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From a Monopoly to an Entrepreneurial Field: The Constitution of Possibilities in South African Energy

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Abstract
In this paper, we draw on a performativity perspective to conceptualize entrepreneurial opportunities as possibilities constituted through discursive-material practices within a field. Based on an analysis of a longitudinal qualitative case study in the field of South African energy from 2007 to 2018 we develop a process model of how possibilities become constituted over time as entrepreneurial actors enact different sets of discursive-material practices. Our process model contributes to entrepreneurship research by examining the transition process from a heavily regulated and tightly controlled field – to an unsettled and entrepreneurial field. The transition is reflected in the frames that organize field actors' discursive-material practices, starting with a single, closed frame that limits existing possibilities, moving to an emergent frame that introduces complementary possibilities, and then an open frame which generates both complementary and competing possibilities. We discuss how our process model contributes to research adopting a performativity perspective and conclude with implications for further research.

Keywords: Entrepreneurial Opportunities; Performativity; Frames; Discursive-material practices

Executive Summary

Entrepreneurship in regulated, monopoly markets is challenged by powerful incumbent actors, who use their ties to regulators to maintain their position in the market (Aldrich and Baker, 2001; Russo, 2001). However, these incumbent actors cannot maintain their positions forever as they are exposed to multiple and sometimes conflicting demands from both the regulators and their customers, while also dealing with legacy technologies and financial challenges (Pache & Santos, 2010; Kraatz and Block, 2008). Although previous research has produced explanations of how incumbent and entrepreneurial actors resolve conflicts and achieve consensus, more recent research has called for a need to examine entrepreneurship where agreement cannot be achieved and meanings of market frames remain contested (Hiatt and Carlos, 2019; Kaplan, 2008).

In this paper we build on previous research, that has examined how practices become framed among actors, to capture entrepreneurial possibilities and institute change (Ansari et al, 2013; Kaplan, 2008;

Lounsbury et al, 2003). Drawing on a performativity perspective (Cabantous et al, 2018; Gond et al, 2016; Garud, Gehman and Giuliani, 2014; Garud, Gehman and Giuliani, 2018), we conceptualize entrepreneurial opportunities as *possibilities constituted through discursive-material practices within a field* (Garud, Gehman and Tharchen, 2018) where actors frame some discursive-material practices as possible and others as impossible.

Based on an analysis of a longitudinal qualitative case study in the South African energy field from 2007 to 2018 we develop a process model of how possibilities become constituted over time as entrepreneurial actors enact different sets of discursive-material practices. Our process model contributes to entrepreneurship research by examining the transition process from heavily regulated, closed and tightly controlled fields – to emerging, unsettled and entrepreneurial fields. The frames that organize field actors' discursive-material practices reflect this transition, starting with a single, closed frame that limits existing possibilities, moving to an emergent frame that complements existing possibilities, and then an open frame which generates both complementary and competing possibilities. Each frame binds actors to certain practices while blinding them to others. Such inclusion and exclusion culminate into critical events where some actors begin to contest previously dominant practices. New frames are added to existing ones, organizing new sets of practices that complement and compete with existing possibilities within a field. We discuss how our process model contributes to research adopting a performativity perspective and conclude with implications for further research.

1. Introduction

A number of scholars have recently called for a need to "contextualize entrepreneurship, particularly in ways that extend the narrow, individualistic perspective on entrepreneurs that has largely dominated the literature" (Lounsbury, Gehman and Glynn, 2019, p. 18; also see Autio et al, 2014; Garud, Gehman and Giuliani, 2014). Such calls have been motivated by the desire to move beyond taken-for-granted understandings of entrepreneurial opportunities derived from theories of the 'individual-opportunity nexus' (Shane and Venkataraman, 2000; Shane, 2012), and are also related to the debate whether entrepreneurial opportunities are discovered or created (Alvarez and Barney, 2007; Alvarez et al., 2013; Davidsson, 2015; Venkatraman et al, 2012). Drawing on the performativity turn in the social sciences

(Butler, 2010; Callon, 2010), but also in organisation, management and technology studies (Cabantous et al, 2018; Gond et al, 2016; Orlikowski and Scott, 2015), recent commentaries have argued that entrepreneurial opportunities are not a thing that entrepreneurial actors either discover or create (Garud, Gehman and Giuliani, 2014; Garud, Gehman and Giuliani, 2018; Garud, Gehman and Tharchen, 2018;). Rather, entrepreneurial opportunities are *possibilities which are constituted through discursive-material practices within a field* (Garud, Gehman and Tharchen, 2018). A field is understood as a sociotechnical space enacted by an aggregate of actors that together "constitute a recognized area of institutional life" (DiMaggio and Powell, 1983, p. 148). As discursive-material practices get reinforced, expanded and transformed, so too do the possibilities for entrepreneurial actors within a field.

In this paper we examine the constitution of possibilities in the South African energy field from 2007 to 2018. This field has long been plagued by carbon-intensive and unreliable energy supply practices, as well as by endemic consumer problems of non-payment and electricity theft. Following the shift towards liberalization of the energy market in 2011 and the influx of renewable technologies, practices contributing to decarbonising have developed through renewable energy generation; and new entrepreneurial actors, who had previously been excluded from participation, have been mobilized through the Renewable Energy Independent Power Producer (REIPP) programme. In more recent years, the programme has been challenged by claims of overpriced renewable energy and reluctance by the monopoly electricity supplier Eskom to sign power purchase agreements with renewable energy generators.

This empirical setting has been chosen because it allows us to examine how discursive-material practices change over time and how new entrepreneurship possibilities are constituted. Previous empirical studies of entrepreneurship adopting a performativity perspective have prioritized discursive over material practices, with the latter often understood as a consequential outcome of the former (Andre et al, 2018; Drori et al, 2018; Snihur et al, 2018). Such studies have tended to focus on micro changes in the practices of entrepreneurial actors and the business possibilities they open up, while losing sight of changes across the field. In this paper, rather than placing emphasis on the relationality between discourse and materiality, we trace the relationality among sets of discursive-material practices enacted across the field over different time periods. This approach has enabled us to examine how the

possibilities in a field, like the South African energy sector, become constituted through discursive-material practices. We ask, *how do possibilities become constituted over time within a field as entrepreneurial actors enact different sets of discursive-material practices*?

In answering this question we build on previous research, that has shown how practices become framed among actors, to capture entrepreneurial possibilities and institute change (Ansari et al, 2013; Kaplan, 2008; Lounsbury et al, 2003). Adopting a performativity perspective, our theoretical analysis shows how discursive-material practices are organized through a framing process which binds actors to specific discursive-material practices while blinding them to others. This process of inclusion and exclusion within a field renders entrepreneurial possibilities and culminates into critical events as some entrepreneurial actors begin to contest previously dominant practices and to enact new practices. For instance, during 2007-2011 Eskom enacted the discursive-material practices of educating consumers to minimize their energy consumption and encouraging technology substitutions for energy efficient technologies. These practices were aimed at meeting consumers' demand, managing low cashflows and overcoming the lack of investment in, and maintenance of, existing infrastructures. These practices excluded energy generation from renewable sources and slowly became marginalized, culminating in a critical event in 2011 when the government opened energy generation for private sector participation. At that point in time a new frame emerged which included possibilities for renewable energy generation by independent power producers.

Drawing on our findings, we develop a theoretical process model for the constitution of entrepreneurial possibilities over time. Our process model contributes to entrepreneurship research by showing the transition from heavily regulated and tightly controlled monopoly fields to unsettled and entrepreneurial fields. The model presents a succession of frames that organize field actors' discursive-material practices; starting with a single, closed frame that limits existing possibilities, moving to an emergent frame that introduces complementary possibilities, and then an open frame which generates both complementary and competing possibilities. The identification of a new theoretical process model contributes to the development of future entrepreneurship research in a number of ways.

First, our model clarifies that entrepreneurial possibilities are shaped not only by the inclusion of some discursive-material practices but also by the exclusion of others. Past research on entrepreneurship

suggests that in tightly regulated fields powerful incumbent actors maintain their practices while excluding new practices from new actors (Aldrich and Baker, 2001; Russo, 2001). Whilst we have observed such exclusions in our case study, we show that excluded practices also shaped new entrepreneurial possibilities. Excluded entrepreneurs found ways to maintain their ventures by pursuing auxiliary, but complementary, possibilities, thus not posing a competitive threat to incumbent actors. Over time, new frames were added that enabled both included and excluded practices to collectively constitute the possibilities in a field.

Second, previous research has shown that entrepreneurs are better off adopting a frame that is similar to that of incumbent actors and creating an initial positive regulatory response by presenting their practices as complementary to existing ones (Gurses and Ozcan, 2015; Hiatt and Carlos, 2019). Our study confirms these findings. However, we also show that the addition of frames with congruent discursive-material practices generates complementary possibilities within the field, while the addition of incongruent discursive-material practices creates competing possibilities. Our process model emphasizes the need to consider the congruency and incongruency of the discursive-material practices as they are generative of complementary or competing possibilities in the underlying framing process.

Finally, our process model points at the transformation of possibilities through unintended consequences (Heinze et al, 2016; Kahl, 2018). We show that as a field transitions from tight control and regulation to an open market driven by entrepreneurship congruent practices can become incongruent. Whereas some incongruence leads to competition and innovation, too much incongruence in practices leads to opportunistic behaviours and market disaggregation (Abolafia, 2001). Market disaggregation is as constraining as market concentration and both can culminate in critical events and new framing cycles. Thus, discursive-material practices need to be governed along a spectrum of congruent and incongruent practices, inviting a balanced set of complementary and competing possibilities across distributed actors.

We conclude with implications for further entrepreneurial research. In particular, we discuss how our process model can be applied in emerging fields such as the mobile payments field, where new actors contest the previously closed frames of incumbent banks to constitute new possibilities.

2. Literature Review

2.1 Performativity in Entrepreneurship Research

Studies of entrepreneurship drawing on performativity diverge from views of entrepreneurial opportunities as entities to be discovered or created (Garud, Gehman and Giuliani, 2014; Garud, Gehman and Giuliani, 2018) by casting opportunities as possibilities generated through discursive-material practices within a field (Garud, Gehman and Tharchen, 2018). This position is also evident in studies of cultural entrepreneurship (Lounsbury, Gehman and Glynn, 2019; Lounsbury and Glynn, 2019; Gehman and Soublière, 2017).

Empirical studies of entrepreneurship adopting a performativity perspective have approached the process of generating possibilities as preceded by discursive practices. For example, drawing on speech acts theory (Austin, 1962) Snihur et al (2018) find that Salesforce was able to generate new possibilities by signalling market leadership early on through a series of discursive framing practices targeted at its ecosystem partners. Similarly, Drori et al. (2018) show how gender markers in the language of microfinance institutions shaped the financial inclusion of women entrepreneurs.

Studies have also explored how discursive practices become inscribed in material devices, thereby shaping possibilities for entrepreneurs. For example, Doganova and Eyquem-Renault (2009) show how business models emerge through entrepreneurial narratives; discursive practices that later come to both describe a plan for action and calculate what each actor should do in order to achieve a desired outcome. Similar studies explore how material devices such as business plans and models (Doganova and Giraudeau, 2014), method handbooks for technological incubators (Leca et al, 2014), and performance metrics for social entrepreneurship (Andre et al, 2018; Petitgand, 2018) emerge through discursive practices that form new possibilities within a field. So, even though these studies acknowledge the dynamic relationship between the discursive and the material, they separate the two as distinct.

Problematizing the underlying assumptions (Alvesson and Sandberg, 2011) of existing empirical research adopting a performativity perspective shows that existing empirical studies have separated the discursive intention of entrepreneurial actors that frames those actors' knowledge of the world from the material devices that come to determine the causal relationships between actors. Guided by the

assumption that discourse precedes over materiality, previous empirical research on performativity has been open to critiques of conflation of performativity with constructivism (see debate between Garud, Gehman and Giuliani, 2018; and Packard, 2018).

