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How to account for the dark sides of social innovation? Transitions directionality in renewable energy prosumerism

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ABSTRACT

Social innovation is gaining attention as a pivotal dimension of socio-technical transitions with renewable energy prosumerism as a prominent example. However, this example also highlights that social innovation evokes concerns about purposes, beneficiaries, normative dilemmas and legitimacy. This paper addresses recent calls to confront the perceived 'dark sides' of social innovations. As debates on these dark sides often get stuck in either naive optimism or paralyzing critique, the paper investigates how transitions theory can inform nuanced understandings. The key concept is transitions directionality. The analysis shows how it conceptualizes the dark sides as manifestations of socio-technical path dependence, as disempowering ideological 'landscape' factors, as internal contradictions within institutionally complex regimes, as niche-regime dialectics, and as transition phases. Rather than proposing a particular normative position, the paper presents a heuristic that supports well-considered engagement with the dark sides.

1. Introduction: sustainability transitions through social innovation?

There is an increasing attention for social innovation (SI) in the context of energy transitions. The attention involves not only the associated behavioral changes (energy saving lifestyles, flexible use of energy), but also various ways to organize and govern energy systems differently (Hewitt et al., 2019; Wittmayer et al., 2020). These innovations might help to address fundamental inequalities, injustices and undemocratic characteristics of dominant energy systems. In the context of sustainability transitions, SI has been often considered as a complement to technological innovations: Transitions research has been urged to pay more attention to the role of social entrepreneurship (Witkamp et al., 2011), grassroots innovation (Seyfang et al., 2014) and the associated 'social niches' (Dóci et al., 2015).

Many definitions of SI have been proposed. These involve different understandings of its purposes, different delimitations of the kinds of innovations it encompasses, and different assumptions about the actors involved. Following arguments of Cajaiba-Santana (2014), Howaldt et al., (2015), and Westley et al., (2016) amongst others, this paper works with a non-teleological understanding that leaves the ends open. We agree with the common understanding that SI involves innovation that somehow seeks to alleviate societal problems, but we do not take it to be inherently 'good'. Colonial history, Nazism and communism have shown abhorring examples of

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practices that can be classified as social innovation. Furthermore, many social innovations seem to elude judgements of either good or bad. Seeking to explore that ethical ambiguity of many social innovations (Cf. Wittmayer et al., 2020), we define SI as purposive changes in social relations, involving new ways of doing, organizing, framing and knowing (Avelino et al., 2019).

For transitions research, renewable energy prosumerism (REP) is a particularly relevant example (Wittmayer et al., 2021). This refers to individuals or collectives that do not only participate in energy markets as consumers, but as producers as well. Concrete manifestations of REP are energy cooperatives, collective self-consumption networks, peer-to-peer energy trading, feed-in tariffs, micro-grids, neighborhood batteries, and dedicated regional development funds (Creamer et al., 2018; Huybrechts and Haugh, 2018; Bauwens et al., 2019; de Bakker et al. 2020; Wittmayer et al., 2021). These empirical examples exhibit the typical intertwinement between various kinds of innovations: In line with the common understanding of sustainability transitions as socio-technical processes, REP involves innovations in technologies, business models, organizational forms, infrastructures, and governance arrangements. This paper focuses on the considerable SI that is involved. REP can be considered first and foremost an innovation in social relations: The very notion of 'prosumerism', a neologism, marks a shift from passive consumerism towards more active roles in production and political involvement (Campos and Marín-González, 2020). Energy communities, feed-in tariffs and initiatives towards energy democracy, all these are SI efforts towards new ways of doing, organizing, framing and knowing.

REP exemplifies the pivotal role of SI for socio-technical transitions. Yet importantly, it also exemplifies how SI comes with concerns over the perceived 'dark sides' of SI. The perceived bright sides have been articulated extensively through concepts such as energy justice (Burke and Stephens, 2018), energy democracy (van Veelen 2018), and energy citizenship (Devine-Wright 2007). The bright sides of REP catch most of the attention. This speaks especially clearly from the attempts to boost its development, through supportive innovation systems and incentive structures. Meanwhile, several scholars have raised concerns about the purposes, beneficiaries, normative dilemmas and legitimacy of REP (Bauwens and Defourny, 2017; Brown et al., 2019; Lennon et al., 2020; Pienkowski 2021). Importantly, these concerns are not at all unique to REP. They coincide with calls to confront the various supposed 'dark sides' of SI more generally (Swyngedouw 2005; Larsson and Brandsen, 2016; Westley et al. 2017; Fougère and Meriläinen, 2019; Pel et al., 2020a). Taking REP as a telling example of social innovation - and of its easily forgotten dark sides-, this article addresses the following research question: *How can transitions theory account for the dark sides of SI?*

We do not propose any particular normative position on what constitutes a 'dark' side. Striving for a nuanced understanding of the dark sides, our discussion will bring out the widespread tendency to lapse into either naive optimism (downplaying dark sides as incidental setbacks) or paralyzing critique (exaggerating the dark sides to insurmountable proportions, and de-legitimizing SI efforts altogether). The difficulty of coming to terms with the dark sides appears to be deep-rooted. A relevant background is the pervasive 'pro-innovation bias' in innovation studies more generally (Godin and Vinck, 2017) and in transitions research (Turnheim and Sovacool, 2020). Especially consumer-led innovations, and REP is a case in point, tend to be idealized (Randelli and Rocchi, 2017: 96). Yet as Schumpeter indicated already, innovation cannot be an unambiguously benign process. It simultaneously creates new opportunities and destructs existing structures. This ambiguous, 'Faustian character' (Blok 2020: 79) of innovation is often neglected in transitions research (Walker and Shove, 2007; Cohen, 2010; Bening et al., 2015; Kenis et al., 2016; Schlaile et al., 2017).

Our analysis will also show however that transitions research is well-equipped to articulate this ambivalence. The key concept is transitions *directionality* (Stirling, 2011). This concept underlines that transitions are open-ended co-evolutionary processes, and as such they can take more or less favorable directions (Smith et al., 2005; Kemp et al., 2007; Weber and Rohracher, 2012; Røpke, 2012; Schot and Kanger, 2018; Pel et al., 2020b; Andersson et al., 2021).

The article proceeds as follows. After an introduction of REP as an example of SI 'dark sides' perceived more generally (Section 2), we discuss how current debates hover between naive optimism and paralyzing critique (Section 3). Taking transitions directionality as the key towards a more nuanced understanding (Section 4), we discuss five transitions-theoretical insights (Section 5). The conclusion captures the main insights in a heuristic. Mapping out a zone of nuanced positions, this heuristic supports a well-considered engagement with the SI dark sides (Section 6).

2. Dark sides of social innovation: renewable energy prosumerism

2.1. SI in energy transitions

Sustainability transitions require large-scale technological innovations and associated innovations in infrastructures and systems of provision (Grin et al., 2010). Transitions in energy systems are a clear example of the massive technological substitution involved. However, technological 'niche' innovations do need to be fit in with broader socio-technical webs (Kemp et al., 1998). This explains the increasing focus in policy and research on the social dimensions of energy systems change (Miller et al., 2013; Sovacool et al., 2015; Foulds and Robison, 2018). Much attention has been paid to the pending social acceptance of technologies (Sovacool and Lakshmi Ratan, 2012; von Wirth et al. 2018).

Beyond these still technology-focused approaches, it is also possible to focus on the *social innovation* aspects of socio-technical transitions. The transformation of socio-technical energy systems also involves many innovations in administrative routines, business models and organizational forms, modes of governance, consumer cultures and expertise. These are all examples of SI, defined broadly as purposive changes in social relations, involving new ways of doing, organizing, framing and knowing (Avelino et al., 2019). Involving attempts to change social relations, SI has certain potentials to challenge, alter or replace dominant institutions (Cajaiba-Santana 2014; Westley et al. 2017; Pel et al., 2020a). Nicholls & Murdoch (2011) underline the particular importance of SI in current knowledge-intensive economies. Changes in the organization of work, in lifestyles, and in governance are crucial factors in the current stage of economic development. Meanwhile, various scholars have articulated the particular relevance of SI for transitions

research. As highlighted in analyses of grassroots innovation (Seyfang et al., 2014), social entrepreneurship (Witkamp et al., 2011), economic-financial transitions (Geels 2013), business model innovations (Huijben et al., 2016; Hiteva and Sovacool, 2017) and 'social-institutional' transitions (Loorbach et al., 2017), it is worthwhile to pay more specific attention to the changes and innovations in social relations. These SI aspects of socio-technical transformation processes tend to be less tangible than their material-technological aspects.

