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Restructuring energy systems for sustainability? Energy transition policy in the Netherlands

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ABSTRACT

Increasingly, researchers and policy makers are confronting the challenge of restructuring energy systems into more sustainable forms. A 'transition management' model, and its adoption in the Netherlands, is attracting attention. Starting from the socio-technical multi-level theory that informs 'transition management', we analyse the 'energy transition' project carried out by the Dutch Ministry of Economic Affairs. Despite considerable achievements, their approach risks capture by the incumbent energy regime, thereby undermining original policy ambitions for structural innovation of the energy system. This experience presents generic dilemmas for transitions approaches.

1. Introduction

In 2001, the Fourth Dutch National Environmental Policy Plan (NMP4) adopted a transitions approach aiming at 'system innovation' in important societal domains like energy. It proclaimed that persistent environmental problems like climate change cannot be solved by intensifying current policies. Instead the plan argues, 'solving the major environmental problems requires system innovation;...long drawn-out transformation processes comprising technological, economic, socio-cultural and institutional changes' (VROM, 2001, p. 30). For the energy system, the policy plan aims at a 40–60% cut in carbon dioxide emissions by 2030 compared with 1990 levels.

Recent publications have pointed out some of the difficulties in moving towards a sustainable energy system in the Netherlands. Technology-specific studies like Agterbosch et al. (2004) looked at the obstacles for wind power implementation, while Negro et al. (2007) and Raven (2004) analysed the slow diffusion of biomass technologies. Dutch renewables policy has been researched by van Rooijen and van Wees (2006) and Dinica (2006). Verbong and Geels (2007) looked at the ongoing energy transition in the Dutch electricity system. Our analysis complements these studies by looking at recent Dutch policy, the energy transition project (ETP), which is an explicit attempt to complement existing policies with a strategic long-term transition approach aimed at structural change. Kemp and Loorbach (2005) have so far only looked at the early stages of the implementation.

Elsewhere we have sought to explain why the 'transition management' (TM) model was adopted by Dutch policy makers (Smith and Kern, 2007). Here, we analyse the implementation of the transitions approach in two senses. First, by seeing how Dutch energy policy is implementing the approach in practice. The main question is to what extent the approach taken by policy makers in practice actually opens up possibilities for structural change in line with the underlying multi-level transition theory. Second, we discuss whether this experience reveals difficulties for the 'TM' model overall, which has implications for attempts at structural change more generally. The core objective of this paper is to critically scrutinise the implementation of the 'TM' model in Dutch energy policy. The main argument of this paper is that despite considerable achievements, the transitions approach risks capture by the incumbent energy regime, thereby undermining original policy aspirations for radical innovation of the energy system.

Our analysis is based on 27 semi-structured personal interviews with policy makers, NGOs, researchers and businesses in the Netherlands conducted in spring 2006. This included 'insiders' involved in the implementation as well as energy policy experts and 'critics' who are not part of the implementation but have a good knowledge of it. The selection of stakeholders was based on a snowball approach and tried to balance between 'insiders' and 'outsiders' as well as between the four categories of stakeholders (for an overview of interviews conducted, please see Appendix A). The interviews were informed by and complemented with an extensive documentary analysis, as well as a review of the relevant transitions literature and Dutch energy policy literature.

The paper is organised as follows: Section 2 will elaborate our analytical framework based on socio-technical multi-level

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transitions theory[1] while Section 3 introduces 'TM' as a policy model. Section 4 will analyse the implementation of the ETP in years 2001–2006. Section 5 will reflect on four generic dilemmas transition approaches are confronted with. Section 6 will present the conclusions.

2. Analytical framework: socio-technical transitions

Energy systems can be characterised as socio-technical systems. We use the term meaning 'the linkages between elements necessary to fulfil societal functions' (Geels, 2004a, p. 900), which in this case is the provision of energy services like heat, light and power. Transitions have been described as social transformation processes in which such systems change structurally over an extended period of time (Rotmans et al., 2001a). Based on historical case studies Geels and others have analysed the dynamics, mechanisms and patterns through which transitions come about (Rip and Kemp, 1998; Geels, 2004a, b, 2005a, b). Geels suggests that a multi-level perspective can be fruitfully adopted to understand system innovations[2] which come about through developments on three levels: landscape, regime and niche (2004a, p. 914). The landscape level comprises external factors such as climate change, which influence the development of the energy system but are beyond the control of regime members. The current fossil-fuel-based energy regime is characterised by a dominant configuration of certain technological artefacts, user practices, market structures, regulatory frameworks, cultural meanings and scientific knowledge. Their alignment provides stability for the technological development. Usually, the literature on change in technological regimes had put emphasis on change along existing (incremental) trajectories (Berkhout, 2002). On the niche level, new energy practices and technological innovations such as renewable energy technologies emerge in protected spaces or market niches, evolve over time and possibly start to compete with the dominant regime. Transition theory claims that system innovations occur through interactions between developments on all three levels. This literature is based on insight from the sociology and history of technology as well as innovation studies. So far only few papers have adopted this framework to analyse energy systems (e.g. Raven, 2004; Verbong and Geels, 2007). It is through this lens of the socio-technical multi-level perspective that we will analyse Dutch energy transition policy[3] based on the 'TM' model which we will briefly summarise in the following section.

3. 'TM' as a policy model

Drawing on the above-described transitions theory as well as insights from complex systems theory, Dutch scholars derived policy prescriptions in the form of 'TM' (Rotmans et al., 2001b; Kemp and Rotmans, 2004; Loorbach and Rotmans, 2006). 'TM' aims at influencing structural change in socio-technical systems alongside system optimisation by a set of coherent policy initiatives. The policy model was developed to tackle persistent, structural problems of unsustainability unsolved by traditional short-term policy approaches in systems such as energy, construction, mobility or agriculture (Loorbach, 2007).