In contrast to these empirical studies, theoretical commentaries explaining the distinct assumptions of the performativity perspective have repeatedly argued that materiality is not separate from discourse (Cabantous et al 2018; Garud, Gehman and Giuliani, 2014; Gond et al, 2016; Orlikowski and Scott, 2015). Rather, materiality and discourse are operationalized through *discursive-material practices*; "discourse lacks an independent, self-contained existence apart from material instantiation in some form" (Orlikowski and Scott, 2015, p. 699). By focusing on discursive-material practices as opposed to separate discursive and material elements we can better capture performativity where "social and material entities are co-constituted in the sayings and doings of heterogeneous actors" and by extension, "material and social entanglements shape how we know and so, constitute what we know" (Garud, Gehman and Giuliani, 2018, p. 62).

In this paper we do not place emphasis on the relationality between discourse and materiality as previous studies have done. Rather, we trace the relationality among sets of discursive-material practices enacted over different time periods. This approach avoids treating discourse as a determinant of change, while treating materiality as merely a consequence. Instead, discourse and materiality are viewed as jointly constituting practices. By examining the temporal relationality between sets of discursive-material practices we aim to capture how possibilities are constituted within a field over time. Previous research has examined how practices become framed across actors to capture entrepreneurial possibilities and institute change. We turn to this literature next and establish links with our performativity perspective.

2.2 How Possibilities Are Constituted through Framing Processes

The construct of frames or framing has been widely adopted in management and organisational theory (Cornelissen and Werner, 2014). The construct has been applied in micro research on managerial cognition and decision-making (e.g. Benner and Tripsas, 2012; Hodgkinson et al, 1999); meso research on strategic framing and meaning construction (e.g. Barrett et al, 2013; Kaplan, 2008; Kwon and

Constantinides, 2018); and macro research on field-level frames and institutional change (e.g. Ansari et al, 2013; Lounsbury et al, 2003).

Research has placed emphasis on 'frame shifts' (Ansari et al, 2013) or 'framing contests' (Kaplan, 2008) to examine how groups of actors use frames as a strategic practice to mobilize change. This research points at cognitive, discursive and cultural processes for constituting new possibilities in a field. Through such processes groups of actors seek to bridge previously unconnected frames and/or replace them with new ones to mobilize collective action and change (Barrett et al, 2013). Thus, the framing process can lead to changes in the field and the possibilities available to different groups of actors (Ansari et al, 2013). In other words, the framing process does not necessarily point to linear change nor consensus, but rather to a compromised settlement of what could be included or excluded as possibilities, which may lead to a new framing cycle.

In this paper, we build on the aforementioned research and conceptualize frames *as binding actors to specific discursive-material practices, while blinding them to others*. Frames are the outcomes of joint activity (Goffman, 1974), that include certain discursive-material practices, while excluding others (Callon, 1998). As Callon (1998, p.249) explains, the framing process:

> *…presupposes actors who are bringing to bear cognitive resources as well as forms of behaviour and strategies which have been shaped and structured by previous experience… But the framing process does not just depend on this commitment by the actors themselves; it is rooted in the outside world, in various physical and organisational devices. This is why framing puts the outside world in brackets, as it were, but does not actually abolish all links with it.*

In other words, even though the discursive practices of human actors (e.g. a policy maker, an entrepreneur) are immediately identifiable (Ansari et al, 2013; Kaplan, 2008), the framing process is simultaneously mediated by material practices (Butler, 2010; Pickering, 1995). There are two points that deserve attention here. Firstly, the discursive intention is not simply a speech act uttered by a human actor, but rather a discursive-material practice, whereby the intention is always mediated by extant material devices "rooted in the outside world" (Callon, 1998). Secondly, once that intention is uttered, the distributed relations between humans and material devices (e.g. technologies) are reconfigured toward new possibilities. That is why Callon (1998) argued that framing does not shed all links with the outside world. New possibilities will be constituted through the discursive-material practices enacted by different actors, as they resist or accommodate the framing process (Pickering, 1995).

Consider, for example, how deploying solar panels on rooftops as on-demand energy generation assets become binding frames for renewable energy entrepreneurs and energy consumers through supply and demand based economies of scale. Solar panels and other renewable energy generation technologies become both the discursive intention in a new policy towards renewable energy generation *and* the material device with which to capture new possibilities in a field. Thus this set of technologies simultaneously frames the discursive intention to take renewable energy to market *and* the relations between entrepreneurs and possibilities.

This framing process of inclusion and exclusion culminates into critical events as some actors begin to contest previously dominant practices and to enact new practices that may transform a field (cf. Lounsbury, 2003). For example, poor energy generation by a monopoly provider may lead to a crisis with lobbying towards the liberalization of the market. Lobbying suggests that new groups of actors in the field contest the existing frame and underlying practices (cf. Ansari et al, 2013). A particular crisis event then can be marked as a point of mediation, signifying the emergence of a new frame and the "impossibility of ex nihilo creation", as Latour (1996, p. 237) notes. Critical events stand as points of mediation between frames, separating past from future discursive-material practices, puncturing the relationality between different sets of discursive-material practices, and generating momentum for the bottom-up emergence of a new frame. This is important for understanding how the possibilities within a field change over time and correspondingly how entrepreneurs respond to those changes.

In the next section we discuss how we operationalized this performativity perspective to better theorize the temporal relationality between progressive sets of discursive-material practices. To do so we draw on an empirical study of the constitution of possibilities in the South African energy field from 2007 to 2018.

3. Case and Methods

3.1 Case Setting

Energy policies of the late 1990s have led to the widespread liberalization of energy markets and the unbundling of monopolies. However, these changes have largely bypassed the energy sector of South Africa, which remains dominated by the state-owned monopoly Eskom. South Africa, like other countries around the world, has faced increasing demand for energy while struggling with declining

generation capacity and an aging infrastructure. Eskom's short-term response has involved extensive electricity cuts, while its long-term response has involved considerable investments in additional generation capacity which are consistently overdue and over budget. Due to the severity of the experienced electricity cuts, energy consumers have been progressively switching to alternative generation options. At the same time Eskom continues to incur high levels of technical and non-technical losses. Technical losses occur because of faulty equipment such as electricity transformers. Direct non-technical losses occur as a result of people tampering with equipment, setting up illegal connections or devising other mechanisms for electricity theft. Indirect non-technical losses consist simply of consumer non-payment.

Following the first energy crisis in South Africa (2007-08), the government has sought Independent Power Producers (IPPs) to help resolve the energy supply challenges of the country by boosting generation capacity and improving the energy mix through renewables. IPPs were to be coordinated through the Renewable Energy Independent Power Producer (REIPP) programme, launched in 2011. Eskom was appointed as the designated buyer for the electricity generated by IPPs through Power Purchase Agreements (PPA), thus confirming its monopoly position in terms of the distribution and sale of electricity in South Africa. Eskom's biggest customers are local municipalities, who then re-sell the electricity to consumers in their municipal area, while adding a markup fee. The REIPP programme was intended to stimulate innovation and improve the generation capacity in the country through renewable energy generation. The challenge for Eskom was that by adding renewable energy sources to its electricity grid, which had always relied on coal and crude oil, the very management of the grid became increasingly more complex, while entering a "death spiral" of increasing prices and lower sales levels (Costello and Hemphill, 2014).

There are multiple reasons behind the continuous increase in Eskom's electricity price. These include: (a) Eskom's aging infrastructure, compounded by a poor maintenance record and consistently running at high utilization (NERSA, 2019); (b) its financial debt due to non-payments by municipalities (amounting to Rand 15 billion[1]) and residential consumers, as well as due to corrupt practices

[1] See https://www.thesouthafrican.com/eskom-municipal-debt-october-2018/. 1 Rand equals 0.060 US Dollars.

(Department of Public Enterprises, 2019); and (c) the financial instability caused by the repeated government subsidies aimed at addressing the first two reasons and saving the state monopoly from collapsing (Deloitte, 2017). The rising electricity prices often had ambiguous effects, ranging from curtailing electricity demand (i.e. energy 'load'), increasing its variability, or leaving it unchanged.

As part of its attempts to cope with the 'death spiral', Eskom started considering the potential use of new digital technologies for balancing the supply and demand for electricity. As early as 2014, Eskom developed a smart grid strategy and started deploying what they called 'smart meters' in major municipalities (Eskom, 2014). Smart meter implementations have taken place almost exclusively in affluent municipalities where there has been sufficient demand from consumers for their enhanced capabilities and therefore a willingness to cover installation costs. According to the South African Smart Grid Initiative (SASGI), supported by the South African National Energy Development Institute (SANEDI), several pilots have been carried out across affluent municipalities, followed by the implementation of approximately 65,000 smart meters (SAMSET, 2015).

However, for other, less affluent municipalities the key objective has been to increase revenue collection and limit unpaid-for energy consumption. The main route to achieve this has been the installation of prepaid meter technology through Eskom's 'Electricity for All' programme[2] (van Heusden, 2009), an initiative started in the mid-1990s and running to this date. In this context it is important to note that thirty to forty percent of the revenue stream of municipalities in South Africa is attributed to the sale of electricity. As the majority of energy consumers are serviced by municipalities[3] there is a strong incentive to protect this revenue stream. Because of the upfront capital investment required, the implementation of smart meters has been perceived as risky among municipal actors in South Africa.

As evident from the above description of the context, the energy field in South Africa provides an ideal case study to examine the constitution of possibilities through progressive sets of discursive-

[2] On the one hand this programme intended to provide electricity to the poor and black household majority who had been largely denied access to electricity during the Apartheid, but on the other hand it was an effort to correct past financial imbalances and protect revenue collection (van Heudsen 2009).
[3] Approximately 5 million consumers are billed directly by Eskom and the rest – approximately 44 million consumers – are billed by municipalities.

material practices within a field. Firstly, the shift towards liberalization of the energy market in 2011 has opened up new possibilities to more actors who had previously been excluded from participation. Secondly, in recent years, new energy technologies connected to smart grids have emerged as viable alternatives to coal power generation. With an abundance of renewable resources and widespread use of renewable energy technologies such as solar panels and wind turbines South Africa stands as an exemplar of the range of new possibilities renewables can open in the global south.

We focused our research on events in the ten years that followed the first crisis in 2007-8. We defined this period as marking the start of the shift towards liberalizing energy generation and, therefore, the beginning of the constitution of possibilities for different actors. The year 2018 is also important because it signifies a turning point for Eskom's monopoly on the generation of electricity in South Africa as a bill has been put forward in parliament to provide for the establishment of an Independent System and Market Operator[4] owned by the state that will buy electricity from any electricity generator.

3.2 Data Collection

Following the example of existing empirical studies of performativity (Ansari et al 2016; Gehman et al 2013), we collected data from multiple sources including archival records and interviews with different actors in the South African energy field. Archival data included publicly available documents, scholarly articles and business cases on South Africa's energy field, as well as white papers produced by Eskom, but also other actors such as technology providers (e.g. Siemens, Cisco), and independent power producers (e.g. Pele Green Energy, Zeroth Energy). We also collected media articles on announcements, commentaries and analyses of the launch and deployment of the REIPP programme in local newspapers, websites and TV channels. These were all important 'texts' enabling us to analyse recollections of the past and anticipations of the future (Boje, 2011).

Our primary data was collected through 60 interviews with different actors in South Africa's energy sector, conducted in three phases over three consecutive years (August-November 2016; March-July 2017; November-December 2018) as seen in Table 1. The first phase of our data collection focused on the objective of understanding technology diffusion (e.g. smart meters and IoT) in the South African

[4] See https://www.moneyweb.co.za/news/south-africa/the-beginning-of-the-end-of-eskoms-monopoly/

energy field and thus most of our interviewees came from companies such as Siemens, Schneider Electric, Ericsson, Cisco and others. Through these interviews we realized that even though these companies provided the technology, new possibilities in the South African energy field were also constituted through new policy and legislation from the independent power producers programme, as well as through the independent power producers themselves. Therefore, the second and third phases focused primarily on these entrepreneurs, whilst also seeking the views of other actors in the energy field such as municipalities and energy consultancy companies that often acted as coordinators of engineering, procurement and construction (EPC) consortia.