A particularly prominent example of SI is renewable energy prosumerism (REP). Indicating the production of renewable energy by households and collectives (Ellsworth-Krebs and Reid, 2016; Horstink et al., 2019), REP exemplifies a broader wave of SI in sustainability transitions: Consumers are starting to fulfill various functions in technological innovation systems (Randelli and Rocchi, 2017). In the context of the energy system, prosumerism is a particularly fundamental SI. Given the hitherto passive role of individuals as energy consumers, prosumerism denotes a paradigmatic change towards energy *citizenship* (Devine-Wright 2007), i.e. of active and politically conscious implication in energy systems. This shift away from the consumerist mind-set shows how REP brings forth 'new ways of knowing and framing': Göpel (2016) considered such SI as pivotal dynamics in transition processes.

REP also displays many new ways of doing and organizing. It amounts to a broad bundle of such social innovations, initiated by citizens, civil society organizations, businesses, as well as governments: Energy cooperatives, collective self-consumption networks, peer-to-peer energy trading, feed-in tariffs, micro-grids, and regional development funds (Creamer et al., 2018; Huybrechts and Haugh, 2018; Bauwens et al., 2019; de Bakker et al. 2020; Wittmayer et al., 2021). Similar to the showcasing of many technology-focused innovations through demonstration projects, REP is prefiguring (Monticelli, 2021) alternative modes of living, working, or governing. Prominent examples are citizen-led installing of solar panels, or cooperatives setting up democratically managed projects in wind, solar, biogas or hydro-power. But the 'new ways of doing and organizing' extend beyond grassroots initiatives. Citizen-led action is also supported by broader innovation ecosystems on renewable energy (Vernay and Sebi, 2020), and by public-private governance alliances (de Bakker et al. 2020). It is crucially facilitated and constrained by policy and regulation (Campos et al., 2020): Financial arrangements of feed-in tariffs and 'green certificates' for renewable energy production are key examples of this. The REP example shows how 'new ways of doing and organizing' often involve innovations in economic-financial arrangements as well. REP involves investments in equipment, returns on investment that have positive external effects in terms of contributions to renewable energy objectives, and changes in (collective) ownership. The rise of energy cooperatives shows the considerable SI that takes place in the form of social entrepreneurship, not-for-profit economic activity, and shifts towards democratized, alternative models for investment in RE. These particular business-oriented 'new ways of organizing', crucial for the sustenance of REP initiatives, have been analyzed extensively in research on REP business models (Huijben et al., 2016; Brown et al., 2019). Likewise, scholarship on digital transition (Lavrijssen and Parra, 2017; Sovacool et al., 2021; Andersen et al., 2021) has pointed out how 'new ways of organizing' are often intertwined with technological innovations in ICT.

REP is thus a very multifaceted form of socio-technical innovation. It can be considered for the renewable energy produced, and for the technological-infrastructural innovations required for this. Yet as expressed through the P of REP, it can also be considered for the social-innovative, ways in which this energy is produced, exchanged and consumed. Involving many innovations in social relations, REP is a particularly rich example of SI.

2.2. Dark sides of REP

REP is widely considered to be a key SI in energy transitions. Beyond its (potential) contributions to environmentally efficient energy production, storage and exchange, it is also endorsed as a shift towards energy democracy (Becker et al., 2017; Campos and Marín-González, 2020; Van Veelen, 2018). REP thus exemplifies the widespread tendency to consider SI as instruments that help to address 'grand societal challenges' (Wittmayer et al., 2020). In the context of transitions research, REP counts as the typical 'niche' to be nurtured and scaled up (Seyfang et al., 2014; Dóci et al., 2015).

REP promises 'bright' futures of sustainable and democratized energy systems. Analyses of the associated innovations in business models and organizational forms specify how it seems to do well on People, Planet as well as Profit: It is almost too good to be true (Brown et al., 2020). The appealing range of apparent bright sides has indeed evoked various second thoughts (Berka and Creamer, 2018; Creamer et al., 2019). Sparked from different perspectives, a critical debate has developed on the detrimental side-effects and societal impacts. Guided by normative standards of sustainability, environmental justice and good governance, this critical debate has brought forward a range of perceived 'dark sides'. Importantly, very similar dark sides have been identified with regard to other examples of SI as well. The discussions on the REP dark sides thus exemplify a broader discussion on SI dark sides more generally. The following perceived 'dark sides' are particularly prominent in the literature:

Commercialization. REP involves 'new ways of organizing' with an important financial-economic component. Various analyses have detailed how it develops through mixtures of state, market and civil society logics, and through accordingly hybrid institutional arrangements (Olkkonen et al., 2017; Bauwens et al., 2019; Wittmayer et al., 2021). These non-traditional governance models have the bright side of reconciled institutional logics and cooperation. Underneath, there appears to be a dark side, however: The decentralization of the energy system still appears to proceed predominantly along the market logic (Pienkowski, 2021), leading to excessive commercialization. Brown et al., (2019) critically discuss how only some of the new REP business models and organizational forms can be considered forms of social entrepreneurship and not-for-profit business, whilst others remain very close to plain profit- seeking. These commercialization tendencies may seem particular to REP, as it revolves around energy commodities. On the other hand, commercialization also recurs in broader discussions of SI dark sides. For example, social entrepreneurship literature has provided detailed accounts of the 'mission drift' and the isomorphic pressures that drive alternative enterprises back into business-as-usual. Even SI icons such as the micro-credits and the work insertion enterprises can thus end up as over-commercialized vehicles of exploitation

(Khan et al., 2007; Dey and Teasdale, 2016). One can also consider how SI initiatives such as Slow Food, makerspaces or Ecovillages become vulnerable to commercialization, just as REP, these SI initiatives bring forth valuable commodities.

Exclusion. Developing renewable energy technologies collectively and citizen-driven, REP arguably has bright potentials in terms of energy citizenship and energy democracy. There also seems to be corresponding a dark side, however: The solidarity does not always extend beyond the narrow circle of initiators and investors (Bauwens and Defourny, 2017). Critical scholars have identified various thresholds for individuals to take part in REP. It often requires a certain socioeconomic status, financial means, social capital, as well as 'energy literacy' (Fraune, 2015; Lapniewska, 2019; Wierling et al., 2020). For example, a survey on membership of German energy communities displayed a strong overrepresentation of males in the 45–64 age bracket, and a share of 60% holding a university degree (Radtke and Ohlhorst, 2021). In addition, REP may be one of the domains in which masculine understandings of innovation still prevail. Lindberg et al., (2015) point out how the innovations in men-dominated industries - including natural resource exploitation and RE development - tend to be valued higher than the service innovations, organizational innovations, and other social innovations brought forward in women-dominated industries. Such exclusion, or unequally distributed inclusion, seems hardly specific to REP only. Exclusion is a quite notorious dark side of SI more generally. It has also been documented regarding, for example, participative governance (Swyngedouw, 2005) and ecovillages (Pel et al., 2020a). Other telling examples are basic income, with its particular reliance on expertise and higher education (Pel and Backhaus, 2020), or the digital divide that looms under the rise of digital social innovation.

Instrumentalization. REP exemplifies the widespread tendency to consider SI as an instrument towards fair, sustainable or otherwise desirable futures (Schubert, 2018; Wittmayer et al., 2020). A prominent 'bright side' consists in the governmental support that civic initiatives can find for their contributions to collective goals. Taylor Aiken (2019) has elicited the associated dark sides. Energy communities may indeed be crucial pillars under governmental decarbonization programs, but these civic initiatives are easily made subservient to these policy programs: Citizens see their community development and search for alternative social relations being reduced to numbers in spreadsheets, and to tangible outputs. Stirling (2014: 89) has similarly warned how narrow 'low-carbon transition' ambitions can go at the expense of broader social-economic ambitions towards energy democracy. This 'dark side' of instrumentalization may apply particularly strongly to REP, for the broad societal interests in (green) energy. SI can be exploited in many different ways, however. Extensive SI research in territorial development has highlighted how community empowerment programs are often instrumentalized for political purposes (Moulaert et al., 2013). Timebanks and various kinds of SI 'Hubs' and incubators are similarly attractive for political instrumentalization: Independence-seeking SI initiatives such as Hackerspaces have developed a sixth sense for instrumentalization, developing counter-strategies to this dark side (Pel et al., 2020a).