In the TM model, positive visions of the future play an important role in outlining long-term goals and in developing pathways along which those goals can be achieved. The model suggests bypassing existing (possibly captured) policy networks by establishing the so-called transition arenas. These public–private networks with a focus on frontrunners are hoped to overcome lock-in in existing systems by engaging diverse societal actors in a reflexive and deliberative learning process. Whereas earlier versions of the TM model excluded incumbent regime members from the process (Loorbach, 2002), more recently a role for those actors has been assumed to boost legitimacy, support and financing of the process (Rotmans and Loorbach, 2008). The model suggests conducting 'transition experiments' to learn about and test alternative energy practices and technologies. In theory, experiments are characterised by a high risk of failure as well as a high potential (Rotmans, 2005). Beyond supporting these niche innovations, TM advocates argue that control policies to put pressure on the existing regime are needed to bring about transitions. The authors suggest e.g. instruments such as taxes to create a 'more level playing field' in which different practices and technologies compete (Kemp and Rotmans, 2004, p. 152). According to the model, the government fosters this diversity through creating space for niches but refrains from 'picking winners'. If the selection environment at the regime level is shaped towards sustainability, winners emerge in an evolutionary way.

Various Dutch programmes on sustainability and innovation in the 1990s already showed that non-technological factors such as institutions and cultural factors are important preconditions for sustainability (Vergragt, 2005). It was increasingly acknowledged that although technology is pivotal, 'there is a need for a goal-oriented, strategic, co-evolutionary, systems perspective, which stresses the dynamic interrelation between cultural, structural and technological innovation' (Weaver et al., 2000, p. 286). The 'TM' model thus put an emphasis on learning processes (Kemp and Loorbach, 2005; van de Kerkhof and Wieczorek, 2005) rather than on technology-push policies.

The 'TM' model potentially seems to be an appealing approach to tackle the problems of current energy systems which are deeply rooted in complex societal structures and to overcome what has been called entrapment (Walker, 2000) or carbon lock-in (Unruh, 2000). By setting long-term ambitions, complementing existing policies with strategic innovation networks as deliberative and reflexive institutions, putting emphasis on regulatory and cultural barriers to innovation, the 'TM' model seems promising and politically acceptable as it does not disrupt existing policies.

However, structural change in energy systems is politically difficult. Jänicke and Jacob remind us that 'a decrease of an industry in its core technologies creating losers and e.g. regional unemployment problems requires huge political endeavour and is therefore possible only exceptionally' (2005, p. 177). Smith et al. draw attention to the fact that governing socio-technical transitions is essentially political and that legitimate agency is key to societal choices about sustainability (2005; also see Smith and Stirling, 2007). Meadowcroft points out that 'substantial policy stability and resilient political coalitions would be required to keep reform from being derailed by changes in political personnel and a turbulent conjuncture' (2005, p. 491). In addition case

[1] We understand that transition theory is a loaded term but we use it to distinguish the socio-technical transition literature from its implementation in policy.

[2] We use the terms system innovation and transition synonymously.

[3] Energy transition policy is here used as a term to summarise all activities initiated by the Ministry of Economic Affairs to implement 'transition management' in energy policy following the National Environmental Policy Plan in 2001. Transition policy aims at realizing a sustainable energy system through the cooperation of consumers, companies, government and agencies in the so-called transition platforms. This is seen as a long-term change process which can take decades to realize. In its publications, the Ministry refers to those activities as the 'transitions approach' (EZ, 2004b, p. 1). The transition approach has also been adopted for other policy areas, e.g. for agriculture and mobility but the analysis here will focus in its implementation in the energy field (see more detail in Section 4). Transition policies are not meant to replace regular policies but to complement them with a more strategic, long-term procedural approach.

studies have called into question whether niches can become powerful enough to overturn an existing energy regime as radical niches have enormous difficulties to be translated into regime practices (Smith, 2007). All of those points already outline the political difficulties which attempts at managing transitions will face.

After having introduced the 'TM' model and pointed to some criticisms, we now turn to our analysis of its implementation in Dutch energy policy.

4. Implementing 'TM': the ETP

4.1. The process, structure and financing of the ETP

The Fourth Dutch National Environmental Policy Plan (NMP4) set the target to achieve a transition to a sustainable energy system (VROM, 2001). In March 2001, the Ministry of Economic Affairs (EZ), responsible for energy and innovation policy, consequently appointed itself as the 'transition manager' of the energy transition to implement this policy (EZ, 2004a, p. 15). The Ministry started the ETP with an initial stakeholder consultation (Rennings et al., 2004, p. 22). The aim was to find out whether and under what conditions businesses 'would be prepared to contribute to actions leading to a sustainable energy system' (EZ, 2002a, p. 60).

The ETP is mainly based on the activities of transition platforms which are claimed to be 'the heart' of the project (Aubert, 2007). In these six platforms, individuals from the private and the public sector come together to develop a common ambition for particular areas (the so-called transition themes), develop pathways and suggest transition experiments (Oudshoff and Klinckenberg, 2003; VROM, 2003; EZ, 2004a). For an overview of the platforms, pathways and experiments please see Table 1.

The initial selection of transition themes was based on stakeholder consultations as well as an intensive scenario study, the long-term energy supply strategy (LTVE) project, which was drawn up in 2000. It outlined the Ministry's principles of a vision for the future energy supply (clean, affordable and secure). Its intention was to stimulate discussions about the energy supply in the Netherlands in 2050 and it focused on devising a portfolio of strategies for investment decisions, sustainability and R&D 'which result in minimum regrets' (IEA, 2003, p. 44). The final report of the project distinguished four scenarios (see Kemp and Loorbach, 2005, p. 137). The project brought up themes that would be important cornerstones for a sustainable energy system in any of the four scenarios. Those four themes (new gas, chain efficiency, sustainable mobility and green resources) also emerged from the stakeholder consultation conducted by the Ministry as ideally suited for a transition approach given the international state-of-the-art in technology development and the specific position of the Netherlands (EZ, 2002a, p. 60). Later two more themes (sustainable electricity, built environment) were added so that now the ETP encompasses six themes. These themes 'will be worked out in more detail to give direction to energy and innovation policy' (EZ, 2004b, p. 5).

Stakeholders recruited from existing policy networks were the starting point for the public–private transition platforms which were established for each theme (interviews 1, 21 and 24). Another mechanism to enrol stakeholders was to create publicity about the project so that interested parties could contact the Ministry (interviews 1, 6 and 15). EZ appointed business representatives as chairs for all platforms who then identified other interested stakeholders (interviews 6, 12, 16 and 17). Our analysis of the composition of the six platforms (Fig. 1) shows that businesses are the dominant actor group while civil society organisations are few.