Insert Table 1 Here

Interviews lasted between 1 and 1 ½ hours. Even though the majority of interviewees felt comfortable to have their interview recorded, some asked us not to record because the information being disclosed was sensitive due to competition. In total, 51 out of the 60 interviews were recorded. For the remaining nine interviews we were allowed to take notes after having assured them that the data would be anonymized.

Interviewees included energy entrepreneurs sponsored by the REIPP programme (e.g. Pele Green Energy), as well as ones without links to the programme (e.g. Zeroth Energy). In addition, we conducted interviews with representatives of international entrepreneurial companies looking to establish themselves within the South African energy field (e.g. Canadian Solar). Interviewees also included municipal actors and representatives of municipal energy companies (e.g. TUMS) who were engaging in entrepreneurial activity by reconfiguring their utility services. In addition, we interviewed a considerable number of actors who responded to the entrepreneurial activity in the energy field as incumbents (e.g., Eskom) and digital technology suppliers (e.g. SAP, Schneider Electric).

Interviewees were asked to describe their involvement in South Africa's energy field and how possibilities were constituted, and also to reflect on significant critical events. By collecting narratives from a wide spectrum of actors, we were able to identify patterns in the narratives of different groups.

A comparison of these patterns allowed us to develop a synthesis of our analysis into a detailed composite narrative (Gehman et al 2013).

3.3 Data Analysis

We followed a qualitative process of analysis of discursive-material practices by considering their relationality and temporality (Garud, Berends and Tuertscher, 2018). We did this by focusing on the critical events identified through interviews and archival data collection. We coded these events according to the event's type (e.g., REIPP launch and entry of IPP entrepreneurs in the energy sector), and the tensions and actions that ensued.

Although the REIPP programme launch was seen as the most critical event in the sense that it provided the 'big bang' of what followed, we soon realized that there were a number of other events, actors, and tensions involved, all of which pointed to disconnected, and often contradictory efforts. As we began to code the events involved, we found multiple emergent and nonlinear streams of activities. We identified a number of events as key for understanding how possibilities were constituted by, and for, disparate actors over time. We then used this set of events to construct a chronology. The data is also reflected in our narrative analysis.

Insert Table 2 Here

From this set of events, we focused on three critical events giving rise to three broad sets of discursive-material practices enacted by different actors. These critical events were the first energy crisis of 2007-8, the REIPP programme instituted in 2011, and the 2015 stalemate in the signing of PPA contracts between Eskom and IPP entrepreneurs. These critical events were used to break down our analysis in key frames, namely, the frame of a *centralized carbon-based energy system*, which organized the discursive-material practices of both entrepreneurs and Eskom during the first period of 2007-2011; the frame of *distributed renewable energy generation* which organized the discursive-material practices of IPP during the REIPP programme between 2011-2015 and which was enacted in addition to the frame of a *centralized carbon-based energy system* which organized the discursive-material practices of Eskom from period 1; and the frame of *distributed mixed energy systems* which

organized the discursive-material practices of engineering, procurement and construction (EPC) consortia in period 3 which was enacted in addition to the frames from periods 1 and 2 respectively. As we show in our analysis, frames were additive in that new frames were being added in each period but the frames from previous periods remained. Thus, even though these frames bound these diverse actors to similar discursive-material practices, the latter were differentially enacted as possibilities were being transformed over time. Figure 1 summarizes these frames and the set of discursive-material practices, with more details offered in Table 3.

Insert Figure 1 here

As we immersed ourselves in this analysis, we continued our fieldwork, thus, keeping ourselves in the 'middle of the action', a position that is consistent with the performativity perspective (Gehman et al, 2013). This was done for two reasons. First, we were able to observe and analyze the emerging constitution of possibilities as those were happening (especially during our third fieldtrip). Second, we were able to get our preliminary analysis 'member checked' by different actors (Lincoln and Guba, 1985). Findings from the chronology of events, our interview analysis, and our provisional insights from archival data were analysed in Nvivo to identify key subthemes and theoretical themes in the data, based on our performativity perspective. For illustrative purposes, Table 3 provides abridged examples of our themes along with representative vignettes (Boje, 2011). Table 3 is mirrored in sections 4.1, 4.2 and 4.3.

Insert Table 3 here
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4. Findings

The constitution of possibilities in the South African energy field between 2007-2018 can be divided in three key periods, demarcated by critical events that were prompted by the cumulative effects of preceding discursive-material practices. The first period was characterised by discursive-material practices within the frame of a *centralized carbon-based energy system*. This period started in 2007,

when the first energy crisis and the subsequent electricity price increases took place, and ended in 2011. During this time, Eskom – as a monopoly provider – placed boundaries on the possibilities in the South African energy market. Entrepreneurs' discursive-material practices were congruent to those of Eskom, focusing on customer concerns about energy efficiency and on the substitution of technologies with more efficient or alternative solutions. However, as widespread improved energy demand management practices had done little towards energy generation, Eskom and the Department of Energy jointly focused on addressing the insufficient energy capacity in the country, culminating in a second critical event in 2011 when the REIPP programme was introduced. This second period spanned the years 2011-2015 and incorporated two congruent frames, *centralized carbon-based energy system* (from period 1) and *distributed renewable energy generation.* The discursive-material practices of Eskom maintained their carbon-based trajectory. Nonetheless, Eskom was able to boost its energy availability by purchasing renewable energy from IPPs. Thus, the practices situated in the two frames were congruent. During this period, new entrepreneurial possibilities (e.g. electrification of remote communities) – in addition to the possibility for IPPs to generate renewable energy and sell to Eskom at a fixed price – began to emerge. Eventually, the REIPP programme was met with criticism about overpriced energy and job losses, which in turn led to a perceived crisis of oversupply at the end of 2015. The REIPP programme was caught up in an impasse whereby Eskom refused to sign supply contracts with 27 IPPs. This crisis culminated in a third critical event and triggered a new period, spanning the years 2015-2018. This period was characterized by practices leading to the emergence of the frame of *distributed mixed energy systems*. This frame bound discursive-material practices that were congruent with the frame of distributed renewable energy generation (from period 2) and incongruent with the frame of centralized carbon-based energy system (from period 1). Eskom continued acting as an integrated operator for energy generation, transmission and distribution, and IPPs continued to be constrained by regulation in terms of the generation segment. Nonetheless, other actors such as municipalities, technology partners, energy entrepreneurs, EPC consortia and consultants began to enact practices that leveraged the generativity of digital technologies. Such practices led to the distributed constitution of entrepreneurial possibilities, consistent with a mixed-energy future.

In the next three subsections, we present our theoretical analysis of the case by breaking down events across the aforementioned time periods and highlighting the discursive-material practices enacted by distinct sets of actors.

4.1 Period 2007-2011.
Frame: *Centralized Carbon-based Energy System*

The journey of the South African energy sector from a monopoly to an entrepreneurial field started with the first energy crisis in 2007, when Eskom began to regularly carry out 'load shedding' on the grid i.e. switching off electricity supply to parts of the grid in order to ensure that energy demand (or 'load') does not exceed energy supply. The origins of the crisis were rooted in a range of historical practices. The South African government had not implemented any energy unbundling policies that would separate generation, transmission and distribution, even though the need for unbundling was acknowledged as early as the late 1990s (Department of Public Enterprises, 2000). Indeed unbundling had been resisted by the labour unions, who perceived it as tantamount to covert privatization and numerous job losses. A further factor was the fact that during the 1990s to early 2000s the state-owned monopoly of Eskom had engaged in large electrification programmes, neglecting infrastructure maintenance (Eberhard, 2005). Thus, during the period 2007- 2011 the South African energy sector was marred by problems such as diminishing energy surplus, high levels of energy theft and technical energy losses due to an aging infrastructure. Such problems exacerbated the need for financial support for Eskom from the government. Nonetheless, concerns about Eskom's financial position were often passed over in favour of resolving problems at the municipal level that challenged the widening of access to electricity; such as limited technical capacity, few income-generating industrial customers and huge backlogs of new connections for low income consumers. It was assumed that as a state-owned monopoly Eskom would be better prepared to handle such ground level problems, compared to a liberalized market. Thus, Eskom maintained its unchallenged leading role in the South African energy field.

The frame binding practices during 2007-2011 was that of a centralized carbon-based energy system. In response to the crisis, Eskom prioritized energy demand management and engaged in a set of discursive-material practices that were aimed at reducing its customers' energy consumption. They

included *educating consumers* not to tamper with the national grid and steal electricity, and instead informing them how to reduce their bills; as well as supporting consumers in *substituting technologies* in order to use less energy and achieve cost savings.

An Eskom Strategy Manager described the two campaigns, Operation Khanyisa (Zulu for 'enlighten' or 'light up') and 49M (the population of South Africans), as follows:

> *We put in place the signal to the consumer to say 'it is not ok to steal it' that's a social thing and that is why we've got projects like Operation Khanyisa and 49M to drive the message of 'tamper with our kit and you can kill yourself' and it is completely the dumb thing to do. … It's about educating the consumer and teaching them how to minimize their bill.*

Operation Khanyisa and its slogan "Use, Don't Abuse" urged every South African to help stop the abuse of electricity. Eskom implemented this through both a customer compliance approach, as well as a door-to-door customer education campaign on the "legal, safe and efficient use of electricity." Similarly, the 49M campaign was aimed at *"imparting a culture of conserving electricity among [49 million] South Africans"*, as the same ESKOM strategy manager told us. Big energy companies signed up and supported the campaigns including industrial customers such as Transnet (a railway company), Anglo Gold (a mining company) and Tsogo Sun (an entertainment company).

The frame of the centralized carbon-based energy system during this time period centred discursive-material practices around Eskom's monopoly. As such, the frame bound entrepreneurial actors' discursive-material practices to those of Eskom, while excluding other practices such as renewable energy generation. Although entrepreneurial actors could not venture into new ways of energy generation, they began exploring energy efficiency and energy substitution technologies in order to assist customers in reducing expenses due to high energy prices. Entrepreneurs zoomed into the *"now and immediate"*, the *"major problem"* of industrial and residential consumers *"in terms of how much they are paying for their electricity"* and who *"need assistance with energy saving"*, as the managing director of Asiye Green explained. In meeting those customer demands, entrepreneurs engineered technology solutions and their *"technology choices were completely situation dependent and bound by Eskom's pricing"*, as one of the founders of Sinani Energy pointed out. Thus, even though South Africa's highly regulated energy market protected Eskom's monopoly from any competing energy generation companies, this frame led to possibilities for small energy consultancies to engage in

auxiliary ventures. Utilizing the congruent discursive-material practices of educating consumers and promoting substitute technologies for cost efficiency, these small energy consultancies were able to enter the energy market while also helping customers better manage their energy expenditure.

For example, energy efficient light bulbs were often cited by entrepreneurs as a technology used in order to improve the efficiency of consumers' energy use. This again followed the practice of Eskom which promoted compact fluorescent lights (CFL) as using up to 80% less energy than incandescent light bulbs and lasting up to 8 times longer. However, in contrast to Eskom's CFL solution entrepreneurs voiced a preference for light-emitting diode (LED) bulbs which are known to last up to 10 times longer than CFL, and 40 times longer than typical incandescent bulbs. The preference for LED solutions was based on their consistent performance and their short payback periods, as well as their *"ability to generate approximately 70% energy savings"*, as the director of Kayjon told us. Thus, by entering the field and developing their own interpretations of the dominant discursive-material practices, entrepreneurs enriched the possibilities in the field. During interviews entrepreneurs often reflected on this by expressing criticism of Eskom technologies or by comparing Eskom solutions and their own. For example, the technical officer from Pillar Energy Services told us in 2018:

> *A few years ago, ESKOM ran a project where they gave 31 million compact fluorescent light bulbs to the general public. They went out and installed them in the home. […] And initially I thought, wow, this is awesome, this is, you know, such a good idea. And then I realised about halfway through the project that a giant multinational had basically sold a product that was hazardous, inefficient, and expensive. Basically, they dumped all their stock from the rest of the world, brought it here, tied it up in a pretty bow and sold us crap.*

Additional examples show the wide scope of technology substitution. Not only were energy inefficient technologies substituted with more energy efficient ones, but also energy powered technologies were substituted with technologies that did not consume energy or consume only renewable energy. For instance, a solution offered in order to alleviate rising energy costs for lighting was transparent roofing, as the managing director of Land of Men construction and projects explained to us:

> *We are providing a transparent roofing solution. So, if you've got an existing structure, we change it and do some transformation and put our own sheets […] in the living areas, […] so that during the day you won't have to light up the electricity. The light may directly access your house through the roofing.*

As this quote shows, transparent roofing was not an alternative energy generation technology but rather a substitute technology that compensated for rising energy bills by allowing sunlight to come in during daylight hours, thus reducing energy consumption. In another example, entrepreneurs were able to provide a substitute for energy consumed on the grid by manufacturing solar powered water heaters. Such water heaters were able to deliver savings to consumers by "*reducing their electricity consumption and generating hot water from the sun*", as the founder of Solar Ray told us. Such technologies were capable not only of "*delivering to consumers the comfort of hot water at night*", especially during rolling blackouts, but it was also claimed by the same interviewee that *"solar water heating systems are capable of reducing electricity bills by up to 24%"*.