Projectification. REP allows for small-scale, community-based and nearby energy production. REP initiatives go through different stages of experimentation and institutionalization (Hewitt et al., 2019). Against the bright side of 'small is beautiful' solutions, various studies have called attention to the dark side of 'projectification'. Fragmenting into transient, local projects, REP may distract from large scale reforms (Torrens and Wirth, 2021). Milčiuviene et al. (2019) stress the related risk that the local REP projects could lose touch with the broader socioeconomic context of social inequality and energy poverty. The celebration of local self-sufficiency could lead to the hollowing-out of collective arrangements: Who will take care of the infrastructures? Will the remaining non-prosumers have to carry the bill alone? More generally, critical SI scholars have warned that small-scale experiments can turn out as mere 'patches' for systemic problems. They could be stepping stones towards broader transformation - but not if they remain solutions for the few, and experiments detached from regular policy (Moulaert and Maccallum, 2019). Projectification tendencies are arguably not unique to REP. After all, much SI relies on small-scale, proximity-based action. Indeed, this dark side has also been observed regarding SI initiatives as diverse as local experiments with the unconditional basic income (Pel and Backhaus, 2020), alternative currencies (North, 2014), and Transition Towns (Scott-Cato and Hillier, 2010).

Responsibilization and overburdening. REP is often accompanied by narratives of empowerment and energy citizenship (Devine-Wright, 2007). These narratives accentuate the much-celebrated 'bright' side of SI, the shift from passive consumerism towards active and ethically conscious roles in energy production, exchange, storage or investment. The dark side of this 'activation' resides in the possible effects of overburdening. As Lennon et al. (2020) argue, not all individuals possess the same resources and capacities. The self-organization narrative comes with expectations that not all citizens can live up to: They may lack the home ownership or the savings to invest, or they may struggle to understand the technological and procedural specificities. REP thus introduces a responsibilization that is overburdening for some individuals. The dark side may reside in social stigma (appearing to fall short in energy citizenship), but also more tangibly in financial opportunities (subsidy schemes) missed out on. REP may stand out for its specific requirements of energy literacy, and for the requisite funds to embark on this kind of SI. Still, also this 'dark side' appears to extend well beyond the REP example. Overburdening tendencies have also been described regarding micro-credits (Khan et al., 2007), and regarding the Ashoka network of social entrepreneurs: Teasdale et al., (2020) elicit how the 'everybody a changemaker' narrative conveys strong pressures towards self-realization and individual responsibilities for success - and not everybody can bear these pressures. In fact, Avelino et al., (2019) indicate how the very discourse of SI is accompanied with rather demanding empowerment narratives.

Hidden systemic repercussions. REP has rather immediate and widely agreed 'bright sides' in terms of sustainable energy and energy democracy. However, this form of SI has a particularly heavy material component. The associated dark sides have long been neglected, but sustainability assessment and material flow analyses have called attention to the broader systemic repercussions: The reliance on scarce raw materials comes with damaging mining practices, which tend to remain invisible for end-users (Marín and Goya, 2021). This dark side may be quite specific to REP, as a form of SI that develops around solar panels and batteries. On the other hand, many SIs have considerable material footprints. Such dark sides are quite familiar to sustainability transitions scholarship. SI developments in digitalization (Anderssen et al., 2021) and sharing economy (Frenken, 2017) have been scrutinized for their hidden

systemic repercussions.

The above accounts of 'dark sides' are of course limited representations of more fine- grained and nuanced analyses of brighter and darker sides. All SIs have their specific dark sides, and this depends notably on their particular intertwinements with innovations in technologies and in business models. Case specifics are crucial, the examples show. Furthermore, it recurs throughout the above accounts that distinctions between 'bright' and 'dark' sides remain complex matters of ethical reasoning: These assessments depend on normative standards and analytical viewpoints. For our argument, the following intermediate conclusions suffice however: 1) REP is a rich and relevant example of social innovation; 2) REP displays a range of (perceived) dark sides, and 3) these dark sides have also been perceived in SI more broadly. This helps us to address our generic research question: *How can transitions theory account for the dark sides of SI?*

3. SI dark sides: interpretations and positions

REP exhibits many of the widely acclaimed bright sides of SI. However, it also exemplifies why SI should not be mistaken for a panacea. SI scholarship has identified various dark sides. The devil is in the details - of more or less profit-focused business models (Brown et al., 2019), of institutional embedding (Pienkowski, 2021) and of individual resources and capacities (Lennon et al., 2020). As substantiated above, the dark sides of REP are quite regular occurrences in SI more generally. In coming to terms with these, it proves difficult to strike a balance between naive optimism and paralyzing critique (Section 3.1) and to acknowledge both unintended as well as intended consequences (Section 3.2).

3.1. Naive optimism and paralyzing critique

Discussions of the SI dark sides easily lapse into idealism, and ultimately into the denial of dark sides. SI is often taken as innovative solutions to social problems (Mulgan, 2006; Phills et al., 2008). This introduces an utilitarian rationale, evaluating SI in terms of concrete, immediate benefits to vulnerable groups. In public innovation scholarship one speaks similarly of SI in terms of 'public value' (Meijer and Thaens, 2021:144). This utilitarian reasoning is typical for the 'reformist' (Moulaert and MacCallum, 2019) strands of SI thought. By contrast, the explicitly counterhegemonic traditions of the 'Economie Sociale' and territorial development are evaluating SI rather for its transformative effects, i.e. in terms of changes in institutions. This zooms out from immediate benefits and utility.

Notwithstanding their ideological differences, these reformist and counterhegemonic understandings share a teleological view on SI. Both tend to consider SI as a 'social' antidote to inhumane societal conditions and oppressive hegemonic systems, i.e. as innovation that is inherently good. This provides a certain normative anchorage, which is often lacking in SI discourse (Teasdale et al., 2020:3). Explicit normative standards would help to systematize various interpretations of 'dark' sides (Section 2): They could for example distinguish 'dark sides' on either substantial or procedural grounds (Rehfeld, 2019).

Specifying the purposes of SI, teleological understandings have important potentials for normatively transparent and ethically careful SI understandings. The problem is that the purposes often remain implicit and general. Pragmatic considerations of opportunities and barriers often prevail over ethical reflection: Exploration of the 'why' is driven out by questions of 'how'. SI is not exempt from the 'pro-innovation bias' (Godin and Vinck, 2017) that pervades contemporary innovation imaginaries. SI is often taken as innovation that is 'social' and therefore inherently good. Cajaiba-Santana (2014) criticized this as the 'teleological fallacy' in SI thinking. Blok and Lemmens (2015) point out that the 'responsible innovation' concept is surrounded with similar idealism. They rightly indicate that this idealism downplays the 'Faustian character' of any innovation: Innovations do not only create - they destroy as well.

Neglecting this 'Faustian' character of innovation, the idealistic SI understandings have difficulties to acknowledge any 'dark sides'. This occurs only seldom in the form of a complete denial, but idealistic understandings do tend to remain rather silent about dark sides. They typically downplay them, speaking about them as mere fringe phenomena. The key problem is the *externalization* of dark sides. Dark sides such as commercialization and exclusion are for example often dismissed as 'perversions', or as 'false' examples of SI. As discussed, REP involves innovations in business models and organizational forms that range from not-for-profit energy communities to the commercially-driven exploration of new opportunities on energy markets. By considering only the former as social innovation, (excessive) commercialization is not acknowledged as a SI 'dark side' - it is kept out from what one considers SI. A mild form of externalization is to downplay dark sides as 'growing pains' (Larsson and Brandsen, 2016). Arguing that the SI has not yet taken off, assertions of dark sides can be dismissed as premature assessments. The exclusion tendencies in REP, for example, can thus be warded off by claiming that a certain community is still in development, and that certain social groups have not yet found their way to it. Such perspectives keep the dark sides at arms' length, and they avoid confrontation with (perceived) dark sides. As a result, SI discourse lands into an 'excess of goodness' (Fougère and Meriläinen, 2019: 14). Such idealistic views leave SI vulnerable to political opportunism: It is elevated into the unambiguous 'solution' that cannot be questioned.