The only environmental NGO actively involved in the ETP is Stichting Natuur en Milieu (SNM, Society for Nature and Environment). Larger companies are much more represented than SMEs (interviews 3, 5, 12, 19; list of participants). The government shows a surprisingly low participation. The involvement of researchers greatly varies across platforms. Critics argue the platforms are dominated by regime incumbents (interviews 2, 3, 11 and 13). Building on existing networks and appointing business chairs who themselves pick more participants led to a self-organising network derived from the incumbent energy regime. van de Kerkhof and Wieczorek cautioned that such a self-organising network strategy will lead to the dominance of regime incumbents and exclude viewpoints of less prominent actors, which may provide insufficient room for learning and innovation (2005, p. 738).

After developing strategic visions for the selected themes for 2030, the task of the platforms is to work out possible transition pathways along which an energy transition can be achieved. A transition path is understood as a 'consistent set of actions, fulfilled preconditions and learning experiences that lead to fulfilment of the ambition formulated' (EZ, 2004a, p. 19). As the transition paths serve as criteria of eligibility for obtaining public funding they had to be officially certified by the Ministry of Economic Affairs. So far 15 out of the 26 transition paths suggested by the stakeholders have been accepted (SenterNovem, 2006b).

The pathways are explored further by transition experiments carried out by coalitions of stakeholders. The experiments propose ways to travel along the suggested transition paths (EZ, 2004a, p. 5). The aim of transition experiments 'is to see how a new energy system behaves in a specific practical situation and how the surrounding area reacts to this new system' (EZ, 2004a, p. 19). The first transition experiments started in 2005 (see Fig. 2 for some examples).

Year 2005 saw two major institutional changes to the ETP. Firstly, the transition platforms were complemented by a taskforce energy transition (TFE). The TFE consists of 17 high-level members mainly from industry and the public sector and is chaired by the CEO of Shell Netherlands. This advisory group was charged with the task to oversee the transition process and identify strategic directions. The taskforce is 'intended to strengthen the role of the platforms and to determine which technological spearheads offer the best prospectus for the Netherlands' (EZ, 2005, p. 30). Since then the taskforce has become a dominant actor in the process, e.g. through publishing a national transition action plan in May 2006 (Taskforce Energy Transition, 2006). In interviews with researchers and NGOs the taskforce has been criticised for being dominated by large energy companies from the existing energy regime such as Shell, Essent, Electrabel and Gasunie (interviews 17, 18 and 20).

The second institutional change was the creation of an interdepartmental directorate Energietransitie (IPE). This new directorate is located at the Ministry of Economic Affairs and encompasses 30 civil servants from six ministries.[4] It is hoped that through the directorate 'a good fit between ongoing policy dossiers and policy conditions for system innovations over the longer term' will be achieved (EZ, 2005, p. 52). The impulse for the directorate came from stakeholders involved in the energy

[4] Ministry of Foreign Affairs, the Ministry of Economic Affairs, the Ministry of Finance, the Ministry of Agriculture, the Ministry of the Environment and the Ministry of Transport.

Table 1
Overview of transition platforms, pathways and experiments

Platforms and their visions	Pathways	Experiments
Chain efficiency Environmental benefits can be achieved when producing goods, which demands the use of many different raw materials, uses a lot of energy and leads to emissions…changing the energy structure can reduce CO_2 emissions, conserve energy and materials use and reduce the environmental impact. Critically assessing production chains, from raw materials to end products, brings the largest savings.	KE 1: Renewal of production systems KE 2: sustainable paper chains KE 3: sustainable agricultural chains	Save 50% energy use along the production chain of paper by 2020
Green resources The Netherlands should use raw materials more carefully. The total demand for energy, chemicals and materials in 2030 must be back to the 2000-level, by saving energy and recycling more materials and products. By 2030, the Platform foresees to replace 30% of fossil fuels…with bio-based raw materials (biomass). And in 2030, bio-based raw materials must supply the following: 60% of transport fuels; 25% of chemicals and materials; 17% of heating requirements; 25% of the electricity demand. The Platform realizes that the Netherlands has a limited agricultural area and that 60–80% of these needed bio-based raw materials will have to be imported to achieve the above goals.	GG 1: biomass production GG 2: biomass import chain GG 3: Biosyngas GG 4: Bioplastics	Conversion of the MTBE (methanol tertiary butyl ether) production process to ETBE (ethanol tertiary butyl ether) based on bio-ethanol Bio-plastics: Breakthrough to self-sustaining growth Breakthrough for bio-plastics to high-value applications A factory for the production of bio-diesel from palm oil
New gas The energy transition in the natural gas sector means that the entire natural gas chain will become more sustainable. In recent years, in cooperation with interested parties, a portfolio of potentially promising routes has been identified that can provide direction and can be developed in parallel. They can be classified into two types: efficient use of gas, green and clean use of gas. The ETP aims to sketch a long-term vision regarding the role of clean fossils in the Netherlands. This includes the significance and opportunities regarding CO_2storage (both on-shore and off-shore), due to the specific geological conditions of its substructure (oil and gas fields, aquifers, coal layers)	EGG 1: energy saving in the built environment EGG 2: micro and mini CHP EGG 3: clean natural gas EGG 4: Green gas EGG 5: energy saving greenhouse	Buses on natural gas in Haarlem/Rijnmond Liquefied natural gas as a substitute for diesel CO_2 delivery to greenhouses in horticulture sector (OCAP) Introduction of compressed natural gas as a mature car fuel in the North of the Netherlands Polder district in Zeewolde gets heating on biogas Pilot project of micro generation in households
Sustainable mobility The platform aims to speed up market introduction of sustainable fuels and vehicle technologies, with a focus on commercially viable options in the Netherlands in the next 2–4 years.	AM 1: natural gas AM 2: biofuels	Realisation of the hydrogen cart (Formula 0) A sustainable petrol station in the North of the Netherlands A large-scale production facility for bio-diesel in Terneuzen
Sustainable electricity The transition has an ambitious but feasible and robust aim: a sustainable electricity provision that can be made virtually CO_2 free. The transition is so robust because the centralized production can deal flexibly with changing insights and market conditions	DE 1: biomass DE 2: wind	
Built environment The total energy demand and CO_2 emission from the use of a building is more important than the heat demands that are determined by the building design. Total energy demand is expected to rise approximately 0.5% p.a., with a decline in natural gas use and a much stronger increase in electricity demand. Neighbourhood development is more important than single buildings. Key is the upgrading of the building stock and organisational and financing innovations to enable building owners to invest in their property	No pathways developed yet	Use of mine water for heating and cooling in Heerlerheide centre A good perspective can give an impetus for energy saving in council housing sector Heating in houses based on waste wood from pruning trees in Eindhoven Heat transition in housing construction 'Geothermal heat for the whole Netherlands' (heat pumps) Collective sustainable energy storage devices for heating and cooling Sustainable heat and cooling through the use of heat pumps

Sources: Klinckenberg and Chobanova (2006), http://www.ez.nl/content.jsp?objectid=41052; http://www.senternovem.nl/eos/projecten/ukr/index.asp (accessed 18.07.06).

transition who 'developed pressure on government to re-organise policies and combine them' (interview 24).