All of these technology substitutions fed into the discursive-material practices of energy efficiency. They provided ad-hoc, short-term solutions to the looming energy crisis but never challenged Eskom's monopoly position. Most importantly, these discursive-material practices did not address the problem at the core of the crisis i.e. insufficient energy supply in South Africa. Eskom's reliance on carbon-based energy through an aging infrastructure was unsustainable. Practices of renewable energy generation started developing, culminating in the critical event of the liberalization of the energy generation market. This event propelled the addition of a new frame in the South African energy field with a new set of discursive-material practices.

4.2 Period 2011-2015.
New Frame Added: *Distributed Renewable Energy Generation*

The liberalization of energy generation through the REIPP programme in 2011 opened up the energy field in South Africa to renewable energy entrepreneurs who were previously excluded from participation. Thus, the frame of *distributed renewable energy generation* was added to the frame of period 1, namely *centralized carbon-based energy system*. The new frame bounded entrepreneurial actors to a new set of discursive-material practices which *articulated new value propositions* in terms of renewable energy generation rather than energy efficiency. They also *configured new energy technologies* so that, in addition to energy efficiency technologies, they also included energy generation technologies such as photovoltaic panels, wind turbines, hydro and biofuel. Entrepreneurs that were active in period 1 continued to deploy energy efficiency technologies. However, possibilities were

expanded for a new set of entrepreneurs, who could now directly address the core of the energy generation crisis.

Realizing that its status as the sole energy generator in the country was being challenged, Eskom enacted practices bound by the frame of centralized carbon-based system. Indeed, Eskom articulated the value proposition of a reliable, managed grid that balanced 'load' with energy generation and hinged on the integration of different energy sources on the grid. From the point of view of Eskom, renewable energy generation was seen as destabilizing the grid and inhibiting centralized control over the energy system. Eskom's 2014 strategy document illustrates the concerns raised by such developments (p. 4-5):

> *Utilities worldwide are facing business disruptors such as distributed and renewable generation… Policy, regulation, national standards and stakeholder engagement is evolving too slowly, not always according to strategy aligned principles (national nor Eskom), and our influence thereof too fragmented and ad-hoc.*

The rise of renewable energy generation by entrepreneurs was interpreted as a security threat to the national grid. A threat that was attributed to fluctuations in the supply of renewable energy and that needed to be contained. An Eskom tech specialist told us in 2016:

> *If the frequency drifts, and we can't bring the frequency back to the set point, then we lose the grid. And we lose the grid because mechanically we cannot take all that stress onto the generators… that means, we need to sacrifice our load to protect the generator. …So that is a scenario we want to protect.*

However, interviewees from companies like SAP, Siemens, and Schneider Electric attributed the security threat to the extent of Eskom's failure to maintain and upgrade the national grid. They pointed out that the variability of renewable energy generation has been successfully addressed at the level of national grid infrastructures in other countries where these multinationals operate. The pressure to develop a smart grid and enable better energy management across a mix of energy sources, including solar, wind and water came not only from multinational companies but also from affluent municipalities like Pretoria, Johannesburg and Bloemfontein. A solutions account manager from Cisco told us:

> *There's a huge opportunity in South Africa for a smart grid especially given the age of our electricity grid infrastructure … what electricity utilities are embarking on is a grid modernisation project and that grid modernisation project is essentially moving towards a smarter grid and as they are modernising the grid they are adopting newer technologies and these new technologies are going to enable a whole host of operational efficiencies.*

A sales director from Schneider Electric added:

The spec is basically IoT centric. So, it uses a machine-to-machine comms layer… if you look at IoT, we say 'there is a lot of opportunity'. It gives us the ability to control the load. Let's go talk to consumers, support consumers, measure consumers, and collect the revenue that is due. Second business opportunity is really around controlling the load. And the third area is around disaster management and disaster prevention. Those are really the three major areas that we see all the way down into the value chain of smart grids.

Even though there was support in Eskom for the reconfiguration of technologies and the rearticulation of value propositions towards better energy management, the discursive-material practices within Eskom remained bounded by the frame of a centralized carbon-based system. This can be evidenced by closer attention to Eskom's deployments of smart meters. Indeed, the immediate potential of *"Eskom's smart vision was only recognised in bigger metropoles but not the country at large"*, as a technical officer from Pillar Energy Services told us. Thus, the deployment of smart meters beyond major municipalities was deemed to remain financially unviable. Services to the broad base of municipalities and residential consumers in the country were delivered by means of pre-paid meters. An ex-smart grid enterprise manager from Eskom admitted to us in 2016, *"it is a one-way meter, it is not bi-directional. …the current metering technology we have out in the field is very dumb."* These pre-paid meters, *"load credit via a banking interface and when that credit has been used up, the customer gets shut off*", as the then Head of Smart Energy Business for Siemens South Africa (a key Eskom partner) told us in 2016.

Entrepreneurs pointed to the confusion caused in labelling pre-paid meters as 'smart' and to the considerable lack of capacity in the country to make use of a smart meter infrastructure. Eskom argued that smart meter infrastructures were viable predominantly in the commercial and industrial sectors, and much less so in the municipal and residential space, because *"businesses have shown an appetite for introducing energy management systems, smart buildings, sensors and solar solutions"*, as a strategy manager from Eskom told us. However, the underlying concern for Eskom's vision for a smart infrastructure was the reduction of revenue losses. The centralised carbon-based system frame bound the discursive-material practices of municipalities to on-the-grid energy generation, transmission and distribution; and away from off-the-grid renewable energy generation. Thus, the deployment of smart meters with functionalities going beyond the distribution segment (e.g. two-way communication for consumers to sell electricity into the grid) was excluded as a practice.

In contrast to Eskom's centralized carbon-based system frame, the distributed renewable generation frame generated new possibilities for IPP entrepreneurs. For example, the Executive Director of Pele Green Energy told us:

> *We have participated in all of the rounds of the REIPP in South Africa. At the moment we have projects close to 900 Megawatts that are in different phases of development... Our business model is to develop, own and operate our renewable energy assets.*

The discursive-material practices bounded by the two frames maintained congruence due to the REIPP programme which mandated the signing of PPA contracts between Eskom and IPPs. Nonetheless, new possibilities were generated beyond the REIPP programme. Thus, energy entrepreneurs started adding renewable energy to their proposed cost-saving energy-efficiency solutions. As the Managing Director of Asiye Green told us:

> *From a commercial perspective, the clients that we deal with, especially from a mining industry, almost 60% of their cost of production is electricity related. So by being exposed to the REIPP programme and to alternative energy sources, and also actually being able to introduce those clients to developers and service providers who would be able to assist them with becoming more energy efficient and getting electricity from alternative resources you're actually assisting them to actually have a better more efficient production system.*

As the above quote shows, energy entrepreneurs were able to rearticulate their energy efficiency value propositions and to reconfigure their solutions within the distributed renewable energy generation frame.

The new possibilities opened up by the new frame often went beyond the business value propositions of energy entrepreneurs, and included social value propositions by institutional and social-responsibility entrepreneurs. Acting within the centralized carbon-based frame, municipalities tended to resist off-the-grid renewable energy generation because it meant compromising one of their most significant revenue streams. A Senior Engineer of City Power, a utility company owned by the City of Johannesburg, told us:

> *…by and large they are not keen to encourage whether it's domestic users or commercial users to generate their own electricity because electricity is quite significant energy pool for most municipalities which are licensed to distribute it. So, from that perspective what you tend to see is actually more in line with revenue protection…*

However, the new distributed renewable energy generation frame revealed to municipalities beyond the major urban centres, i.e. rural and less affluent municipalities, possibilities for improving

electrification and access to electricity which were excluded by the old frame. The Executive Director of Tifiso Energy explained:

> *People who are resident in areas that are, from an electrification planning perspective, not foreseen to get electricity in the next five years or more… infrastructure going in there is a challenge... So, from that perspective you know, their energy use or consumption from I'll say an electricity retailer for lack of a better word, an Eskom, it's difficult to justify that kind of investment.*

In other words, large-scale investments in grid infrastructure did not make financial sense in such remote areas. Despite commitments for electrification by Eskom and the Department of Energy, such investments were rationed and subject to the availability of funds. This, in turn, meant that remote communities were excluded from Eskom's existing value proposition and technology configuration. These remote communities, however, were included in the discursive-material practices of energy entrepreneurs with a social responsibility value proposition. This group of entrepreneurs were able to reach out to, and support, less affluent and remote communities in their electrification journeys.

The social responsibility value proposition generated support from the government, since it aligned with the latter's own social responsibility agenda as part of the REIPP programme policy. The government supported entrepreneurs' efforts through a fee-for-service model (i.e. install for free but get paid for maintenance services) and through direct subsidies for asset installation (e.g. solar panel installations). This support opened up possibilities for entrepreneurs to establish non-profit subsidiaries and to differentiate themselves from other renewable energy entrepreneurs who had adopted a more commercial value proposition, as we discussed above. The Executive Director of Pele Green Energy told us:

> *… the differentiating factor is in our ability to understand the communities we operate to put in social programmes that are being bespoke and that have full community buy-in, that are inclusive and in fact allow for a community to become more sustainable...*

In summary, during the period 2011- 2015 the discursive-material practices among actors in the South African energy sector were bounded by both the frame of a centralized carbon-based system that was dominant in period 1, but also a newly added frame of a distributed renewable generation. Despite the seemingly opposing frames, the discursive-material practices enacted by different actors were congruent and revealed at least three types of possibilities. Firstly, energy entrepreneurs pursued possibilities based on energy efficiency that were enhanced by renewable energy generation. Secondly,

the incumbent monopoly Eskom acknowledged the need for more energy generation in order to avoid further electricity cuts. However, in tandem with municipalities – their biggest consumers – Eskom continued to pursue revenue collection possibilities that required minimal grid investments and focused on pre-paid meter technology. Thirdly, energy entrepreneurs with social responsibility agendas pursued possibilities which offered electricity to remote, non-affluent communities cut off from the national grid. Through government subsidies, they offered low budget electrification technologies and social programmes of training in the installation of renewable energy assets. All three sets of actors enacted discursive-material practices leading towards a reconfiguration of existing technology solutions, and towards a rearticulation of value propositions targeted at specific segments of energy consumers.

By the end of 2015, both Eskom and the labour unions perceived energy generation by IPPs as a threat. While labour unions feared that it would lead to privatisation and hence to job losses, Eskom's reasons were more complex. Patronage networks within Eskom had historically exerted their influence on municipalities and other Eskom network partners, but struggled to extend their influence to the IPPs (Department of Public Enterprises, 2019; Deloitte, 2017). The REIPP programme faced criticism of Eskom for supplying overpriced energy into the grid. Thus, by 2015 the crisis of undersupply was being portrayed as a crisis of oversupply. This resulted in an impasse in the negotiation and signing of PPAs between Eskom and 27 IPPs. The PPA stalemate precipitated the enactment of discursive-material practices within a frame of distributed mixed energy systems, whereby energy entrepreneurs, industrial customers, municipalities and others started to implement business models that went beyond distributed renewable energy generation and the REIPP programme. We discuss the discursive-material practices enacted as part of this newly added frame in the next section.