Various critical understandings of SI take firm distance from such naive optimism. They easily lapse into the other extreme, however. The critique can become paralyzing. Overemphasis on the dark sides can delegitimize SI activities, obscure how dark sides can be attenuated, discourage actors from participating in SI initiatives, and lead actors to withhold institutional support. The critiques on projectification and locally confined action raise the issue whether SI is at all a worthwhile activity (e.g. North, 2014), just as the experiments with basic incomes for individuals have been ridiculed by basic income hardliners for their dramatic gap with a true, universal basic income (Pel and Backhaus, 2020). Ashoka's 'everyone a changemaker' narrative can be deconstructed to the point of de-legitimizing social entrepreneurship in general (Teasdale et al., 2020). This is how critique can stifle the search for ways to attenuate dark sides. When overemphasizing the dark sides and framing SI as a suspect activity, critiques can ultimately undermine

political support. For example, social enterprises often rely on subsidies, political support, and on favorable public perceptions of their social impacts (Dey and Teasdale, 2016; Pel and Bauler, 2017). This also applies to REP, as it is approaching the 'post-subsidy era' (Brown et al., 2019): Will it retain political support, despite its apparent 'dark sides'?

The naive embrace of SI has been challenged through various transformation-oriented perspectives. Against the utilitarian logic of problem-solving and 'meeting societal needs', these counterhegemonic perspectives rather pinpoint how SI may reproduce structural power asymmetries. Critical accounts have therefore stressed that SI should revolve around the pursuit of empowerment (Moulaert et al., 2013), institutional innovation (Unger, 2015) and radically democratized organizational forms (Scott-Cato and Hillier, 2010). Pointing out the discrepancies between radical SI visions and often rather incremental and system-confirming SI practices, these transformation-focused perspectives leave little room for naive understandings: Dark sides such as commercialization, exclusion and hidden systemic repercussions are shown to be pervasive. The critique often gets carried away, however. REP may tend towards responsibilization that overburdens people (Cf. Section 2), but should the initiatives towards energy citizenship be mistrusted *as such* (Lennon et al., 2020)? The system-confirming dark faces of SI have also been underlined in critical studies of participative governance (Swyngedouw, 2005), initiatives against child labor (Khan et al., 2007), and social entrepreneurship (Teasdale et al., 2020). These attempts to 'unmask' SI icons have usefully clarified how and why dark sides emerge. Considering the dark sides as pathologies of hegemonic 'neoliberal' orders or oppressive governmentalities, these critiques do tend to disregard empirical variety, however: The devil is no longer in the details - he is omnipresent. This is particularly striking in the many wholesale critiques of the SI *concept*: Exposing its ideological operation as a misleading narrative of empowerment, Fougère and Meriläinen (2019) effectively obscure its bright sides.

Wholesale critiques and exaggerated analyses of SI dark sides paralyze SI analysis (they obscure shades of brightness) as well as action (they delegitimize and disempower). Overemphasizing the vulnerability to exclusion and commercialization, critiques delegitimize political efforts to support, institutionalize and subsidize REP. Underlining the tendencies towards excessive responsibilization and the severity of hidden systemic repercussions, exaggerated criticisms can discourage individuals from engaging in REP altogether. Obscuring the bright sides of REP, they evoke resignation in energy *con*sumerism (Devine-Wright, 2007).

In search of more nuanced perspectives, scholars have thus described SI dark sides rather as the 'other side of the coin' of institutional change (Van Wijk et al., 2019), or as the 'tensions' inherent to institutional bricolage (Pel et al., 2020a). Showing how many historical examples of SI emerged out of societal contradictions and conflicting values, Westley et al. (2017) demonstrate instructively how the 'dark sides' may be inherent to SI - but they are not the essence of it. It is indeed telling how SI is often endorsed for its disruptiveness (Fougère and Meriläinen, 2019), i.e. the temporary dark sides that occur before its bright sides come forward. There are thus accounts of the SI dark sides that are critical, yet without landing in wholesale critiques with the indicated paralyzing effects.

3.2. Unintended and intended consequences

The division between paralyzing critique and naive optimism is cross-cut by another line of polarization. The SI dark sides tend to be considered either as unintended consequences (which cannot be attributed to particular actors), or as quite intended consequences (enacted by particular groups of people).

The latter view on SI dark sides seems quite intuitive. Regarding REP, one can think of commercial actors' attempts to seize the business opportunities that emerge alongside with the innovations in governance, organizational forms, and business models. Various forms of exclusion can similarly be attributed to elitist attitudes of particular groups within prosumer collectives. 'Intended consequences' framings do not necessarily identify *individual* culprits, however. Dark sides can also be attributed to mechanisms of systemic violence and domination. Prominent examples are the critiques on the Ashoka change-maker ideology (Teasdale et al., 2020), on participative governance (Swyngedouw, 2005) and on energy citizenship (Lennon et al., 2020). These accounts describe SI as the quite purposive introduction of discipline, and of pressures to conform: The dark sides do not appear by accident, they are intended consequences. Also relevant are accounts of SI as morally dubious or irresponsible *in hindsight*. The historical case studies of Westley et al. (2016; 2017) show well how dark sides can emerge out of patronizing, control-oriented 'good intentions'. The 'intended consequences' framings often indicate gray zones, rather than clear-cut dark sides. Relevant examples are the analyses of controversial forms of SI, such as described in case studies on alternative psychiatry (Crossley, 1999) and the universal unconditional basic income (Pel and Backhaus, 2020). Meanwhile there is increasing attention to the newly emerging dark sides of digitalization (Andersen et al., 2021) and digital social innovation. This involves tendencies towards exclusion (Meijer and Thaens, 2021) and infringements on privacy (Sovacool et al., 2021).

These dark sides of digitalization-related SI exemplify the considerable room for interpretation. They can be attributed to particular actors' design choices, to policies, or to the Big Tech companies that drive 'surveillance capitalism' (Zuboff, 2019). By contrast, SI dark sides are often described without any reference to intentional agency. They can be treated as negative 'side-effects', i.e. as unintended consequences: The 'projectification' of REP is widely recognized, for example, yet only seldom is somebody held accountable for it. The interpretation in terms of unintended consequences also speaks from the common notions of 'negative systemic repercussions' (Khan et al., 2007:1057) and 'perverse effects' (Meijer and Thaens, 2021:140). Another example is the commercialization of REP. Even if it can be attributed to concrete energy market 'players', analyses often refer to the dominance of market logics (Brown et al., 2020; Wittmayer et al., 2021). Likewise, critical scholarship on social entrepreneurship often highlights mechanisms of 'mission drift' and 'institutional isomorphism' (Dey and Teasdale, 2016). Martin (2016) discusses the dark sides of the sharing economy as innovation 'capture' by incumbent exploitative societal structures. This notion of 'capture' actually comprises two sides of the spectrum. In the literal sense it refers to purposive agents taking possession of an innovation, yet it is also often used to indicate unintended consequences, processes of evolutionary drift, and 'mutation', as evolutionary economists describe it rather clinically (Schlaile et al.,

2018:17).

The distinguished stances towards SI dark sides - as occurring in REP and in many other examples of SI - are summarized in Fig. 1. Indicating that all four quadrants provide certain reasonable considerations, it calls attention to the limitations of one-sided understandings: Arguably, these can be rejected for neglecting this broader range of reasonable considerations. Importantly, this does not mean that only the exact middle of the diagram would be tenable. Various understandings of the 'dark sides' do lean towards one quadrant or the other - yet without entirely negating the reasonable considerations of other stances[1]. Fig. 1 indicates a *zone of nuanced positions*. Transitions scholarship has proposed various routes into this zone. The key concept here is transitions *directionality*.

4. A nuanced view on the SI dark sides: transitions directionality

Looking for a nuanced view on the SI dark sides, transitions research is perhaps not the obvious research strand to turn to. It tends to focus on the *bright* sides of innovation (Turnheim and Sovacool, 2020). Dark sides are difficult to account for in Technological Innovation System (TIS) approaches, for example, as these tend to assume the desirability of innovations (Weber and Rohracher, 2012; Bening et al., 2015; Schlaile et al., 2017). Other limitations of transitions thinking could reside in its 'post-political' elements (Kenis et al., 2016), or in its limited capacity to handle ambivalence (Walker and Shove, 2007). Particularly relevant for our REP example was the point made by Stirling (2014): Often focusing on technological aspects, transitions research easily gets carried away by the bright sustainability potentials of renewable energy technologies. Neglecting SI aspects such as REP, this tragically forgets about the associated bright (e.g. energy democracy) and dark sides (e.g. reinforced socioeconomic inequalities).