The transition approach also led to the policy renewal project, launched by the Ministry of Economic Affairs in 2002, where the government was looking for a new way of steering and contemplated about the instruments used in energy policy. The project was supposed to help EZ change its relationship with business (Kemp and Loorbach, 2005, p. 142). The project identified the roles stakeholders want the government to play to best support the energy transition. The findings were that stakeholders primarily expect commitment and partnership from the government (VROM, 2003; EZ, 2004a). The project led to several suggestions such as creating (regulatory) scope for experiments, ensuring clarity, consistency and certainty about the enabling policy mix and to devise a range of financial instruments for transition experiments (VROM, 2003, p. 8). Besides the above

Platform	Government	Business	NGOs	Intermediaries*	Science	Total
Green Resources	1	6	1	1	6	15
New Gas	1	6	1	1	3	12
Chain Efficiency	1	6	0	1	3	11
Sustainable Mobility	3	10	3	0	0	16
Sustainable Electricity	1	3	0	0	3	7
Built Environment	0	4	4	2	1	11

Fig. 1. Participation in the private–public platforms of the energy transition. *The category *Intermediaries* encompasses representatives from municipalities, SenterNovem (excluding the secretaries), the provinces, regional initiatives (such as Rijnmond) or national advisory boards such as SER. *Source*: own compilation based on list of participants obtained from the secretaries of the platforms from SenterNovem (as of June 2006).

One project supported under the UKR scheme is a ***micro heat and power project***. In a trial project 50 homes in Groningen have been supplied with home power plants which produce heat and electricity from natural gas boilers. Any surplus electricity can be sold to the electricity company (EZ 2004a: 16). It is planned to upscale the project to 1000 units by 2007 and 10.000 units in later stages. Another example is the ***50% project by the Dutch paper industry***. The ambition of the Dutch Paper Industry Association (Koninklijke VNP) is to save 50% energy use along the production chain of paper by 2020. The association cooperates with actors from the entire production chain – from raw materials and machine suppliers to end users and waste processors – to fulfil this ambition (EZ 2004a: 17). A third example for a transition experiment is the ***'residual heat' project in Rotterdam***. This project aims at providing a residential area in the South of Rotterdam with residual heat from industry in the Rotterdam Harbour District (Shell-Pernis) (EZ 2004a: 18).

Fig. 2. Examples for transition experiments.

described subsidy scheme to support 'transition experiments' another concrete result of this project is the frontrunner desk for innovators. It was set up by a joint initiative of the Ministry of Economic Affairs, the Ministry of the Environment and the Ministry of Agriculture and is supposed to help identify barriers to innovation (EZ, 2004a, p. 27). Stakeholder input channelled through the frontrunner desk is hoped to help policy change.

The ETP is funded through public subsidies and investments by companies. The National Energy Research Strategy (EOS) has an annual budget of €135 m (EZ, 2001, p. 3). The ETP has led to an additional subsidy scheme under EOS, the Unique Chances Subsidy Scheme (UKR), which provides funding for transition experiments. It was preceded by a limited subsidy scheme to support feasibility studies which ran between 2003 and June 2004 and had a total budget of €1.5 m (Novem, 2003, p. 5). The UKR itself has a budget of €35 m over several years (EZ, 2004a, p. 29). So far the scheme has attracted private investments totalling more than €200 m (Aubert, 2007). The UKR was set up because 'existing energy and innovation instruments do not yet fit in well with the set-up of transition experiments' (EZ, 2004a, p. 29). This can be considered to be a response to criticism that the Dutch innovation system lacks support for high-risk innovation (Dutch Innovation Platform, 2006, p. 9; Taskforce Energy Transition, 2006, p. 24).[5] Two Dutch advisory councils criticised the level of spending on transition projects so far and advocated for a significant increase as the UKR only makes up 1% of the total annual public spending on energy-related issues (approximately €850 m in 2005) which could be interpreted as a lack of commitment (VROM-Raad and AER, 2004, p. 26).

However, funding for the energy transition is expected to rise substantially. High gas prices have led to windfall profits for the Dutch government (who retain major shareholdings in national gas business) which will partly be spent on the energy transition process. These initiatives are the so-called Borssele deal that includes a public contribution of €250 m (for details, please see Fig. 3) as well as €200 m for the Northern provinces as part of a deal to produce natural gas from the North Sea[6] (VROM, 2006a). The Ministry of Economic Affairs pledged that the financial resources for the ETP will be put on a permanent basis and that the transition approach 'will be intensified in the coming years' (EZ, 2005, p. 52). However, the TFE recently claimed an even larger public investment of €2b annually is needed (Taskforce Energy Transition, 2006, p. 24).

Apart from the funding for concrete projects the Ministry of Economic Affairs also invests in the energy transition process in terms of marketing, communication and accumulation of knowledge. For this purpose EZ provided around €20 m over 3 years (EZ, 2002a, p. 60). Kemp and Loorbach note that EZ's budget for transition policies has increased from €200,000 in 2000 to approximately €80 m in 2005 but they also identify part of this as 're-labelled' money (2005, p. 143). They claim that transition policy is 'also leading to convergence and integration of existing funds, subsidies and investments' (Kemp and Loorbach, 2005, p. 143).

4.2. *The influence of the ETP on 'regular' energy policy*

To asses the potential influence of the ETP it is crucial to put it into the context of wider Dutch energy policy. Similarly to other countries Dutch energy policy has three major goals: security of supply, environmental quality and economic efficiency (EZ, 2005, p. 23). Over the longer term, the government aims to achieve a

[5] Interestingly, the taskforce criticises the government for a risk-averse strategy while at the same time suggesting criteria for the selection of transition experiments which are also very conservative (effectiveness, feasibility, strength of demand and pace) (Taskforce Energy Transition, 2006, p. 14).