4.3 Period 2015-2018.
New Frame Added: *Distributed Mixed Energy Systems*

As described above, in 2015 pressure built on the REIPP programme and Eskom and labour unions claimed there was now an oversupply of energy. The Executive Director of Pele Green Energy articulated the response of entrepreneurs to the unfolding crisis:

> *As entrepreneurs we have to find ways to work in our market. ESKOM has not wanted to sign the latest round of power purchase agreements. That hampers your business but as an entrepreneur what you do, you have to find other markets. […] the current impasse is bad for business […]. But*

I think we also have to do a lot of work of opening up other markets. So yes, it's not a great situation that we're in but it would be remiss for me to ignore the fact that there are other markets that have opened up as a result of this programme.

Having experienced the challenges that the distributed renewable energy generation frame brought to its operational model, Eskom's refusal to sign the PPA contracts can be described as a practice bound by the frame of the centralized carbon-based energy system, going back to period 1. Indeed, interviewees commented on the downward spiral that Eskom was facing by resisting deviations from the frame of centralized carbon-based energy system. CEO of Zeroth Energy told us in 2017:

There are companies that have been around for numerous years. A lot of them have played in the REIPP space and now they are moving into a private space because ESKOM is not signing IPP deals anymore… So that's why we came up with the model to do the lease and the rental and the private PPA which other countries are doing as well. And then we go to the clients and we say cool, you can have solar without cap upfront… the beauty about our product is that we go to a client and do a ten-year contract…[so] even though ESKOM might lower their prices, the client is buying with us for the next decade which means that ESKOM is slowly losing clients one by one.

By refusing to sign PPAs with IPPs, Eskom made the REIPP PPA non-viable, thereby pushing energy entrepreneurs to seek out alternative possibilities. This further endangered Eskom's market position since the cost of many renewable technologies (e.g. solar panel installations) was dropping significantly and their performance was improving. There was also more demand by large energy consumers for renewable energy installations.

We found that entrepreneurial responses to the impasse with the IPP contracts spanned the existing frames of centralized carbon-based energy systems and distributed renewable energy generation, and also included practices bound by the frame of distributed mixed energy systems. Notably, energy entrepreneurs engaged in practices of *forming networks of collaborators* and *leveraging the generativity of digital technologies*. The networks of collaborators included renewable energy generation companies, landowners, big energy consumers from the industrial sector such as mines and paper mills, consultants such as Accenture and IBM, as well as EPC (engineering, procurement and construction) consortia.

Practices in the newly added frame were congruent with practices in the distributed renewable energy generation frame. For example, multiple parties including energy consumers with sustained energy needs (e.g. industrial consumers), entrepreneurs who could design and implement the project, financial institutions who could fund it, and energy consultancies came together in order to pursue

possibilities for distributed renewable energy generation. Energy entrepreneurs were able to work with off-takers and develop an operating model drawing on the EPC companies for renewable energy generation facilities. The CIO of Next Renewable Generation explained:

> *We would put an asset on their rooftop or in their grounds next to the off-taker and basically sell them electricity for own use. In some of the cases the asset would be group tied, or the system would be group tied, meaning that it has the potential of feeding back into the grid.*

These EPC projects constituted possibilities for 'asset management' and 'shared savings'. Energy entrepreneurs could now see themselves as building up "*a fund of solar plants where we manage and run them, we sell the power, we rent the systems over [to you], [or] you rent the roof over your house [to us]",* as the director of Sinani Energy told us. Thus, entrepreneurs could now grow a portfolio and develop an asset base with proven cash flows. Entrepreneurs also testified to the increased interest of banks to invest in this space. "*Banks are learning as they go and developing their risk appetites",* the director of Sinani Energy stated. With the help of participating banks they could now refinance their portfolio and redeploy their capital. These possibilities only emerged because practices in the two frames were congruent, and the practice of forming networks of collaborators could easily be appropriated within the distributed renewable energy generation frame.

Entrepreneurial possibilities in the distributed mixed-energy system frame were multiplied by leveraging the generativity of digital technologies in generation-consumption networks of collaborators. As entrepreneurial networks were no longer constrained by Eskom's national strategy and the REIPP programme, possibilities emerged for the private PPA model to serve renewable energy generation-consumption networks through the 'wheeling' of renewable energy. Wheeling is the practice of transporting electric energy from within a grid to an electrical load used by third parties. The 'wheeling' business model became possible because of the modularity of the technology and its ability to scale on demand. For example, solar panels can be installed on rooftops and generate energy that can be sold to Eskom for use by others on the grid. Through a financial agreement, the party generating the energy can then get energy in another part of the grid or even in another country, where the off-taker of the originally generated energy pays for the new energy to be consumed. This 'wheeling' is an example of leveraging the generativity of technology. The CIO of Next Renewable Generation explained:

With wheeling you can produce anywhere in the country … so you can have a solar system on a big building or warehouse in Johannesburg and then have an off-take agreement with a client in East London or wherever. And that wheeling arrangement means that you then use the grid where you pay a wheeling fee to the grid, to Eskom or the municipality and the off-taker pays you for that use.

Leveraging the generativity of technologies, entrepreneurs recognized that the consumption of excess energy does not necessarily need to be distributed over space. Indeed, excess energy can be consumed at the location where it was generated when there are energy storage technologies capable of preserving energy generated during off-peak consumption times and make it available for use during peak times. For example, the CEO of Zeroth Energy told us:

Houses use about 75% of their electricity in the evening so in order to give them a solution you need to give them kind of an off-grid solution, you can't give them just solar without batteries because they are not really going to save anything.

Any excess energy generated can be stored in modular batteries to be sold in other parts of the country through financial agreements between different parties. This is a value proposition that many of these new entrepreneurial networks are pursuing in an effort to go completely off the grid and become autonomous utility providers. The Director of Sinani Energy suggested:

We're looking at an off-grid solution with batteries by reducing our reliance on them [Eskom]; by producing some of our own electricity and adding backup and battery banks and things and take ourselves off-grid completely. And that's most of our clients' ultimate objective once battery storage becomes more feasible […].

The Chief Operations Officer of Lamo Solar added:

The emergence of energy storage is the thing that has been the answer and not only at household level or at the commercial building level but at the municipal level, and at a large utility national level. You need storage, you need ways to keep the energy.

Unfortunately, the price of storage remains prohibitive and storage is not yet seen as a good investment at the moment. Nonetheless, there is optimism that "*[the price of] all these technologies [are] actually reducing quite drastically"*, the director of Kayjon told us.

The newly added frame was also observable at the municipal level, where digital technologies were seen as key in enabling public-private coalitions aimed at improving electricity distribution and consumption. Constraints to municipal organisational capacities were alleviated through the involvement of entrepreneurial networks from the private sector. By leveraging the generativity of digital technology, as well as the expertise of different actors within these networks, possibilities

emerged for protecting municipal revenue streams while creating new financial and technological value. The Managing Director of Accenture explained:

> *We started looking at how to create a platform …[as] a shared service type model, not necessarily on a national scale because I think the policies of trying to provide a national platform and then cutting across the spheres of provincial and local government becomes highly complex but there is no reason why we couldn't start to look at shared services or shared platforms, you know, in a provincial context. So for the North West as a province and for the 30, 40 municipalities in the North West, this could be a viable option where you increase the size of the project to a place where the critical mass makes sense financially but is not too big that it's difficult to execute.*

This shared platform model has already been executed successfully in predominantly urban municipalities e.g. Pretoria (with TUMS as the energy utility), Johannesburg (with City Power), Bloemfontein (with CENTLEC). Different technology solutions have been used in each case, such as, Siemens' SCADA platform along with iTron metering, which together provide components for communications and data modelling for controlling and monitoring generation and distribution networks. The CEO of Siemens South Africa noted about the success of TUMS (Tshwane Utility Management Systems) in Tshwane (i.e. Pretoria):

> *Half the electricity of the city of Tshwane is measured through the smart metering system. They love it. … They can check their consumption down to fifteen-minute intervals. And they can prepay that via any payment channel they choose. Via their mobile phone, via their banking app, they can go into a city of Tshwane municipal centre and pay there if they feel like it.*

With this shared platform model entrepreneurial networks leveraged the generativity of technology through such practices as time-of-use tariffs and mobile payments. Through such a shared platform model new entrepreneurial networks combined renewable energy technologies with digital technologies to constitute new possibilities, trade different types of energy, and achieve both a wider reach of value and a way of better meeting the expectations for actors involved. In doing this, entrepreneurs aspired to a long-term business model of becoming 'mini utilities'. As the president and chief operations officer of Lamo Solar summed it up, *"if we're not thinking of becoming a mini-utility ourselves we would be crazy."*

Of course, for such a shared platform model to be able to deliver value – especially for the less affluent municipalities – there needed to be an upfront capital investment by a third party, who then took a share of the income once consumers begin to pay their bills. From a third-party point of view,

this translated into investors getting involved in the management of the shared platform model and the training of the employees at the municipality, as the CEO and of SqwidNet explained:

> *There are investors who've been involved in this space who are prepared to try on a small scale to see how well it works. … because we're investing the money we want to put in smart meters but we want to have full control of that revenue collection, we want to take that money and we want to make sure that it's all under our control until we're paid back. … the approach I'm taking with SANEDI*[5] *is we need to upskill and train the municipalities so we're working on you know, giving them money and helping them but we want to send the executive staff and other staff and managers for a utility focused like MBA or …a high diploma level training… And we stand beside them and teach them and help them until they're ready to stand up and do it on their own. So, it's kind of working through that upliftment, that reskilling to hopefully instil more capability and efficiency in the organisation.*

This quote points to multiple forms of value created from the shared platform model, including tangible financial benefits for the investors, and intangible socio-economic benefits for 'upliftment' and 'reskilling' for local communities. According to a report by the IPP Office on the achievements of the REIPP programme as well as additional off-the-grid renewable energy projects, approximately 30,000 new jobs have been created for the local population. In addition, 13.3 megaton carbon emission reductions have been realized in the period since the programme's inception up to 2018. These achievements come on top of meeting the demands for more energy generation set out originally (IPP Office, 2018).

The year 2018 marked the beginning of the end for Eskom's monopoly in the South African energy field. New legislation has been announced which will provide for the establishment of a state-owned Independent System and Market Operator that will buy electricity from electricity generators, including Eskom but also independent power producers who already engage in many of the business models we described above. Eskom is currently facing significant financial problems with yet another large bailout and strict restructuring conditions being considered by the government.

In the next section we discuss the implications of our analysis and develop a process model of the constitution of possibilities within a field.

5. Discussion & Implications

In this paper we examined how possibilities are constituted over time as entrepreneurial actors enact different discursive-material practices within a field. We focused on the transition of a monopoly to an

[5] South African National Energy Development Institute – *(State Actor)*

entrepreneurial field in South Africa from 2007 to 2018. Our analysis shows how the possibilities in the South African energy field were not causally determined by a set of contextual conditions, nor solely creatively constructed by individual entrepreneurs, as past entrepreneurship research would argue (Shane and Venkataraman, 2000; Shane, 2012). Rather, the constitution of possibilities is punctured by critical events, which are the product of past discursive-material practices. Even though, during different time periods, frames organize sets of discursive-material practices, these frames do not point at consensus among entrepreneurial actors. Instead, each of these frames bind groups of actors to specific discursive-material practices, while blinding them to others. By including some while excluding other discursive-material practices, frames eventually become contested and culminate into critical events (cf. Ansari et al, 2013; Kaplan, 2008; Lounsbury, 2003). This process continues, with new frames being added to organize yet another new set of discursive-material practices. Figure 2 illustrates our process model which we discuss below in more detail.