On the contrary, we argue that transitions research is actually quite well-positioned to handle the SI dark sides. First of all, its 'pro-innovation bias' should not be overstated, given the proliferation of work on transition failures (Weber and Rohracher, 2012), transition backlash (Pel, 2021), undesirable transitions (Cohen, 2010) and dark sides of transitions (Marín and Goya, 2021; McGowan and Antadze, 2023). Meanwhile, the SI dark sides are quite regular topics in studies on the politics (Avelino et al., 2016) and the ethics (Bening et al., 2015; Kanger and Sovacool, 2022) of sustainability transitions. Even apart from the recent proposals for 'critical perspectives' (Hopkins et al., 2020) or 'critical turns' (Feola, 2019; Ford and Newell, 2021), transitions research is a form of critical social theory from the outset (Pel et al., 2016): It diagnoses the social problems (and the persistent 'dark sides') of its time, and seeks remedies to those (Honneth 1991).

Importantly, transitions theory has been developed to provide a *balanced* theory of change. It aims to articulate both transformation as well as stability, lock-in as well as lock-out (Geels, 2005; Grin et al., 2010). Avelino and Grin (2017) stress the 'reconstructive' ethos that guides transitions governance: *De*constructive analyses of systemic problems are to inform *re*constructive attempts to unleash processes of system innovation. This also implies a nuanced stance towards SI dark sides. They are acknowledged through deconstructive analyses of systemic sustainability problems, but always with a *re*constructive appreciation of the brighter sides. Transitions governance treats the dark sides neither as products of conspiracies nor as random systemic effects. Such extreme, heavily structuralist positions obscure the scope for change, and the concrete activities of various actors that seek to develop the bright sides of innovations.

The key strength of transitions research resides in this nuanced understanding of *innovation*. This helps to elaborate the dialectical perspectives that have been developed in SI scholarship. Notable articulations of the bright and dark sides have been developed through analyses of institutionalization paradoxes (Cajaiba-Santana, 2014; Pel et al., 2020a; Van Wijk et al., 2019) and of empowerment ambiguities (Swyngedouw, 2005; Dey and Teasdale, 2016; Westley et al., 2017; Avelino et al., 2019). It remains difficult however to get beyond general conceptual statements about 'double-edged swords'. Transitions research recognizes that innovation simultaneously creates and destroys (Cf. Blok, 2020). SI (such as REP) is therefore no longer considered statically, i.e. as an object with certain dark and bright effects. Instead, it is considered as ontogenesis, i.e. as a coming-into-being of new social relations - in various forms, and with brighter and darker sides.

Finally, it may even be an advantage that transitions research does not focus exclusively on SI. Considering social innovations as inextricable parts of socio-technical innovation processes[2], SI phenomena are viewed in a more holistic and dynamic manner. Transitions are understood as dynamic co-evolutionary processes of multiple socio-technological innovations. The many SI aspects of REP are considered to evolve in interaction with other innovations, notably in technologies and infrastructures. Through this co-evolution, transitions unfold as complex, open-ended processes. Importantly, this implies that transitions can take more and less desirable courses (Rotmans, 2005; Grin et al., 2010). In recent years, transitions scholarship has become more sensitive to this *directionality* of transitions, i.e. the diversity of possible transition pathways (Stirling, 2011, 2019; Røpke, 2012; Pel et al., 2020b; Andersson et al., 2021). Focusing on the directionality of transitions, SI dark sides are considered as inherent aspects of transition processes. As underlined by Kemp et al., (2007), transitions cannot be controlled. Transitions governance therefore amounts to continuous attempts to bring out the relatively brighter sides of innovations.

5. Transitions directionality: articulating SI dark sides

The transitions directionality perspective leads into the 'zone of nuanced perspectives' on SI dark sides (Cf. Section 3). We briefly

[1] Also the authors themselves take different approaches to the SI 'dark sides'. This paper expresses their collective venture into the zone of nuanced perspectives.

[2] This also implies that transitions theory does not draw a strict line between dark sides of SI, and dark sides associated with broader bundles of socio-technical innovations - such as REP.

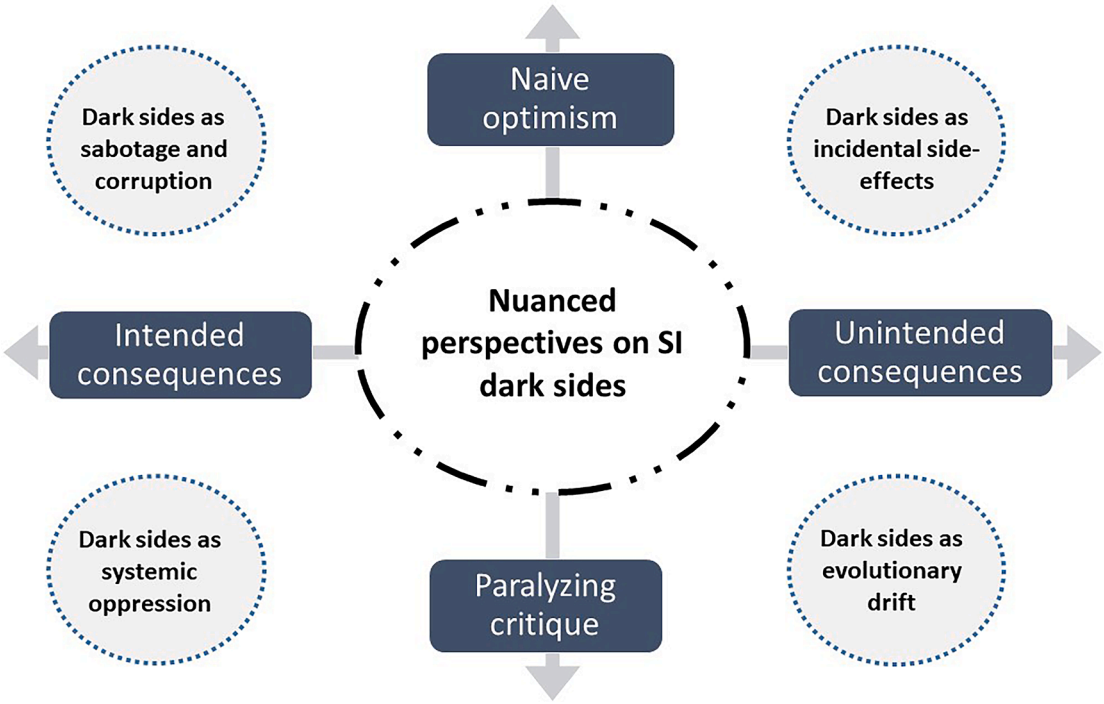

Fig. 1. Understandings of SI dark sides.

discuss 5 key insights.

5.1. Socio-technical path dependence

The advances towards decentralized energy systems open up many bright perspectives towards energy democracy and sustainable energy practices. In light of these bright sides, the 'dark sides' of REP (and of SI more generally) are often dismissed as transient, secondary ills. By contrast, the awareness of transitions directionality emphasizes the path dependence of socio-technical innovation processes. This makes for a sobering perspective on SI and its dark sides: Rotmans (2005) argued how the persistence of current sustainability problems can be attributed for a significant part to the success of many past innovations. Stabilizing into inert socio-technical structures, their dark sides transpired only later. Schot and Kanger (2018) underlined this point about inherited dark sides, indicating the historical emergence of 'industrial modernity'. As this deep societal structure continues to set the directions for innovation, social innovations can never fully escape from its systemic generation of dark sides. REP is a case in point: It forms part of historically unprecedented attempts to break with a path-dependent energy system (Stirling, 2014). Viewed in the socio-technical context of long-lasting infrastructures, deeply entrenched technologies and unequally distributed expertise, SI 'dark sides' such as exclusion, commercialization and 'hidden systemic repercussions' come forward as quite regular phenomena.

Considering REP in the context of matured Large Technical Systems, this SI can no longer be mistaken for something inherently positive. Integrating a broad range of insights about system reproduction, institutional inertia and path dependent innovation (Geels, 2005), the notion of the socio-technical 'regime' highlights the heavy hand of the past. Referring to Fig. 1, this takes us far away from 'naive optimism'. To be sure, SI scholars without such socio-technical outlook have indicated the importance of path dependence as well: Moulaert et al., (2007) consider how SI developments towards increased political participation have to deal with historical legacies of power concentration, marginalization, and spatially distributed privilege. This similarly avoids 'naive optimism'. The framings in terms of 'privilege' do lean rather strongly towards the 'intended consequences' positions. By contrast, the analyses of socio-technical regimes accentuate the 'unintended consequences' involved. Combining insights from the history of technology, evolutionary economics and the social construction of technology, they highlight how SI dark sides such as 'exclusion' and 'hidden systemic impacts' can be considered as historical accidents. The socio-technical outlook on SI calls attention to rather impersonal culprits such as dominant technological designs, inert infrastructures, routines of maintenance, and prevailing expertise. Stirling (2014) underlines the importance of the latter kind of path dependence: The range of what counts as reasonable, feasible, and realistic choices regarding new energy practices is often defined through incumbent expertise.