[6] This was controversial because of the ecological risks for the special ecosystem of the Wadden Sea. The government says they made a deal that the gas fields will be exploited and in return some of the revenue is invested in the development of a sustainable energy system (interview 8).

The Dutch government agreed with the owners of the only Dutch nuclear power to keep the Borssele plant open longer than originally planned (until 2033) in exchange for investments in sustainable energy supplies (VROM 2006b). Both the government and the companies will spend €250m between 2006 and 2012 to achieve CO_2-reductions of 1.4 Mton per year (EZ 2006: 3). VROM claims that, "This package is intended to provide an additional boost for the transition to sustainable energy management" (VROM 2006a: 58). Its focus is on energy conservation, clean fossil fuels (CO_2 storage) and renewables. The funds will be distributed equally between those three areas. The "energy transition policy will serve as a guideline for working out the details of proposals" (VROM 2006a: 58).

Fig. 3. The Borssele deal (VROM, 2006a,b).

sustainable energy system (EZ, 2005, pp. 8–9). Current energy and climate policy focuses on cost-effective measures to CO_2 reductions, on energy conservation and sustainably produced electricity. Until 2010, the policy goals and instruments are claimed to be largely fixed (EZ, 2004a, pp. 33, 39). However, the Ministry of Economic Affairs expects that by 2010 current energy policy will increasingly be influenced by the results of the transition approach while at the same time admitting that the transition project and current energy policy 'appear to be two separate lines of policy…The challenge for the years ahead is to further integrate these lines of policy' (EZ, 2004a, p. 7).

The most immediate impact of the energy transition process is visible in Dutch energy RD&D policy as the national energy research strategy (EOS) is being synchronised with the energy transition priorities (VROM, 2003, p. 9; EZ, 2004a, p. 38). However, Harmsen and Menkveld conclude that the ETP and EOS are so far only partially integrated and argue for further linking (2005, p. 74). Others point to a large overlap but also see 'notable differences in the type and level of detail of the research areas, and the width of the scope of the platforms' (Klinckenberg and Chobanova 2006, p. i).

So far, there have been few direct linkages of the energy transition policy with renewables policy. Dutch renewables policy has been widely criticised for having been too unstable to provide sufficient incentives for investments into renewable energy technologies (Dinica, 2006; van Rooijen and van Wees, 2006; Negro et al., 2007; interviews 6, 8 and 21). Current renewables policy remains hamstrung by funding limitations rather than long-term ambitions. The Dutch government introduced feed-in tariffs providing a fixed subsidy per kWh for domestically produced renewable electricity in 2003 (the so-called MEP scheme) (Agterbosch et al., 2007) but this scheme was stopped again in 2006. Although in 2005 renewables only accounted for 6% the government argued to be on track to reach the 9% goal for renewables in 2010 without further support (EZ, 2006). This decision was taken independently from the ETP (interview 8, 18 and 21). However, the influence of the ETP on renewables policies might increase in the future once the platform on sustainable electricity is fully established. Initially, sustainable electricity was believed to be well covered by current policy and thus was not deemed to be part of the ETPs (EZ, 2004a, p. 20). However, market interest in renewables decreased after the changes in the feed-in scheme and the decentralisation of electricity networks yielded more interest which subsequently led to the set-up of the new platform (interview 12). This change opens up opportunities for the transitions approach in this field (interviews 1, 12 and 24). The Ministry of Economic Affairs claims that its wind offshore policy will increasingly be given shape by the transition approach (EZ, 2004a, p. 39).

Although the role of nuclear power is limited as it only accounted for 4.1% of the total electricity generation in 2002 (IEA, 2004), the future of nuclear power is a controversial issue in Dutch energy policy. In 2006, van Geel (then the state secretary for the environment) announced that more nuclear power is needed if environmental goals are to be achieved (see Fig. 3). For some members of the taskforce, platforms and working groups the government lost credibility through this public statement as they claimed that this topic should have been openly discussed within the energy transition process (interviews 5 and 8). Also, the mentioned Borssele deal to operate the only existing nuclear power plant much longer than expected by-passed energy transition negotiation processes. Instances like these suggest limited influence of the transition project within energy politics.

Apart from energy R&D policy the biggest interaction between energy policy and the ETP might be in the field of underground CO_2 storage, owing to a lack of established policy on clean fossil fuels. A working group of the ETP is actively involved in shaping policy on carbon capture and storage (interview 8). As demand reduction and energy conservation by consumers has not been a major topic of the energy transition process yet, there is no influence on this policy field. The set-up of the platform on the built environment might change this in the future. The government announced that the energy performance standard for newly constructed buildings will be developed under a vision coupled to the energy transition process (VROM, 2006a, p. 64).

In summary, so far most observers do not see a substantial impact of the energy transition on 'regular' energy policy. Our assessment above highlights this. Core energy policy issues like security of supply, liberalisation and affordable prices are not being reframed by the energy transition. In 2004, two Dutch advisory councils came to the conclusion that there is a lack of commitment to the goal of the energy transition by the cabinet and parliament (VROM-Raad and AER, 2004, p. 21). The councils nevertheless acknowledged the progress the Ministry of Economic Affairs had made while emphasising that 'the transition approach should form the guiding principle for energy policy as a whole' (VROM-Raad and AER, 2004, p. 24). There are few signs that the commitment has greatly improved. Although the energy transition process does not yet have a major influence on energy policy, it is becoming robust as a side track, and so develops potential to make more impact in the longer term.

4.3. The ETP from a multi-level socio-technical perspective

In this section, we reflect upon the achievements and challenges of the ETP so far in terms of opening possibilities for structural change by interpreting its activities through the multi-level lens on socio-technical change.