Figure 2 here

5.1 Process Model of the Constitution of Possibilities

Our process model builds on our initial theoretical framework, which conceptualized discursive-material practices as organized by frames. Drawing from our empirical findings we now abstract a process model of how possibilities are constituted in the context of transitioning from a monopoly to an emerging entrepreneurial field. As evident from Figure 2, the model shows an additive framing process. First, in a *closed frame*, the discursive-material practices available to field actors are bounded by the actions of a dominant actor, such as a monopoly. By extension, so are the possibilities within a field as actors are locked into enacting practices within existing possibilities. As other actors begin to contest the position of the dominant actor, a new *emerging frame* is added following a critical event. This emerging frame introduces new practices, which are congruent to the practices of the initial frame, yet constitute new complementary possibilities within the same trajectory. Finally, new *open frames* are added following another critical event, whereby the dominant actor contests the previously emerging frame and associated discursive-material practices. Open frames are different and incorporate both congruent and incongruent discursive-material practices, alongside the practices of past frames.

The multiplicity of practices within open frames points at both complementary and competing possibilities for diverse groups of actors across multiple trajectories. Below we discuss each cycle of framing and its implications for constituting possibilities.

Closed Frame. State-regulated monopolies like Eskom have dominated many fields from electricity, water, telecommunications and railroads across geographical regions and spanning the 20th century (Graham and Marvin 2001). The key objective behind these state-regulated monopolies has been to integrate fragmented islands of utility infrastructures towards standardized networks designed to deliver predictable and dependable services across nations. 'Natural monopolies' were created around a single supplier that could drive down costs through economies of scale and achieve efficiencies in service provision (Hughes, 1983). As our empirical evidence shows, Eskom has benefited from such a monopoly position even when there were clear signs that the company was financially frail and failing to meet the demands of energy consumers.

During 2007-2011, our empirical evidence points at a closed frame with tightly controlled discursive-material practices very much aligned with Eskom's monopoly position toward cutting costs with substitute technologies. Eskom enacted discursive-material practices that reinforced existing possibilities by excluding energy generation by independent power producers. However, although entrepreneurial actors could not venture into new ways of energy generation, they began to explore energy efficiency and energy substitute technologies in order to address problems of rising energy costs. Entrepreneurs started promoting technologies such as solar water heaters and transparent roofing in an effort to educate energy users on ways to lower their energy consumption and reduce their electricity bills. Demand for substitute technologies emerged from Eskom's own failure to limit technical losses by maintaining their aging, carbon-based, grid infrastructure. These alternative enactments of discursive-material practices never challenged the dominance of Eskom's practices and the boundaries on the possibilities within the field set by Eskom's practices. Yet, alternative practices raised concerns over Eskom's historical practices.

As an incumbent, Eskom fought against the market uptake of renewables, and lobbied for protectionist policies that aimed at maintaining its market share, while insisting that consumers continued to pay for the maintenance of a grid infrastructure which was no longer able to support their

rising demands (cf. Pache and Santos, 2010; Kraatz and Block, 2008). Eskom kept maintaining existing technology and trying to meet financial pressures while avoiding unnecessary risks. While this was happening, the demand for more energy in South Africa kept rising and global awareness of the use of renewable energy came into prominence. As substitutes like solar water heaters became more popular and the technology cheaper, so too did the adoption of photovoltaic panels for energy generation begin to gain momentum across countries, including South Africa (Pegels, 2010). Together, the discursive-material practices of Eskom and the move of local entrepreneurial actors toward renewable energy generation culminated in the critical event of market deregulation and the REIPP programme in 2011. Like other state-regulated monopolies in the past, Eskom's monopoly position and legacy infrastructure began to disintegrate toward substandard and inefficient service delivery (Graham and Marvin 2001). As a result, Eskom's historical practices began to be contested by field actors.

Emerging Frame. In 2011, the market for energy generation in South Africa was deregulated through the REIPP programme. During the period 2011-2015 our empirical findings point at two frames, namely, the frame of a centralized carbon-based energy system from period 1, and a second emerging one of distributed renewable energy generation by IPP entrepreneurs. These two frames contained congruent discursive-material practices, with complementary possibilities within the same trajectory. For example, these frames allowed for the signing of PPA contracts between Eskom and renewable energy entrepreneurs for energy generation within Eskom's centralized carbon-based trajectory. Such renewable energy generation was not previously possible and thus complements possibilities in the field. Value propositions towards greater energy efficiency from the frame in period 1 were re-articulated. Other value generating possibilities introduced by new digital technologies, such as smart meters and Internet of Things infrastructures, were sidelined. Specifically, while affluent municipalities embraced digital technologies and smart meters in particular, budgetary constraints and historical practices around revenue protection by both the municipalities and Eskom constrained possibilities toward a smart grid. Instead, Eskom resorted to the implementation of more 'dumb' pre-paid meters with the sole purpose of increasing revenue protection. Once again, the monopoly provider's legacy infrastructure, along with accumulating financial pressures excluded certain possibilities.

Eskom's exclusion of less affluent, remote communities generated possibilities for other entrepreneurial actors to include them in their own value proposition. Remote communities tended to remain excluded from the benefits of electrification due to the financial difficulties faced by Eskom and local municipalities. The marginalization of remote communities and the inequalities in electrification in South Africa has been extensively reported in the literature (Eberhard, 2005) and even acknowledged by the state (Department of Public Enterprises, 2000). Instead remote communities were now approached by renewable energy entrepreneurs with a social responsibility value proposition which offered an opportunity to generate support from the government. In turn, this support expanded possibilities for these entrepreneurs to establish non-profit subsidiaries and differentiate themselves from the rest of the actors in the South African energy sector.

Open frames. The aforementioned inclusions and exclusions culminated in yet a new critical event, namely, the failure of Eskom to sign PPAs with 27 IPPs. The success of the IPPs both on- and off-the-grid was threatening for Eskom and the labour unions. Consequently, the recurrent crisis in the energy sector was portrayed by them as a crisis of oversupply. This happened at a time when the price for installing and generating renewable energy dropped significantly, enabling a new frame to be added. This new frame of distributed mixed energy systems projected new business models for on- and off-the-grid energy generation. The new frame incorporated both congruent and incongruent discursive-material practices to the practices from the previous two frames. Many actors began to recognize complementarities between earlier cycles of discursive-material practices, and to think of ways of establishing networks with other actors. These entrepreneurial networks were no longer constrained by Eskom's national strategy and the REIPP programme. Private PPAs, wheeling agreements and operational models such as the shared platform model and the asset management model, as well as possibilities for the generation, transmission and distribution of renewable energy were constituted. Such possibilities were endorsed by municipal actors and technology partners. By identifying savings possibilities and developing client engagements whereby renewable generation was integrated at the level of municipalities, entrepreneurial networks were able to challenge the existing energy generation, transmission and distribution practices and to respond to consumer demands. In addition, by leveraging the generativity of digital technologies such as wheeling, mobile payments and the application of time-

of-use tariffs, emergent entrepreneurial networks were able to pursue competing possibilities outside the REIPP programme.

From this discussion, it becomes clear that discursive-material practices build on previous cycles and get performatively re-constituted. The discursive-material practices of distributed actors "oscillate" (D'Adderio et al, 2019) over time and across additive frames, to constitute yet new possibilities. For example, the practice of wheeling is currently enacted only through financial off-taker agreements negotiated at the point of energy generation. In the future, as battery storage becomes cheaper, wheeling will be possible long after energy generation has taken place. Energy will be stored and sold on demand without the need for solar panel installations or other forms of energy generation technologies at the customer site. Thus, the practice of wheeling will help to re-articulate previous value propositions such as the asset management model. As new frames are added, new possibilities will continue to be constituted through progressive sets of discursive-material practices.

5.2 Contributions to Entrepreneurship Research

Our process model contributes to research examining the transition process from heavily regulated and tightly controlled fields to unsettled and entrepreneurial fields. The frames that organize field actors' discursive-material practices reflect this transition, pointing at the constant re-constitution of possibilities, even when actors are excluded. Indeed, exclusion generates contestation, culminating in critical events and a re-framing process. Our process model makes three contributions to entrepreneurship research.

First, past research on entrepreneurship suggests that in tightly regulated fields powerful incumbent actors maintain their practices, while excluding new practices by new actors (Aldrich and Baker, 2001; Russo, 2001). We certainly observed exclusions in our case, with Eskom resisting new entrepreneurial practices in the energy generation, transmission and distribution segments. For example, Eskom blocked possibilities from the distributed renewable generation frame by refusing to sign PPAs, and municipalities curtailed entrepreneurial possibilities by protecting their revenue streams and their work with Eskom in energy distribution. However, we also observed that, although excluding energy generation from entrepreneurs, Eskom's discursive-material practices allowed for other, auxiliary

entrepreneurial practices. These auxiliary practices were congruent and complementary to those of Eskom and, thus, did not pose a threat. For example, energy entrepreneurs during the first period enacted practices towards energy efficiency, such as implementing solar water heaters and transparent roofing that were complementary to those of Eskom. Although these practices never scaled up – as in the practices of IPP entrepreneurs during the second period – they continued to be enacted across all three periods. As evident from our analysis, *both included and excluded practices can generate possibilities in a field, albeit at different scales.*

Second, previous research has shown that during periods of technological change, entrepreneurs take advantage of the uncertainty created to shape the market in their favour by challenging existing frames (Gurses and Ozcan, 2015). In such market entry circumstances entrepreneurs are better off adopting a frame that is similar to that of incumbent actors and by presenting their innovations as complementary to create an initial positive response by the regulators (Gurses and Ozcan, 2015; Hiatt and Carlos, 2019). Our study confirms these findings, since IPP entrepreneurs entered the REIPP programme by initially generating renewable energy to feed into the grid, congruent with practices within the centralized carbon-based electricity system frame. Eventually though, entrepreneurs realized that off-the-grid energy generation through dedicated assets was also possible, especially given the demand by industrial customers. This expansion of possibilities tended to include more actors like banks that were willing to finance the renewable energy assets for industrial customers. Thus, our findings show that *the addition of frames with congruent discursive-material practices can result in incongruency across practices* (Kaplan, 2008). *Our process model emphasizes the need to consider the congruence and incongruence of discursive-material practices over time, as they are generative of complementary and competing possibilities respectively*.

Third, our findings indicate that there are unintended consequences that transform the field (Heinze et al, 2016; Kahl, 2018), as entrepreneurial actors frame their discursive-material practices to include and exclude different possibilities. Our process model shows the transformation by capturing how frames with congruent discursive-material practices are transformed into frames with both congruent and incongruent practices. The emphasis on practices points at how discursive intentions become materialized in multiple forms (Orlikowski and Scott, 2015), such as smart meters, renewable energy

technologies and mobile applications in our case. This is especially true for generative technologies that bind together previously disconnected actors with dispersed possibilities. As discussed earlier, during the third period in our case analysis, entrepreneurial networks leveraged the generativity of technologies through such practices as wheeling, load management via smart grids, on-demand tariffs and mobile payments. These practices were transformative in that they broke free from the initial closed frame of the monopoly actor Eskom, while also building on the REIPP programme. Although these possibilities currently seem beneficial for entrepreneurs and detrimental to Eskom, further cycles may prove that the frames organizing these possibilities are too open for actors to maintain a competitive position for long. Our findings show that *as a field transitions from tight control and regulation to an open market driven by entrepreneurship, congruent practices become incongruent through competition*. On the one hand, some incongruence leads to competition and innovation, as discussed earlier. On the other hand, too much incongruence in practices leads to opportunistic behaviours and market disaggregation (Abolafia, 2001). The energy field in South Africa is now disaggregated across practices aimed at self-generation of energy by industrial customers and their partners; shared platform generation of energy by a collection of municipalities and their partners; off-the-grid energy generation by renewable energy entrepreneurs through private PPA; and on-the-grid energy generation by Eskom. Such market disaggregation is as constraining for the field as Eskom's market concertation was in previous periods. Thus, *discursive-material practices need to be governed along a spectrum of congruent and incongruent practices, inviting a balanced set of complementary and competing possibilities across distributed actors.*

5.3 Implications for Entrepreneurship Research Adopting a Performativity Perspective

This paper builds on recent commentaries which have argued for a conceptualization of entrepreneurship as constituted through the discourses and materiality embedded in the practices of a distributed set of actors (Garud, Gehman and Giuliani, 2014; Garud, Gehman and Giuliani, 2018; Garud, Gehman and Tharchen, 2018). The process model developed in this paper has important implications for a contextualization of entrepreneurship away from theories of the 'individual-opportunity nexus' (Shane and Venkataraman, 2000; Shane, 2012) and the related debate about whether

entrepreneurial opportunities are discovered or created (Alvarez and Barney, 2007; Alvarez et al., 2013; Davidsson, 2015; Venkatraman et al, 2012). Our process model avoids the object/subject dichotomy (Venkatraman et al, 2012) in our understanding of entrepreneurial opportunities. Rather, it contributes in a number of ways to recent research arguing for a reconceptualization of entrepreneurial opportunities as possibilities constituted by discursive-material practices within a field (Garud, Gehman and Giuliani, 2018; Gehman and Soublière, 2017; Lounsbury et al, 2019). The implications of our process model include the following.