5.2. Institutional contradictions

Attentiveness to transitions directionality also involves the insight that socio-technical regimes are not monolithic structures. They

are rather understood as diversified structures, characterized by institutional contradictions.

Socio-technical path dependence clarifies the pervasiveness of SI dark sides. The transitions directionality perspective avoids determinism, however, which would lead into one-sided 'paralyzing critique'. Importantly, socio-technical regimes are acknowledged to be institutionally hybrid structures (Fuenfschilling and Truffer, 2016), driven by mixtures of market, state and civil society logics. Such constellations do not allow for a systemic, inevitable production of SI dark sides. They leave considerable scope for actors to mitigate dark sides. Stirling (2019) underlines similarly that innovations do not run into the dominance of fully coherent systems, but rather into the more dispersed barriers of so-called 'configuring fields'. This view roughly coincides with SI insights developed in Third Sector Studies scholarship, network governance and social entrepreneurship research: The hybridization and intertwinement between diverse institutions comes with many institutional contradictions and tensions (Brandsen et al., 2016). Certain SI dark sides are therefore endemic. 'Projectification' can be considered a quite regular effect of fragmented administrative structures. By contrast, the institutional contradictions mainly remind us that brighter and darker sides evolve through ongoing struggles: The dark sides of 'overburdening responsibilization', 'commercialization' and 'exclusion' can be retraced to the tensions between the market, state and civil society actors - all playing a part in social innovations such as REP.

The awareness of institutionally fragmented 'regime' structures leads away from both 'paralyzing critique' as well as 'naive optimism' stances. The SI dark sides are considered rather as institutional tensions that can be seized to create opportunities for change. Rotmans (2005) underlines that system innovation *revolves* around the institutional tensions between market, state, civil society and knowledge institutes. Transitions governance scholarship underlines how these tensions can be channeled towards brighter sides of innovation through network governance, the development of multi-actor innovation systems, and public-private partnerships (Grin et al., 2010; Pel et al., 2020b). SI scholars such as Westley et al. (2017) have indicated similarly how SI is often developed 'at the cracks of the system', and how it is often born out of tensions. Van Wijk et al. (2019) specify how new organizational forms tend to emerge as responses to institutional tensions, and Schubert (2019) insightfully describes SI as 'repair work' for the cracks in the social order. One could thus consider how REP has resulted from institutional tensions between energy consumerism and energy citizenship. The sensitivity to hybrid institutional origins provides a pragmatic, nuanced perspective: Social innovations are seldom confused for neat 'solutions' to problems.

The focus on 'institutional contradictions' helps to acknowledge SI dark sides as both unintended as well as intended consequences. Highlighting how REP develops through institutionally hybrid arrangements, its various dark sides have been described as fairly regular aspects of unavoidably messy institutionalization processes (Brown et al., 2020; Wittmayer et al., 2021). Transitions research can appreciate these SI dark sides as transient hitches in an as yet unsettled decentralization process. Considering them as unintended consequences in an ongoing institutional experiment, the dark sides are treated as a form of 'collateral damage' - as undesirable but somewhat accidental side-effects of disruptive innovation.

The focus on institutional contradictions is relatively silent on the purposive production of dark sides. By contrast, the commercialization and exclusion tendencies of REP have been criticized elsewhere as fundamental flaws (Lennon et al., 2020), and as the quite intended consequences of single-minded actions. After all, social innovation processes such as REP also tend to involve less than altruistic actors: Greedy players on the energy market, indifferent grid operators, and selfish consumers. These issues of responsibility, blame and the distribution of dark sides are gaining attention in transitions research. The prevailing emphasis on 'unintended consequences' is counterbalanced notably through the scholarship on energy democracy and energy justice (Burke and Stephens, 2018; Jenkins et al., 2018; McCauley and Heffron, 2018; Kanger and Sovacool, 2022).

5.3. Evolving ideological 'landscapes'

This third insight concerns the ideological 'landscape' structures that form the background to SI processes. Analyses of socio-technical regimes raise attention to the systemic selection pressures on social innovations, and they clarify why dark sides are endemic. The concept of the socio-technical 'landscape' indicates how regime tensions are created in turn through slow societal developments, the 'longue durée' (Geels 2005; Grin et al., 2010). This comprises technological shifts such as the ICT revolution, but also cultural-ideological shifts such as individualization, emancipation of minorities, paradigms of participative democracy, and the rise of do-it-yourself attitudes to consumption. Sensitivity to transitions directionality implies attention to these deep ideological structures, such as those of 'industrial modernity' (Schot and Kanger, 2018): Beneath the more tangible material features of socio-technical regimes, these shifts in the ideological landscape determine which socio-technical configurations are considered empowering, alienating, effective, or fair.

The 'landscape' shifts in mind-sets and hegemonic beliefs are arguably of particular importance for SI. Next to new ways of doing and organizing, SI includes new ways of framing and knowing (Cf. Section 2.1). The very notion of RE *prosumerism* is an example: This neologism reflects how innovations in energy systems have co-evolved with broader ideological-cultural shifts, away from consumerist social relations (Randelli and Rocchi, 2017). Situating SI in a shifting ideological landscape, its relative darker and brighter sides can be appreciated with more nuance. The exclusion effects of REP, for example, could thus be viewed in light of taken-for-granted forms of energy system expertise, modes of planning, forecasting and management (Stirling, 2019). Likewise, one could consider REP in the context of newly emerging governmentalities (Hopkins et al., 2020). Various proposals for 'critical turns' in transitions research have thus called attention to the ideological structures of capitalism (Feola, 2019), colonizing discourses (Ghosh et al., 2021), automobility cultures (Wells and Xenias, 2015), and hegemonic belief systems more generally (Ford and Newell, 2021). Göpel (2016:47) even proposed a Gramscian view on transitions, extending the MLP model with the overarching structuration of society through worldviews, visions and paradigms.

Highlighting the deep societal roots of SI dark sides, these analyses of shifting ideological landscapes steer clear from naive

optimism. They rather lean towards the opposite stance of 'paralyzing critique'. Similar to the analyses of critical SI scholars, SI dark sides are considered as manifestations of oppressive structures that pervade society. SI is seen to either reproduce these oppressive forces (Swyngedouw, 2005), or to exist alongside them, in secluded zones (Cf. Scott-Cato and Hillier, 2010; North, 2014). Transitions research remains optimistic about the scope for innovation and change, however. Landscape developments may generate dark sides, but they may also create windows of opportunity for transformative innovations (Geels, 2005): The rise of REP, as a move towards decentralized and democratized energy production, can be understood as a result from landscape pressures on a centralized energy 'regime'. In the same vein, Göpel (2016) presents a quite optimistic reading of Gramsci. Against the oppressive effects of ideology, awareness of transitions directionality also acknowledges the scope for second-order learning, reframing of system purposes, and shifts in mind-sets. The attention to evolving ideological landscapes thus ensures a certain balance between 'naive optimism' and 'paralyzing critique' views on the SI dark sides.

Regarding the spectrum between intended and unintended consequences understandings, this focus on ideological 'landscape' developments does lean quite strongly towards an 'evolutionary drift' stance: The 'landscape' is an evolutionary category, and it zooms out from purposive action. It highlights how SI dark sides such as 'instrumentalization' and 'overburdening responsibilization' can be retraced to ideologies of neoliberalism, welfare states and individual autonomy (Kemp et al., 2022). Regarding the 'hidden systemic repercussions' associated with mining, this perspective similarly underlines how social innovations such as REP form part of deep societal structures such as 'industrial modernity' (Schot and Kanger, 2018). The associated dark side of unsustainable mining activities is attributed less to particular actors and industries. Instead, attention is directed rather towards 'extractivist' ideologies, and towards economic models that downplay the damage caused by large-scale extraction of minerals. Meanwhile it remains possible to focus on ideological landscapes whilst articulating purposive agency. Analyzing automobile cultures, Wells and Xenias (2015) show how certain ideological constructions are actively produced by particular actors, such as those of the advertisement industry.