4.3.1. Niche: institutional innovations, but selection criteria limit variety of niches

To create room for system innovations towards sustainability reflexive and deliberative institutions have been set up within government and between government and stakeholders. Within government one example is the interdepartmental working group which bundles the efforts of six ministries to achieve an energy transition and increase coordination. Between government and stakeholders the platforms have been created as innovation networks to bring together partners for setting ambitions,

	Themes	Pathways	Experiments
Criteria	Focus on ***'robust elements'*** from LTVE study, focus on strategies "which result in minimum regrets" (IEA 2003: 44)	***Substance***: The transition path must be capable of achieving at least 10% of the ambition on the respective main roads to a sustainable energy system.	***effectiveness***: the project leads to a significant reduction of CO2 emissions, higher production of sustainable energy, new areas of commerce or greater independence from imports
	Competitive advantage: international state-of-the-art in technology development and the specific position of the Netherlands	***Robustness:*** The transition paths must be 'robust'; in other words, they must fit into all of the different scenarios developed for the LTVE project.	***Feasibility:*** technological feasibility, cost-effectiveness
	support from the relevant stakeholders	***Innovativeness:*** The transition path must contribute to a sustainable system innovation in the respective part of the energy supply and offer opportunities for industry.	***Strength of demand:*** is there a sufficiently strong market demand, where the results of the projects are sufficiently competitive to achieve market share?
		Costs and Benefits: It must be likely that the balance of social costs and benefits over the whole path will be in balance.	***Pace:*** the project can be achieved quickly, distinguishes itself in international competition, there is a sense of urgency and there is support
		Support: This encompasses the willingness of companies to invest in this area as well as broader societal support for the transition paths.	
Source:	(IEA 2003), (EZ 2002a: 60)	(EZ 2004a: 29)	(Taskforce Energy Transition 2006: 14)

Fig. 4. Selection criteria for themes, pathways and experiments.

translating them into possible pathways and conducting niche experiments. Those initiatives potentially provide dynamic networks for coordination, experimentation and social learning across government and stakeholders.

However, while in theory the 'TM' model emphasises the need for a diversity of practices and technologies, this is challenging to implement. Some evolutionary economic concepts have been adopted in Dutch policy documents (such as diversity of technologies, cooperation in public–private partnerships, future visions to map possible routes) but others which are less in accordance with traditional notions of efficiency and effectiveness (such as selection environment, co-evolution) have been neglected (van den Bergh et al., 2006). The energy transition process reflects this general picture. In the ETP, the market remains the dominant selection mechanism even in the early stages of niche development. The selection criteria for themes, platforms and transition experiments are quite narrow in emphasising conventional economic efficiency criteria (see Fig. 4).

The criteria reflect existing strengths, focus on 'minimum regret options', cost effectiveness and business opportunities. Transition themes and research priorities were originally selected on the basis of the competitive technological advantage and capabilities of the Netherlands (EZ, 2002a, p. 60; ECN, 2004, p. 47). The criteria thus unduly neglect social and institutional innovations and accentuate marketable technological fixes.[7] New forms of energy business (such as energy service companies) and social change are being neglected. This practice undermines the goal of the ETP. Markets for radically new technologies are not easily formed. Such niche innovations may be ill-adapted to the existing system and often have cost disadvantages to incumbent technologies for the individual investor (whilst offering societal benefits such as emission reductions) (Jacobsson and Bergek, 2004, p. 16). The criteria for experiments reduce options for long-term change and favour technological options already economically viable or close to the market.

Given that the 'TM' model pays special attention to the co-evolution of technology and society, some researchers criticise the focus on technologies (interviews 17, 18 and 19). We argue that the dominance of business actors and the dominant aim of the Ministry of Economic Affairs to create new energy business led to a focus on technological innovation on the supply side rather than social or institutional changes. Even though energy conservation is generally believed to play a major role in sustainable energy systems there is no '80% lifestyle'[8] platform, or experiments in which behavioural change is central. A senior researcher argued that in the ETP demand-side aspects are only recognised in narrow economic terms, and deeper life style issues are not part of the transition policy discourse (interview 20).

In contrast, a strategy based on more diverse selection criteria would help to balance the niche portfolio. Other methods of sustainability appraisal such as social multi-criteria evaluation or three-stage multi-criteria analysis take broader sustainability

[7] In part this default to more familiar tools for civil servants is understandable as the TM model was by no means developed in detail or much depth at the time it was adopted (interviews 1, 18 and 15). Thus policy makers followed a learning by doing approach (EZ, 2004a, p. 15), relying very much on intuition (interview 17).

[8] i.e. a lifestyle in 2050 that is 80% less carbon intense than today.

criteria into account and have a strong element of public and stakeholder engagement (for a review see Stagl, 2007). They are well suited to help decision making in the context of a long-term transition towards a sustainable energy system.

Our analysis shows that activities of the ETP so far have focussed on stimulating niche level innovations. Even on the niche level the selection of transition experiments focuses on economic efficiency resulting in variation that is limited with concomitant implications for structural change. The ETP process is mainly focussed on new energy business as this is both in the interest of the Ministry of Economic Affairs as well as the incumbent energy companies.

4.3.2. Regime: limited influence of ETP on energy regime

As we have argued above the influence over conventional energy institutions aligned to the current energy regime (such as regulation of infrastructures, organisation of markets) is limited. One vital test of the political influence of the ETP will be whether the government will invest a more substantial amount of resources into the process or even follow the request of the taskforce to spend €2b annually. The relatively low-level political status of sustainability issues, that ironically has permitted this policy innovation to flourish, also poses a considerable challenge for its future influence over the system restructuring it seeks. The ETP's influence on 'regular' energy policy, and thus the energy regime, is so far low and policy coordination has been difficult to achieve.

The ETP has led to a significant mobilisation of actors and resources. VROM speaks of a 'large number of enthusiastic actors who have invested a great deal of their time and energy' (VROM, 2003, p. 18). The six platforms and 15 working groups as well as other actors more indirectly involved show the commitment of stakeholders to the goals of the ETP-creating networks thinking about the long-term energy future, bringing their knowledge and expertise together, and fostering new alliances to conduct experiments. However, this mobilisation has so far mainly involved large energy regime companies and only few civil society organisations. The dominance of regime incumbents leads to legitimacy issues. The TFE, led by the CEO of Shell Netherlands, has become one of the 'transition champions'. The understanding of the taskforce that the platforms set out the transitions paths and then 'policy can be developed to serve the needs of the Platforms (policy on demand)' (Taskforce Energy Transition, 2006, pp. 27–28) is questionable as the platforms and the taskforce are not democratically legitimised, are not accountable for their actions and offer limited representations of societal interests. This has implications for the legitimacy and ultimately for the success of the energy transition process as structural change will need wider societal engagement and support. This is difficult to achieve as long as the energy transition process is perceived to be carried out as an 'elite-driven process' of regime incumbents with vested interests (interviews 13, 17 and 18).

