica’s cooperatives between the 1960s and today. Using the MLP, I illustrated the developments at the different levels contributing to their emergence: (i) ICE showed no interests in rural electrification, (ii) cooperatives had shared expectations, gained internal momentum by learning processes and external support from AF and NRECA, and (iii) socio-economic developments made rural electrification a national topic; coupled with US interest in putting Costa Rica under its zone of influence. This opened a window of opportunity: cooperatives were added to the electricity regime to solve rural electrification. With increasing electricity demand and rising prices, cooperatives opened up the centralised electricity generation system, hence triggering a regime reconfiguration. By the early 2000s cooperatives were not only distribution but also electricity generation regime actors, thus forming part of the current electricity regime.

While cooperatives successfully changed the electricity regime, they did not challenge the electricity generation mode. Cooperatives are part of a regime that despite increasing electricity demand, environmental and social problems of hydropower, is encapsulated in large-scale hydropower to remain in control of centralised electricity generation; in the process they curtailed DRE. Interconnected mechanisms reinforce regime stability: (i) on institutional level, the electricity system is highly centralised, run in a cartel-like manner and provides market entry barriers, (ii) on technology side, the hardware characteristics of large-scale hydropower is used to centrally control future development, (iii) on a social level, idealisation of state-actors as father figures contributes to public inertia, and (iv) hydropower is the cheapest source for future developments and DRE are experiencing economic bottlenecks. These interconnected mechanisms contribute to path dependence on hydropower which constrain future alternative pathways.

These findings imply that Costa Rica’s cooperatives are failing to push for a transition to community-led electricity generation. This is related to their changing role and nature within the electricity system: While cooperatives were type A energy communities in the 1960s/70s, nowadays they are not part of this communitarian discourse anymore and changed to type B communities. Thus, returning to my title, in Costa Rica, community energy does not necessarily mean that there is a high degree of community participation - that a community is ‘empowered’. It depends how community energy is defined and what it really means. For Costa Rica this means that the current stable electricity regime
cannot address its problems. Considering this, I argued that type A energy communities could provide a holistic alternative; this would require transition management, which could be facilitated by the state/MINAE.

The cooperatives’ shift from type A to B energy community raises the question from where this change originated. Further research is needed to gain knowledge about the mechanisms contributing to such changes. This could also include investigating inter-regime dynamic and agency, thus analysing power relations between ICE and cooperatives. Against the background of energy community becoming a global topic, further research in sustainability science is needed to find a universal definition of community energy. In this context my thesis may serve as a starting point to initiate this discussion.
10. References


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Islar, M., & Busch, H. (2016). “We are not in this to save the polar bears!” – the link between community renewable energy development and ecological citizenship, 1610(January 2017). https://doi.org/10.1080/13511610.2016.1188684


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## 11. Appendixes

### Appendix 1: RE generation of the four cooperatives and Conelectricas

<table>
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<tr>
<th>Cooperative</th>
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Source: Annual reports of Conelectricas, Coopeguanacaste, Coopelesca and Coopesantos (Conelectricas, 2014; Coopeguanacaste, 2015; Coopelesca, 2015; Coopesantos, 2016)
Appendix 2: List of Electricity legislation from MINAE/DSE

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### Appendix 3: National plans

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### Appendix 5: Interview guide for cooperatives

| Personal information | • What is your name?  
|                      | • What is your position in the cooperative?  
|                      |   o How long have you been in the job?  
|                      |   o Can you briefly tell me what your job entails?  
|                      |   o What made you pursue a job in this cooperative?  
| Niche creation       | • Why has your cooperative been established? What was its objective?  
|                      | • How would you define an energy cooperative?  
|                      | • Who is represented in your cooperative? Both genders?  
|                      | • How has energy access improved the livelihoods of people in the region?  
| Role of cooperative  | • What do you see as the role of energy cooperatives in Costa Rica at the moment? What is their importance?  
| regime interaction   |   o What about the role of your cooperative?  
|                      |   o What is needed for them to flourish?  
|                      |   o What could the government do?  
|                     | • Do you feel like your cooperative is receiving enough policy support?  
|                     | • How is your relationship with ICE and ARESEP?  
|                     | • Do you communicate often?  
| Transformation       | • To generate electricity:  
| pathway              |   o How do you go about it?  
|                     |   o Where do you get the money from?  
|                     |   o What is your driver: To cover own electricity needs or to sell it back to the grid?  
| Cooperatives as      | • Is there a problem with hydropower?  
| regime actors        |   o If yes, in how far have hydropower plants impacted the communities and livelihoods?  
|                     | • In how far is your cooperative involved in distributed renewable electricity generation?  
| Way forward          | • What is the vision for your cooperative in 10 years?  
|                     | • How do you expect your cooperative to be involved in electricity generation over the next 10 years?  
|                     | • How could a policy framework support energy cooperative to grow? Is this important?  

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## Appendix 6: Interview guide for ICE and ARESEP

| Personal information | • What is your name?  
• What is your position in ARESEP/ICE?  
  o How long have you been in the job?  
  o Can you briefly tell me what your job entails?  
  o What made you pursue a job in this field? |
|---|---|
| Regime stability | • What are the objective of ARESEP/ICE?  
• How has ARESEP/ICE developed over the past years?  
• How has energy access improved the livelihoods of people in the region? |
| Role of cooperative | • What is an electrification cooperative for you?  
• What do you see as the role of energy cooperatives in Costa Rica at the moment? What is their importance?  
  o What is needed for them to flourish?  
  o What could the government do? |
| Niche-regime interaction | • Do you feel like cooperatives are receiving enough policy support?  
• How is the relationship between ICE and ARESEP and the cooperatives?  
• Do you communicate often? |
| Stability of the new regime | • Is there a problem with hydropower?  
  o If yes, in how far have hydropower plants impacted the communities and livelihoods?  
• In how far is your cooperative involved in distributed renewable electricity generation? |
| Way forward | • What is the vision for ARESEP/ICE in the next 10 years?  
• How do you expect your cooperative to be involved in electricity generation over the next 10 years?  
• How could a policy framework support energy cooperative to grow? Is this important? |
# Appendix 7: Interview guide for CUS

| Personal information | • What is your name?  
|                      | • What is your position in CSU?  
|                      |   o How long have you been in the job?  
|                      |   o Can you briefly tell me what your job entails?  
|                      |   o What made you pursue a job in this field?  |
| Information about CSU | • What is the objective of CSU?  
|                      | • What are sustainability challenges in Costa Rica?  |
| Role of cooperative | • What do you see as the role of energy cooperatives in Costa Rica at the moment? What is their importance?  
|                      |   o What is needed for them to flourish?  
|                      |   o What could the government do?  |
| Path dependence of new regime | • How do you perceive the electricity system in Costa Rica?  
|                      | • Are there any problems with that system?  
|                      | • Is there a problem with hydropower?  
|                      |   o If yes, in how far have hydropower plants impacted the communities and livelihoods?  
|                      | • Why is there no energy communities in Costa Rica like in Europe, USA? What are the problems with DRE?  
|                      | • What mechanisms does the ICE/ARESEP/cooperatives use to maintain the status quo?  
|                      | • Why do you think they are not interested in changing away from hydropower?  
|                      | • What could be the role of solar PV and wind power?  |
| Way forward | • What is the vision for CSU in 10 years?  
|            | • How do you expect your cooperative to be involved in electricity generation over the next 10 years?  
|            | • How could a policy framework support DRE to grow? Is this important?  |
## Appendix 8: List of interviews

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