5.4. Niche-regime dialectics

A fourth key insight from transitions directionality is the consistent treatment of SI as *innovation* processes. This may appear trivial, but SI scholarship also has various conceptual origins in which innovation is not at the center of attention (e.g. social entrepreneurship, social movement studies, urban development). Rather than considering social innovations as *things*, transitions research understands them rather as processes of coming-into-being, and of diversification. Transitions research has a fine sense of this ontogenesis. Not only does it distinguish between radical 'niche' innovation and incremental 'endogenous renewal', it also investigates the complex *interplay* between these kinds of innovation processes. Various empirical studies have highlighted how radical niches tend to be translated, appropriated, and captured (Smith, 2007; Pel, 2016). In the process, innovations such as the energy-producing greenhouse (Hoffmann and Loeber, 2016) go through series of prototypes and local adaptations. The notion of transitions directionality underlines this: Just as innovations more generally, social innovations tend to diversify over time, into brighter and darker variations.

The acknowledgement of niche-regime dialectics shakes off the 'naive optimism' view in which the dark sides are considered *false* instances of a SI. Larsson and Brandsen (2016:298–299) indicate similarly that SI is often surrounded with 'inflated expectations of diffusion'. This neglects how dark sides may occur quite naturally, as flaws of immature prototypes. In fact, frameworks such as Strategic Niche Management often take dark sides as opportunities for learning and fine-tuning (Kemp et al., 1998). Studies on broadband internet (Røpke, 2012) and driverless cars (Pel et al., 2020b) have also highlighted how transitions directionality calls for careful balancing and continuous adjustment towards the relatively brighter sides of innovations - innovations that remain fundamentally ambiguous. As elaborated by Andersson et al. (2021), sensitivity to transitions directionality implies a morphological interest in the different *forms* that innovations may take over their lifetime. This empirical concreteness drives away from the extreme positions of 'naive optimism' and 'paralyzing critique': The devil is considered to be in the details.

The sensitivity to niche-regime dialectics also leads towards a balanced position on the 'intended/unintended consequences' spectrum. Highlighting how social innovations are translated, appropriated and 'captured' by diverse actors, analyses of niche-regime dialectics are very attentive to strategic agency: This clarifies how SI such as REP may be often promoted as radical niches (bringing fundamental SI in terms of energy democracy and energy justice), whilst simultaneously solving problems of incumbent actors (contributing to renewable energy targets, and - as became obvious after the Russian invasion of Ukraine in 2022-, to energy security). Meanwhile, analyses of niche-regime dialectics also acknowledge how SI dark sides can emerge as unintended consequences: Kooij et al., (2018) highlight for example how REP continues to evolve through a variety of institutional, technological, organizational and juridical developments.

5.5. Phased innovation processes

Analyses of niche-regime dialectics situate SI dark sides within ongoing processes of translation, i.e. of attempts to adapt and appropriate innovations. Importantly, the 'capture' of innovations is often only a passing moment (Pel, 2016). In hindsight, innovations with apparent dark sides may turn out to have been stepping stones towards brighter futures (Meadowcroft, 2009). A fifth key insight from transitions directionality is this long-term, processual perspective. This avoids considering SI dark sides as incidental corruptions (the 'naive optimism' position), or to take apparent dark sides as the definitive 'unmasking' of SI (the 'paralyzing critique' position). Attentiveness to transitions directionality also implies attentiveness to the different phases that SI may land into, and to the occurrence of dark and bright sides *over time* (Kanger and Sovacool, 2022). This perspective underlines that there are no natural, linear, pre-determined sequences of phases: SI Dark sides are not considered as mere growing pains - they can always resurface, depending on the changing dynamics of socio-technical systems.

Various SI scholars have similarly discussed the dark sides as phases of SI. Larsson and Brandsen (2016: 299) indicate how SIs tend to lose their radical contents in the course of mainstreaming processes. Fougère and Meriläinen (2019:7) indicate that SI dark sides may occur as immediate disruptions, but they may also involve systemic ramifications that manifest only over the longer term. Westley et al. (2017) situate SI in an adaptive cycle. Their initial bright sides fade over time: As their system environment changes, they become inert, outdated and dysfunctional. The transitions-theoretical distinction of pre-development, take-off, acceleration and stabilization phases provides a similarly helpful temporal perspective. Other than indicating a linear model of stepwise maturation, it calls attention to the changing feedbacks between innovations - which may lead to mutual reinforcement, but not necessarily so (Rotmans, 2005). This clarifies how social innovations, depending on their transition phases, may become vulnerable to particular kinds of 'dark sides'. The 'instrumentalization', 'commercialization' and 'exclusion' tendencies of REP could thus be considered as phase-specific dark sides, rather than as inherent ones.

The attentiveness to transition phases leads away from 'intended consequences' understandings. Considering REP as part of an *ongoing* transition, its dark sides appear as rather unintended consequences of changing societal contexts. Dark sides such as commercialization and exclusion could be attributed partly to the advent of the post-subsidy era, for example (Brown et al., 2019). SI dark sides can be considered similarly as side-effects of accelerated transition processes (Skjølsvold and Coenen, 2021), or as innovation dynamics specific to the current 'advanced stage' of energy transition (Markard, 2018). On the other hand, analyses of transition phases do not necessarily obscure strategic agency. Lindberg and Kammermann (2021) indicate for example how changes of transition phases come with changing actor coalitions. More generally, attentiveness to transition phases can very well inform a nuanced view on SI dark sides. As Garud and Gehman (2012) indicate, this can be done through reflection on temporal scales: Zooming in on concrete events or zooming out towards transition phases, apparent SI dark sides are considered through different perspectives.

6. Conclusion and discussion

6.1. Conclusion: accounting for the SI dark sides

SI research tends to focus on the bright sides of these innovations in social relations. This paper responds to recent calls to mind the dark sides as well (Section 1): *How can transitions theory account for the SI dark sides*? Having unfolded this debate through the example of renewable energy prosumerism, it is clear that the occurrence of dark sides is widely acknowledged (Section 2). The challenge remains however to develop a more nuanced understanding of them. It is important to steer clear of extreme, one-sided stances. There is a wide range of reasonable stances between naive optimism and paralyzing critique, and between understandings in terms of intended and unintended consequences (Section 3). Transitions theory is actually well-positioned to develop such nuanced understandings. The key concept is transitions directionality (Section 4). Table 1 summarizes how it places the SI dark sides at the heart of transitions thinking (Section 5):

The listed insights provide specific answers to our research question. Taking a systemic, socio-technical view on the matter, they lead away from the extreme views on the SI 'dark sides':

- Beyond 'naive optimism': Overall, the field of transition research displays a certain 'pro-innovation bias' (Godin and Vinck, 2017; Turnheim and Sovacool, 2020). This follows from its strong commitments towards constructive, actionable knowledge. However, attentiveness to transitions directionality helps to acknowledge the SI dark sides as inherent elements of transition processes. Particularly strong drives towards such acknowledgement are the insights on path dependence, ideological landscapes and institutional contradictions.
- Beyond 'paralyzing critique': The transitions directionality angle acknowledges the pervasiveness of SI dark sides, yet it avoids the extreme position of considering them immutable or inevitable. Especially the insights on niche-regime dialectics and institutional contradictions highlight that the devil is in the details: Brighter and darker adaptations are under constant negotiation. Importantly, SI dark sides can also be appreciated as opportunities for learning.
- Beyond 'intended consequences': The awareness of transitions directionality steers clear from assumptions of purposively and unilaterally inflicted dark sides. Highlighting distributed agency and complex power asymmetries, it tends not to attribute SI dark

Table 1
Understanding SI dark sides: Insights from transitions directionality.