First, it contributes to existing entrepreneurial studies adopting a performativity perspective by placing emphasis not on the temporal relationality between the discursive and the material, but rather between different sets of discursive-material practices. The evolution of discourse and materiality is one of mutual entailment (Orlikowski and Scott, 2015). Our model shows this mutual entailment by focusing on how progressive sets of discursive-material practices are enacted over time. Congruent practices within similar frames complement existing possibilities; whereas incongruent practices within different frames are competitive of existing possibilities within a field. By pointing at this analytical distinction we are able to explain how possibilities within a field can evolve.

Second, this process model is particularly useful to entrepreneurial studies of field transformation, i.e.. where entrepreneurial actors enact discursive-material practices involving digital technologies, distributed skills, and non-traditional assets in order to transform products and services. For example, under the frame of a gig economy, the dominance of expensive taxi medallions was transformed by such taxi-hailing platforms as Uber and Lyft. Uber and Lyft articulated value propositions for car-sharing and on-demand taxi services while leveraging the generativity of digital technology. Similarly, in our case in South Africa entrepreneurial actors leveraged the generativity of new technologies through such practices as wheeling, load management via smart grids, on-demand tariffs and mobile payments, which transformed existing generation, transmission and distribution practices. In contrast, they marginalized the practices of Eskom as an incumbent, who attempted to resist this transformation by protecting its monopoly position only to find itself in a death spiral of higher prices and fewer customers (Cramer and Krueger, 2016).

Our process model thus has important implications for understanding the dynamics of digital transformation in different entrepreneurial fields. Further research is needed to examine how some discursive-material practices are included, while others excluded, culminating to critical events. Using our process model, further research could examine the discursive-material practices of different entrepreneurial actors to understand how possibilities are constituted. For example, the emerging entrepreneurial field of mobile payments has recently experienced the enactment of a new regulatory framework across Europe, namely, the second payment systems directive (PSD2). Much like the REIPP programme in our South African case, PSD2 enables new entrepreneurial actors such as, financial technology firms (e.g. TransferWise) and challenger banks (e.g. Monzo), to enact a new generation of payment products and services to customers through open application programming interfaces (APIs). However, in enacting their own discursive-material practices, these new entrepreneurial actors will have to respond to regulatory frameworks and emerging new technologies. Specifically, in addition to the PSD2, individual countries in Europe have their own regulatory frameworks (Cortet et al, 2016), adding tensions about the prioritization of specific standards and policies. Also, APIs can be designed with varying degrees of congruence and incongruence in the practices of ecosystem partners (Constantinides et al, 2018). Entrepreneurial actors can choose the level of congruency in their practice by deciding how much to open their API, whether to partner with other actors or to join neutral or open source technology platforms such as the Open Bank Project. *Tracing the congruency and incongruency of discursive-material practices afforded by innovations in the financial sector, and organizing them under different frames can allow us to grasp the scope for both complementary and competing possibilities*.

Evidently, despite the disruptive potential of new technologies, transitions from old to new are never linear and not always successful (Ansari and Garud, 2009; Cennamo, 2018). As our model shows, new possibilities open up, while discursive-material practices – involving both old and new technology – oscillate over time. More importantly, unlike past studies adopting a framing perspective which rarely examine how the frames of multiple actors coevolve (Gurses and Ozcan, 2015), our model places emphasis on the evolution of the whole entrepreneurial field. Using this perspective could offer opportunities for future research to investigage how possibilities are constituted through the

relationality of extant and new discursive-material practices, and how resistance to and accommodation of new practices culminates into critical events whilst also producing new framing cycles.

Table 1. List of Interviewees

Research Phases	Company & Actor Group	Interviewees
Phase 1 (August-November 2016)	**Eskom** – (Incumbent – ex-monopoly provider of energy)	1. Strategy Manager 2. Corporate Tech Specialist 3. Smart Grid Enterprise Manager
	Siemens – (Device and equipment provider)	4. Head of Smart Energy Business
	Accenture - (Digital technology provider)	5. Senior Principal Smart Grid Services
	Schneider Electric - (Device and equipment provider)	6. Sales director – field services
	SAP - (Digital technology provider)	7. Director mining & metals industries 8. Industry principal
	IBM - (Digital technology provider)	9. Programme director
	Dimension Data - (Digital technology provider)	10. Chief solutions and marketing officer
	HP - (Digital technology provider)	11. Country Manager 12. Director of strategic marketing
	Microsoft - (Digital technology provider)	13. Partner Channel Development Manager
	FastNet – (Digital technology provider)	14. Head: Product Portfolio Management
	SenTech – (Digital technology provider)	15. Head: Innovation & Solutions
	MTN – (Digital technology provider)	16. Senior Manager: Service Delivery
	Ericsson – (Digital technology provider)	17. Head: Governance and Industry Relations
	Cisco – (Digital technology provider)	18. Client executive 19. Solutions Account Manager
	CSIR Council for Scientific and Industrial Research – (State Actor)	20. Research group leader
	NRG Renew Africa – (IPP Entrepreneurs)	21. Chairman
Phase 2 (March -July 2017)	**Department of Energy IPP Office –** (State actor)	22. Specialist Engineer 23. Technical Management Unit Officer
	Eskom – (Incumbent – ex- monopoly provider of energy)	24. Corporate technology specialist
	City Power Utility provider, City of Johannesburg – (Municipal utility provider)	25. CIO 26. Senior Engineer
	TUMS Total Utilities Management Services, Utility provider, City of Tshwane – (Municipal utility provider)	27. Head of Business Operations
	CENTLEC – Utility provider, City of Maungaung – (Municipal utility provider)	28. CIO
	University of Johannesburg - (Independent entity)	29. Researcher
	SANEDI *South African National Energy Development Institute* **–** (State Actor)	30. Acting CIO and Programme Manager
	CSIR Council for Scientific and Industrial Research – (State Actor)	31. Executive Director
	Accenture – (Digital technology provider)	32. Managing Director
	SqwidNet – (Digital technology provider)	33. Founder and CEO 34. Solutions Consultant
	Pele Green Energy – (REIPP Entrepreneur)	35. Executive Director
	Pendo Energy Solutions – (Renewable energy Entrepreneur)	36. CEO
	Matleng Energy Solutions – (REIPP Entrepreneur)	37. Chairman

	Tifiso Energy – (Renewable energy entrepreneur)	38. Executive Director
	Zeroth Energy – (Energy consulting)	39. Founder and CEO
	Next Renewable Generation – (REIPP Entrepreneur)	40. CIO
	Canadian Solar – (Device manufacturer)	41. Sub-Saharan Africa Regional Leader
Phase 3 (November - December 2018)	**ANON 1**[6] (Renewable energy entrepreneur)	42. CFO
	ANON 2 (Energy consulting)	43. Managing Director
	ANON 3 (Energy consulting)	44. Owner and Managing Director
	ANON 4 (Renewable energy entrepreneur)	45. Owner/ Founder
	ANON 5 (Energy consulting)	46. Managing Director
	ANON 6 (Financial services)	47. Chief Operations Officer
	ANON 7 (Energy consulting)	48. Founder and Managing Director
	ANON 8 (Renewable energy entrepreneur)	49. Founder
	ANON 9 (Legal services consulting)	50. Managing Director
	Asiye Green (Renewable energy entrepreneur)	51. Managing Director
	Sinani Energy (Renewable energy entrepreneur)	52. Director
	Solar Ray (Renewable energy entrepreneur)	53. Founder
	Pillar Energy Services (Energy consulting)	54. Technical Officer
	Evolve Technologies (Digital technology provider)	55. Managing Director
	Lamo Solar (Renewable energy entrepreneur)	56. President / Chief Operations Officer
	Land of Men Construction and Projects (Electrical services provider)	57. Managing Director
	MCP Electrical (Electrical services provider)	58. Founder/ Partner
	Kayjon (Energy consulting)	59. Director
	Joule Energy (Energy consulting)	60. Founder

[6] Some interviewees requested that their company affiliations remain anonymous. These are listed as ANON

Table 2. Chronology of the Case

Frames	Year	Critical Events	Tensions and actions
Centralized Carbon-based Energy System (Eskom and energy entrepreneurs)	2007-2008	First energy crisis	- Not enough energy generation - Disorganized load shedding and load limiting (switching off primarily big industrial consumers)
	2008-2011	Integrated Energy Policy Plan discussions based on the National Energy Act 34 of 2008	- Not enough energy generation for consumer needs - High energy costs - Discussions for better demand-side management through renewable energy generation by Independent Power Producers (IPP)
	2011	The Renewable Energy Independent Power Producer (REIPP) programme commences	- Efforts to increase energy generation through IPPs - Environmental and sustainability concerns by the government and customers leads to a push for renewable energy generation and distribution - Power Purchase Agreements (PPAs) between Eskom and IPPs - Tariffs per kWh generated increase significantly[7]
Added Frame: *Distributed Renewable Energy Generation* (Eskom, IPPs, energy entrepreneurs, municipalities)	2011-2014	First stage of liberalization of energy generation through the REIPP programme	- Renewable energy generation not very affordable (e.g. solar panel installations expensive) - Electrification of remote communities off the national grid excluded by Eskom plans, but included in renewable energy entrepreneurs' initiatives
	2014	Eskom Smart Grid national strategy	- Eskom presents its vision and strategy for a national smart grid - Smart meter rollouts in affluent municipalities in South Africa - Pre-paid meter rollouts in less affluent municipalities as a way of combating non-payment and increasing revenue collection
	2014-2015	Second energy crisis	- Not enough energy generation leads to organized load shedding and load limiting, while energy costs increase - Solar panel perceived as more affordable and more viable given high conventional energy costs. Tariffs per kWh generated by solar panels drop significantly, well past grid parity, and is cheaper than the traditional coal power generated power.
	2015	Labour unions and Eskom claim the sector is facing energy oversupply	- Eskom claims it is overpaying for PPAs and, together with labour unions, claim the sector is now experiencing oversupply - On-the-grid energy becoming increasingly expensive - Solar panel energy becomes more affordable and more viable given high conventional energy costs yet energy storage on batteries still expensive

[7] From the beginning of the energy crisis in 2007 till 2011, Eskom increased their tariffs by 300%. See http://www.statssa.gov.za

			- Off-the-grid energy generation through private PPAs between big industrial consumers and renewable energy entrepreneurs
Added Frame: *Distributed Mixed Energy Systems* (Eskom, energy entrepreneurs, IPPs, off-takers, municipalities, consultants, technology partners, EPC consortia, etc.)	2015-2017	Resistance to sign PPAs by Eskom. Successive changes of Energy Ministers	- Eskom raises energy prices for municipalities and consumers - South African Wind Energy Association (SAWEA) lodges a formal complaint with the National Energy Regulator of South Africa (NERSA) with respect to the refusal of Eskom to sign PPAs for procured renewable energy supply contracts from IPPs. - Possibilities for energy 'wheeling' through micro grid installations
	2017-2018	Shared platform models emerging	- Shared platform models emerging in major municipalities (Pretoria, Johannesburg, Bloemfontein), with consortia between technical providers, landowners, financiers and EPC (engineering, procurement and construction) companies - Shared platform models utilize on-the-grid and off-the-grid energy generation, as well as digital technologies such as smart meters, mobile apps and cloud data servers.
	2018	ISMO – Independent System Market Operator established. Second stage of liberalization	- Eskom cannot manage energy supply and demand, effectively calling for further liberalization - Energy prices too high - Environmental and sustainability concerns due to the reliance on conventional energy generation (e.g. coal)