Contrary to the promise of the 'TM' model, the ETP is not opening existing energy policy networks to broader societal and democratic debate. Rather than the ETP pressuring the energy regime, incumbent energy firms dominate the project. Additional 'control policies' which could put the incumbent energy regimes under concerted pressure to become more sustainable, essential to TM, remain absent.

4.3.3. Landscape: liberalisation more dominant than sustainability concerns

Two Dutch advisory councils already claimed that 'not enough pressure is exerted by the landscape factors to bring about most of the intended changes at the *energy regime level* before the middle of this century' (VROM-Raad and AER, 2004, p. 19). Landscape factors like liberalisation and Europeanization so far have been the strongest political drivers of the Dutch energy system (see Verbong and Geels, 2007). Liberalisation has had profound consequences for the electricity regime: it led to underinvestment in peak capacity which increases the risk for supply disruptions and price spikes (ECN, 2004; IEA, 2004). With liberalisation the long-term planning of future power plants and securing the reliability of supply is jeopardised by the preference for short-term return on investments (Raven, 2004, p. 33). Liberalisation also led to decreasing R&D budgets of energy companies as well as to an emphasis on short-term research (EZ, 2002a, p. 61). Verbong and Geels are pessimistic about the possibility that under the given circumstances of Europeanization and liberalisation and the relatively low profile of environmental concerns a transition towards a sustainable electricity system will occur in the near future (2007). However, Markard and Truffer argue that liberalisation can also contribute to weakening the regime. They see liberalisation as 'a driver that transformed the basics of search and innovation processes and may thus weaken prevailing technological regimes' (2006, p. 624).

The ETP is not (yet) politically strong enough to play the role of a driver towards sustainability (interviews 4, 8 and 19) or counter any adverse sustainability effects of liberalisation from the landscape level. Also politically, civil servants dealing with the ETP are aware that the project needs to connect to liberalisation, and be framed in liberalisation terms, which dominates the agenda of the Ministry of Economic Affairs as otherwise influence of the ETP will remain limited (interview 12). This means the project will have to bend to the logic of liberalisation. Sustainability selection pressures put on the regime or the engagement with wider societal discourses around paradigm shifts towards sustainability such as a steady-state economy will consequently remain absent. This is important since transition theory suggests the emergence of niches on their own will not achieve system innovations (Hoogma et al., 2002). Developments on the landscape level need to reinforce changes at the niche and regime level.

5. Implications for the transitions approach: the neglected politics of transitions

Having critically scrutinised the implementation of the ETP in the Netherlands, we will now discuss how this experience reveals difficulties for the transitions approach overall. We argue that the Dutch experience reveals four generic dilemmas for transitions theory which are all facets of the neglected politics dimension of steering socio-technical change. We argue that most of the difficulties described above are a consequence of these dilemmas.

5.1. Long-term goals and commitment vs. short-term success

On the one hand, it is desirable to have a long-term transition agenda as structural change in complex societal systems is a long process. Historic studies of socio-technical change have stressed this (Geels, 2005c, 2006; Verbong and Geels, 2007). On the other hand, observers, participants as well as critics expect some quick and assuring visible results from the process (interviews 8, 12, 18, 19 and 21). This creates legitimacy issues for civil servants, companies and NGOs alike (interview 12). Some short-term results are needed to keep supportive momentum behind the process (interview 8). It is difficult for participating actors to point to substantial (cf. procedural) achievements: thus 'showcases' need to fill this void (interview 19). The downside of this need for showcases is that it might result in a risk-averse strategy thus undermining the original long-term goals. The dilemma with long-term multi-stakeholder processes is that short-term objectives easily become dominant and long-term visions recede behind the horizon (Vergragt, 2005, p. 305).

5.2. Level playing field vs. certainty for investors

The second dilemma is that while the 'TM' model calls for a 'level playing field' for different technologies and practices this also creates uncertainty for companies faced with investment decisions. These decisions taken now determine the structure of the energy system for decades. In TM theory, keeping options open is the necessary condition to prevent lock-in and backlash from choosing options prematurely (Rotmans et al., 2001a). Several interviewees recognised this dilemma (interviews 11, 12, 13 and 16). A level playing field implies that the government does not select technologies directly.[9] However, this is exactly what a variety of stakeholders expects (Wijffels, 2002, p. 7; interviews 5, 8 and 22). One of the problems arising from this dilemma is that stakeholders do not view the government as a reliable partner and criticise a lack of commitment, consistency and continuity of policy (VROM-Raad and AER, 2004, p. 21).

5.3. Regime incumbents vs. focus on frontrunners

Another dilemma is the question of including regime incumbents or to focus entirely on newcomers, outsiders and innovators. Originally, the TM model excluded regime actors from the process while later admitting a role for incumbents. In practice, Kemp and Loorbach already pointed out that incumbent energy companies are dominant in the energy transition (2005). Our analysis confirms this finding. In part this seems to be due to the Ministry's emphasis on 'new energy business opportunities'. A focus on regime incumbents risks incremental innovation rather than contributing to structural change. However, regime incumbents can also be innovative if their engagement in the energy transition process helps them to redefine their interests and to think more long term. The extent to which this is happening in the ETP is contested (interviews 11, 13, 20, 21 and 24).

5.4. Nurturing niches vs. control policies

Creating space and momentum for innovations at the niche level ('carrots') has received much attention but the TM advocates also point to control policies ('sticks'), which are necessary to pressure the regime and change the selection environment to create market pull for green innovations. In the absence of such policies, a transition to sustainability cannot be achieved (Kemp and Rotmans, 2004, p. 152). In practice, control policies are politically challenging. The 'TM' model was aimed at tackling persistent environmental problems in the energy, the construction, the mobility or the agricultural sector (Loorbach, 2002). It is especially in those sectors that we observe policy failure. To achieve sustainable development in these sectors structural change is necessary but for this kind of intervention the capacity is very low (Jänicke, 1997, p. 19). Consequently, additional 'sticks' are absent in the energy transition. Civil servants from the Ministry of Economic Affairs argue that as long as the transition process has momentum, a long-term perspective and 'carrots' will be enough to achieve a transition (interviews 15 and 24). This approach has been criticised for a lack of pressure on the existing regime (interviews 8, 11, 13 and 19).