Transitions Directionality aspect	Key insights on 'dark sides' of social innovation
Socio-technical path dependence	• Dark sides as unintended consequence of past innovations and socio-technical 'regime' formation • Dark sides as side-effects of dominant technological designs and inert infrastructures
Institutional contradictions	• Dark sides as competing institutional logics • Dark sides as collateral damage of institutionally hybrid innovation
Evolving ideological 'landscape' structures	• Dark sides as manifestations of hegemonic ideology • Dark sides as evolutionary drift
Niche-regime dialectics	• Dark sides as immature prototypes • Dark sides as opportunities for learning
Transition phases	• Dark sides as passing phases • Dark sides as bright sides becoming outdated

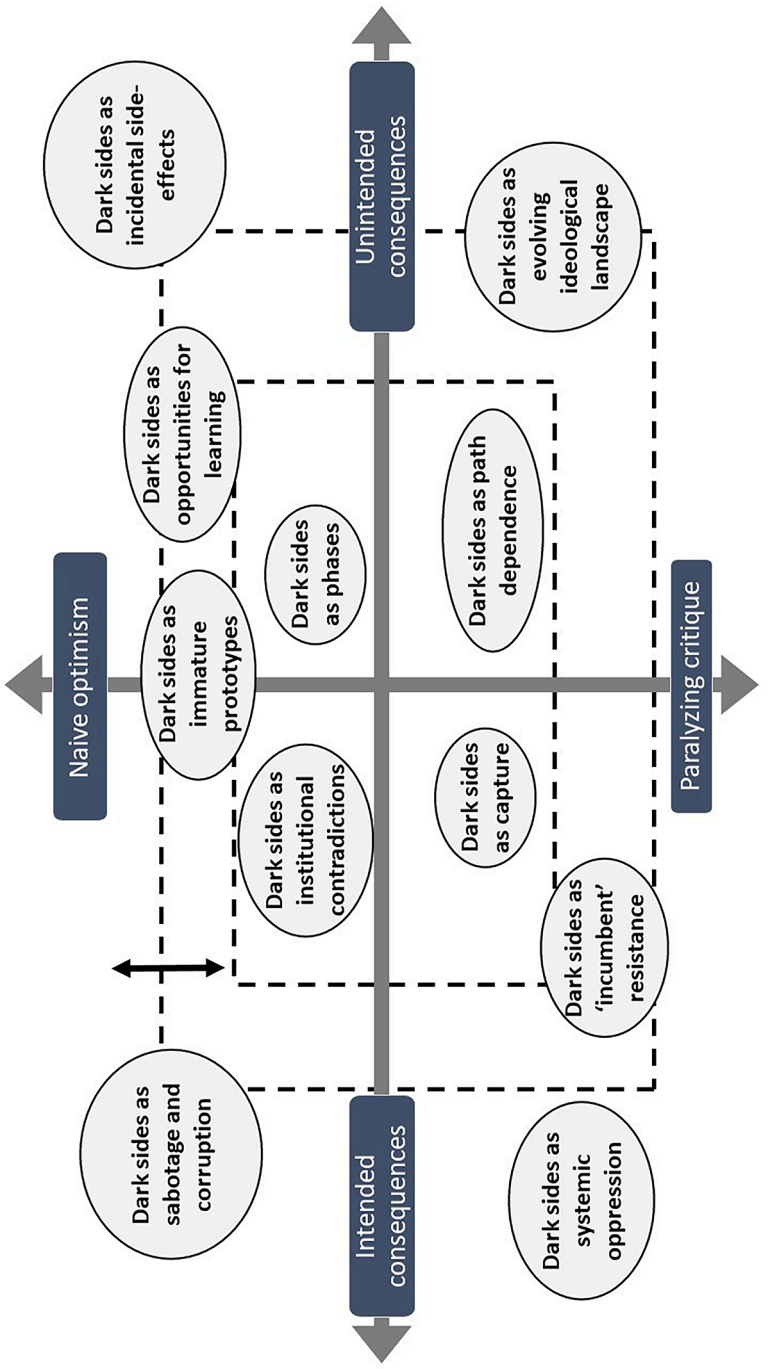

Fig. 2. The 'dark sides' of SI: Zone of nuanced positions.

sides to particular actors. Especially the insights on evolving ideological landscapes underline how dark sides can emerge unintentionally, from evolutionary drift.

- Beyond 'unintended consequences': The transitions directionality angle leans towards 'unintended consequences' understandings of SI dark sides. This is counterbalanced by the attention to innovation capture, i.e. to active, purposive appropriation of innovations by incumbent actors and structures.

6.2. Discussion: SI dark sides, a heuristic

Transitions research can provide a reasonably nuanced perspective on the SI dark sides. The transitions directionality angle captures at least a part of all corners of the 'SI dark sides' debate. It does not hold the precise middle ground, however. It is a systems-evolutionary perspective, leaning towards the 'unintended consequences' understandings. Furthermore, transitions directionality comprises a diversified range of more specific insights (Cf. Section 5), it is not one singular position. Bringing together a range of possible stances, Fig. 2 provides a heuristic:

The heuristic provides a systematic ordering of positions, along the two main axes of the debate. Calling attention to the diversity of possible perspectives, the heuristic reminds of the broad range of relevant considerations that have been brought forward. Inviting to consider multiple, sometimes opposing, viewpoints, the heuristic supports a nuanced engagement with the SI dark sides. It does not prescribe or advocate any particular position, yet it does argue against extreme, one-sided perspectives (Cf. Section 3). As visualized through the dotted rectangles, the heuristic does not propose a definitive demarcation of perspectives deemed 'sufficiently nuanced'. Where to draw this line, is a matter for further reflection, and for case-specific elaboration.

For further application in transitions research, the heuristic calls attention to three specific issues:

Balancing reconstruction and deconstruction. Overall, the transitions directionality angle leans towards the upper part of the diagram. Whilst avoiding the instrumentalist positions that leave much transitions research in the 'naive optimism' area, it comes with a certain optimism about the possibilities to mitigate dark sides. It is reconstructive (Avelino and Grin, 2017) in spirit: Its diagnoses of dark sides are hopeful analyses, meant to disclose the potentials for brighter futures. By contrast, our analysis has shown how one can also deploy transitions theory in *de*constructive spirit. Critical perspectives may have 'paralyzing' effects through their wholesale dismissals of certain social innovations. Still they do have the useful capacity to elicit the deeper societal roots of certain SI dark sides (Feola, 2019; Hopkins et al., 2020; Ford and Newell, 2021). The attention to transitions directionality underlines it: The notion of the socio-technical 'regime' has under-utilized potentials for critical-theoretical diagnosis (Pel et al., 2016). It is therefore worthwhile to explore the positions in the bottom half of Fig. 2.

Balancing evolutionary wisdom and acknowledgement of 'intended consequences'. The transitions directionality angle leans towards 'unintended consequences' understandings. This usefully sidesteps understandings in term of blame, debt and retribution. Such retrospective approaches to SI dark sides ('which actors were responsible for the commercialization of REP?') may seem unsuitable for *forward*-looking transition activities. On the other hand, the framings in terms of 'unintended consequences' may be a bit too convenient. Sometimes the dark sides can very well be retraced to visible hands, known interests and established positions of power. Considering this relative blind spot, it merits consideration to approach the SI dark sides more in terms of *intended* consequences and even in terms of purposive harm - and also as problems suffered by particular groups of people. Such approaches are gaining ground through the scholarship on transition ethics and 'just' transitions (Jenkins et al., 2018). SI research has traditionally been very attentive to individuals and groups at the receiving end of innovation (Moulaert and Maccallum, 2019). Transitions researchers can learn from this literature.

Balancing ethical judgement and normative reflection. Political actors often struggle to clearly distinguish dark from bright sides, and success from failure (Larsson and Brandsen, 2016). Guided by market, state as well as civil society logics (Brown et al., 2020; Wittmayer et al., 2021), REP exemplifies the confusingly broad range of normative standards that may be considered relevant. By consequence, REP comes with many trade-offs (Moroni et al., 2019): Between individual utility and broader welfare effects (Bauwens and Defourny, 2017), and across the dimensions of the 'energy trilemma'. This calls for careful, systematic and transparent ethical judgement. *Why, by which and by whose normative standards, do we consider something a 'dark' side of SI?* On the other hand, the very quest for judgement might explain why debates on this topic gravitate towards extreme positions. Approaching the SI dark sides as principled ethical matters in need of final diagnosis, we easily neglect their mixtures of brighter and darker sides. Moreover, we may overlook the evolution of the normative frameworks themselves. REP is closely connected to the rise of domestic 'smart systems', for example, and these come with ambiguous effects in terms of convenience, care, and control (Sovacool et al., 2021). For many societal actors it is not clear yet how to judge these socio-technical innovations. Taking the directionality of transitions seriously, it is essential to reflect on these changing parameters of ethical judgement (Stirling, 2011). However important they are for careful evaluation and discussion of apparent 'dark' and 'bright' sides, normative standards themselves are subject to innovation and change (Elzen et al., 2011; Correljé et al., 2022). Focusing more on social innovations and their brighter and darker sides, transitions research gains understanding of these important normative aspects.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.eist.2023.100775.

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