Table 3. Illustrative Narrative Analysis

Narrative Vignettes	Narrative Themes	Theoretical Themes
"The challenge in South Africa is that we've got grid limitations but we also have a high technical loss, where people steal electricity." (Strategy Manager, Eskom) "*Some of the plants are 30 to 40 years old … they are very fragile to increased demand"* (Corporate tech specialist, Eskom) *"[…] a lot of people just pay electricity bills and don't actually understand what they're paying for and how they could use it better. […] [Efficiency] until this point has been overlooked … it's an education process… now that electricity is becoming more expensive and more of an issue it's becoming a focus area and we slot into that space."* (Director, Sinani Energy) "*The renewables came into the picture when LED bulbs started becoming more commonplace. … And the technology has grown a lot in the last five years. The quality of the stuff you're getting is a lot better and the prices have dropped enough to make it available to the general public."* (Managing Director, Evolve Technologies) "*So, we save the consumers money by generating hot water from the sun. And the whole situation with the rolling blackouts that we currently have is something that when you get home in the evening and there was no electricity during the day then at least you have the comfort of hot water at night, free from the sun for that matter."*(Founder, Solar Ray)	<u>Challenges</u> Addressing energy theft Managing an aging infrastructure <u>Possibilities</u> Achieving cost efficiencies Implementing cheap technology substitutes	**<u>Period 2007-2011.</u>** **<u>Frame:</u>** *Centralized Carbon-based Energy System* (Eskom and energy entrepreneurs) <u>Practices</u> *Educating consumers* (on cost efficiencies) *Substituting technology* (for cost efficiencies – e.g. solar heaters, glass roofs, LED lamps)
"…by and large municipalities are not keen to encourage whether it's domestic users or commercial users to generate their own electricity because electricity is quite significant energy pool for most municipalities which are licensed to distribute it. So, from that perspective what you tend to see is actually more in line with revenue protection…" (CIO, CityPower). *"[…] the number one barrier to social community development is the lack of electricity, sustainable communities actually need electricity for hospitals, schools, for their water, and you name it. So, at the centre, at the pinnacle we believe that the number one barrier is the lack of electricity and that's what we're hoping to [address]…"* (Chief Operating Officer, ANON 3). *" […] our solution specifies what's your return on the investment that you're making. What's your payback period that you should expect in terms of time for your investment. What we offer you is an integrated solution that should give you peace of mind."* (Managing Director, Asiye Green) *"So, if the consumer can't afford it, we arrange finance for them and then they pay monthly. With ESKOM being the way it is right now the market is growing."* (Technical Officer, Pillar Energy Services) *"People take kindly to large scale PV that falls under the ESKOM IPP process … we are working with several different levels in the community from lower income to higher income housing typologies and each one receives or takes this technology a bit differently. Low income people funnily enough don't want to really pay for electricity out of a renewable source where high income understand the whole concept."* (CEO, Pendo Energy) *"The last smart meter project that we did was during 2015. And those meters at the time were costing us about 6500 rand a meter, compare that to a typical bill at the time of maybe 1000 rand a month. So, there wasn't really a business case to do it.* (Smart Grid Enterprise Manager, Eskom)	<u>Challenges</u> Protecting revenue Addressing the lack of electricity for remote communities <u>Possibilities</u> Energy efficiencies enhanced by renewable energy generation Electrification of remote communities through social programmes <u>Challenges</u> Replacing prepaid with smart meters and the lack of a business case except	**<u>Period 2011-2015.</u>** **<u>Added Frame</u>***:* *Distributed Renewable Energy Generation* (Eskom, IPPs, energy entrepreneurs, municipalities) <u>Practices</u> *Articulating value propositions* (e.g. energy efficiency, remote electrification) *Configuring technology* (e.g. smart meters as platforms for multiple services)

"the bulk of these are prepaid meters which are not active communicating devices. In other words, they don't send any data necessarily back to the utility. So, all they would keep on the meter itself is credit information." (Managing Director, Accenture) *"Yeah, so the data that is collected is obviously at regular intervals the consumption, you know… your meters can also control equipment because they're smart so they can turn the equipment on and off or they can prevent certain high consumption equipment turning on during certain times and so on. So, there is a hell of a lot one can do with smart meters… probably the city of Tshwane is the best example where there's probably about 15,000 meters running for high consumers."* (Executive Director, CSIR) *"[These pre-paid meters] load credit via a banking interface and when that credit has been used up the customer gets shut off*" (Head of Smart Energy Business for Siemens South Africa)	for affluent municipalities <u>Possibilities</u> Exploring new smart meter applications & protecting revenue collection	
"But the other challenge that we have is when you deal with large scale projects you can't do it as a municipality or as City Power, you have to do it as a triple P. And I'll explain why: the scale is so large that you can't afford it." (CEO, City Power) *"EPC are Engineering Procurement Construction companies. So, they design, they procure the modules and then they install or construct them. And many of them have been around and have seen that consumers don't have the money to buy the equipment. So, they've resorted to try and finance it and have now started calling it a private power purchase agreement"* (CIO, NRG). *"So hence we took a view that says maybe instead of trying to solve these challenges internally within a single municipality, given the constraints of lack of human capacity and organisational capacity maybe we should look at packaging this into a project portfolio that an external third party, private sector party would be interested in underwriting the risk financially and deliver and be able to execute it across a group of municipalities"* (Managing Director, Accenture) *"The move of business to digital ecosystems means that a lot more businesses are going to start applying more of a partnering approach. We see ourselves as an integrator of IoT solution sets for clients, where we help bring multiple partners together and help integrate them into the lifecycle solution for the client."* Chief Solutions Officer, Dimension Data) *"Like for example, the billing side of it or the data management side of it we know that we've got the instruments that are relevant. Our smart meters are configured to do that. We've got the time of use that can be leveraged to do that. … The demand side management platform makes this come to life"* (Senior engineer, CityPower) *"For the last two years I've been deploying industrial IoT projects... and introducing whether we integrate all of the existing assets into one platform or all the existing assets and add new sensors … it's about understanding how much energy you are producing, okay, versus how much you are consuming … and then intelligence around that* (Managing Director, Evolve Technologies)	<u>Challenges</u> Scale and cost of new energy generation and distribution <u>Possibilities</u> Exploring a private PPA model through entrepreneurial networks Diffusing a shared platform model (public, private and third parties) Digitalizing energy technology on platform models	**<u>Period 2015-2018.</u>** **<u>Added Frames:</u>** *Distributed Mixed Energy Systems* (Renewable energy entrepreneurs, Eskom, IPPs, off-takers, municipalities, consultants, technology partners, and EPC consortia, etc.) <u>Practices</u> *Forming networks of collaborators* (through private PPA and shared platform models) *Leveraging the generativity of technology* (e.g. wheeling, time of use tariffs, mobile payments)

Figure 1. Critical events, Frames and Discursive-Material Practices in the Case

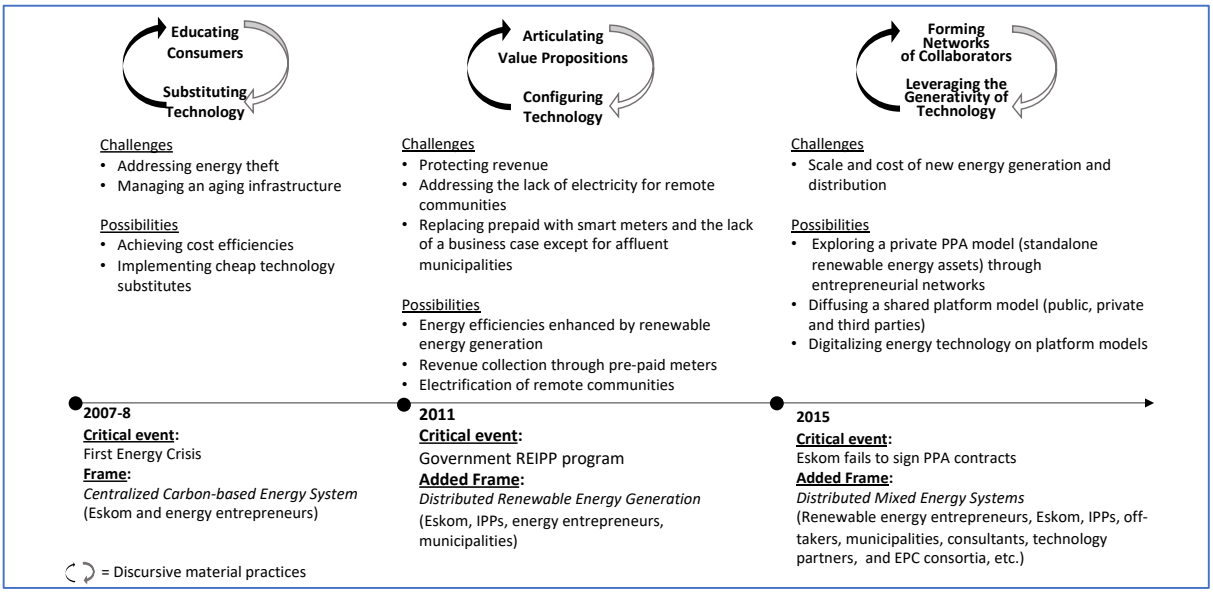
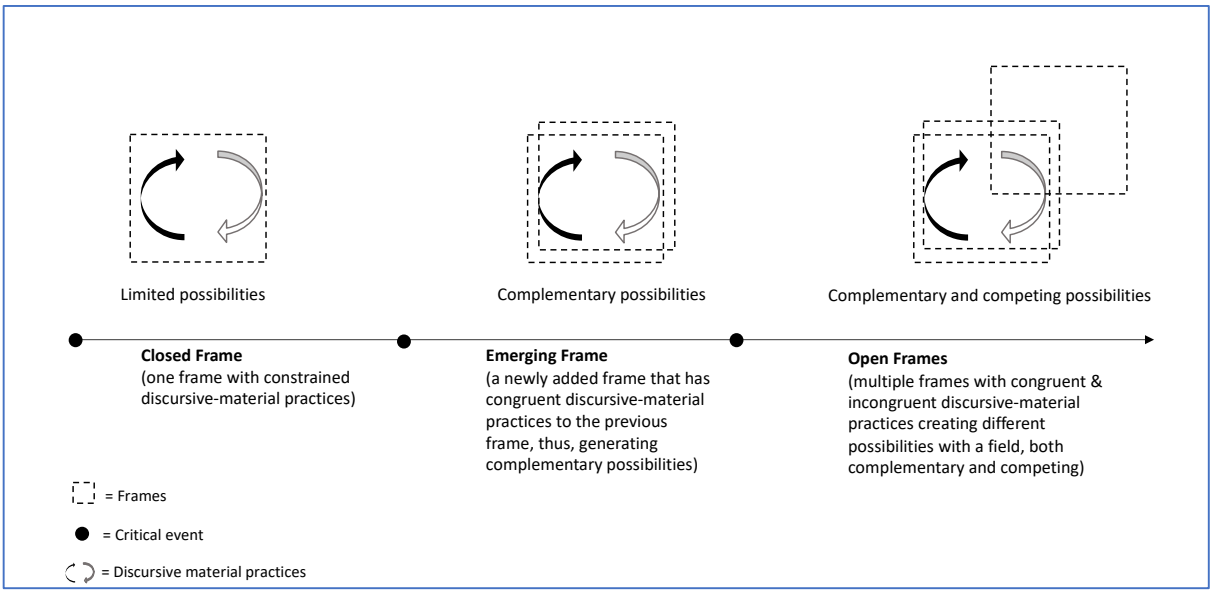


Figure 2. Process Model of the Constitution of Fields of Possibilities



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