The practical experience with the ETP in the Netherlands presents dilemmas that the 'TM' model does not yet fully address. We suppose those issues to be generic dilemmas of long-term structural change processes. None lends itself to easy answers. Fostering system innovations is politically difficult. The transition debates so far have been overly optimistic about the role of governments in system innovations while neglecting the realities of policy formulation and implementation which is essentially a political process, not a managerial task. In the Dutch ETP it has become clear that a power and legitimacy base for structural change is largely absent. Existing policy arrangements and political coalitions do not easily give way to new institutional routines. The ETP shows that even in the presence of ambitious goals and an innovative policy approach (which endured three changes in government in 2002, 2003 and 2006), existing socio-technical structures and organisational routines are major obstacles for sustainable system innovations. 'TM' as a policy model has not yet paid sufficient attention to those aspects of power and organisational routines. Its analysis *for* policy needs to be complemented by analysis *of* transition policies and their politics (Hill, 1997).

6. Conclusion

In this paper, we have analysed the ETP carried out by the Dutch Ministry of Economic Affairs. The project is based upon a 'TM' model developed by Dutch researchers and is aimed at achieving a sustainable energy system in the Netherlands by 2030. This policy model seems innovative and has received a lot of attention from researchers and policy makers alike. The Dutch experience is being watched for clues about how to promote more radical, system-level innovations elsewhere. However, its merits in practice are unclear and there is little research on this so far. As a first step in this direction this paper analysed the implementation of the 'TM' model in Dutch energy policy from a socio-technical transitions perspective. The main question has been to what extent the approach taken by policy makers in practice actually opens up possibilities for structural change and whether this experience reveals difficulties for the 'TM' model overall.

The Dutch transitions approach has created long-term visions and high ambitions by aiming for system innovation in the energy system as well as combining these goals with a process architecture aimed at learning and stakeholder involvement. This way of policy planning encourages long-term thinking in energy policy and the energy sector itself. However, this paper has argued that despite considerable achievements, the transitions approach risks capture by the incumbent energy regime, thereby undermining the original policy ambition for radical change of the energy system. The described capture has two consequences: Firstly, the dominance of regime actors led to the use of selection criteria for the themes, pathways and experiments which do not sufficiently contribute to opening up space for a wide variety of energy practices which could contribute to system innovations (e.g. experiments in low energy lifestyles are missing). This makes the optimisation of the existing socio-technical system more likely than structural change as those actors, themes, pathways and niches which fit into the existing regime will be selected

[9] However, this is a skewed interpretation by policy makers as TM proponents have usually argued for a 'more level playing field', meaning that the government should internalise the external costs e.g. of emissions which indirectly helps cleaner technologies to compete (e.g. Kemp and Rotmans, 2004, p. 152). Van den Bergh et al. have used the term 'extended level playing field' to describe a condition which is not only characterised by the 'free market', but a market in which prices reflect all external social costs and government support is differentiated based on technological learning curves and different time horizons of competing technologies, corrects for increasing returns to scale and levels differences in selection environments (van den Bergh et al., 2007). However, this notion is not (yet) part of the official transitions policy.

rather then the ones contributing to Schumpeter's 'creative destruction'.[10] Niches fitting into the incumbent regime will not demand structural changes in the socio-technical system. More radical niches, however, have difficulties to be translated into regime practices (Smith, 2007). Secondly, the dominance of regime actors in the ETP also makes it difficult to combine the nurturing of niches with 'control policies' to put the existing regime under pressure as applying such pressures would 'harm' the energy regime actors and thus undermine their constructive engagement in the transition process. This would matter less if the ETP was based on a broader societal process rather than energy regime incumbents. As according to the socio-technical multi-level transitions theory structural change comes about through the interplay between dynamics of diversity creation at the niche level, changes in the selection environment at the regime level, as well as developments on the landscape level, it seems unlikely that the ETP in its current unbalanced form will achieve the original goal of system innovation.

The Dutch experience also helped us to identify several policy dilemmas important for sustainability transitions which the 'TM' model does not yet fully address. We argued that the model neglects the politics of structural change and that steering system innovations is politically difficult. The transition debates have therefore been overly optimistic about the role of governments. We have argued that those issues are generic dilemmas of long-term structural change processes and thus have implications for transitions in energy systems towards sustainability more widely.

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Appendix A. Overview of interviews conducted

Interview 1	Policy Advisor from the Ministry of Economic Affairs (EZ), 16.01.06, The Hague.
Interview 2	Researcher I, 14.02.06, Eindhoven.
Interview 3	Researcher II, 14.02.06, Eindhoven.
Interview 4	Researcher III, 14.02.06, Eindhoven.
Interview 5	Member of the TFE, 15.02.06, Utrecht.
Interview 6	Platform secretary, 16.02.06, Utrecht.
Interview 7	Representative from Competence Centre Transitions, 16.02.06, Utrecht.
Interview 8	NGO member of a platform, 17.02.06, Utrecht.
Interview 9	Representative from Innovation Network Agriculture, 17.02.06, Utrecht.
Interview 10	Researcher IV, 21.02.06, Amsterdam.
Interview 11	Business representative, ex-member of platform, 21.02.06, Amsterdam.
Interview 12	Policy Advisor from the Ministry of Economic Affairs (EZ), 22.02.06, The Hague.
Interview 13	Representative from an Environmental NGO, 23.02.06, Amsterdam.
Interview 14	Business representative, member of platform, 27.02.06, The Hague.
Interview 15	Policy Advisor from the Ministry of Economic Affairs (EZ), 28.02.06, The Hague.
Interview 16	Business representative, member of platform, 01.03.06, Groningen.
Interview 17	Researcher, 06.03.06, Rotterdam.
Interview 18	Researcher, 14.03.06, Rotterdam.
Interview 19	Researcher, 07.03.06, Amsterdam.
Interview 20	Researcher, 24.05.06, Brighton.
Interview 21	Researcher, 10.03.06, Utrecht.
Interview 22	Business representative, ex-member of platform, 04.04.06, Brussels.
Interview 23	Researcher, 15.03.06, Rotterdam.
Interview 24	Policy Advisor from the Ministry of Housing, Spatial Planning and the Environment (VROM) 28.02.06, The Hague.
Interview 25	Representative from Competence Centre Transitions, 16.02.06, Utrecht.
Interview 26	Energy Consultant I, 10.03.06, Utrecht.
Interview 27	Energy Consultant II, 10.03.06, Utrecht.

[10] Jänicke has argued that in many cases sustainable transitions will not be achieved without 'creative destruction' while 'fear of destruction may at the same time be the most important obstacle to structural change' (Jänicke, 2004, p. 206).

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