



# Theorizing Energy Transitions

## What we know, and what we don't know

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Knowledge-network System Innovations ([www.ksinetwork.nl](http://www.ksinetwork.nl))





# Introduction: Objectives of this lecture

- Hopefully contributing to
  - your project
  - further development of transition studies
  - international collaboration & comparative studies
- ... through presenting some key insights on
  - transition dynamics
  - Transition governance
- ... and through identifying needs for further study





## Introduction:

# Transitions: rationale and nature

- Persistent problems - e.g.
  - Growth = excess manure in intensive agriculture
  - Economic growth = more energy use; more energy use = more GHG production
- How come that we cannot do good without doing harm?
  - Side effects of established practices,
  - ... embedded in and privileged by structures
  - ... that have co-evolved with these practices





## Introduction:

### Transitions: rationale and nature

- Transition := mutually consistent and reinforcing changes in practices and associate structures ('regime')
- These changes may be influenced by 'autonomous' changes (the 'landscape') that press on (destabilize, challenge) incumbent structures and practices:
- → **Multilevel dynamics**
  - Three levels of structuration





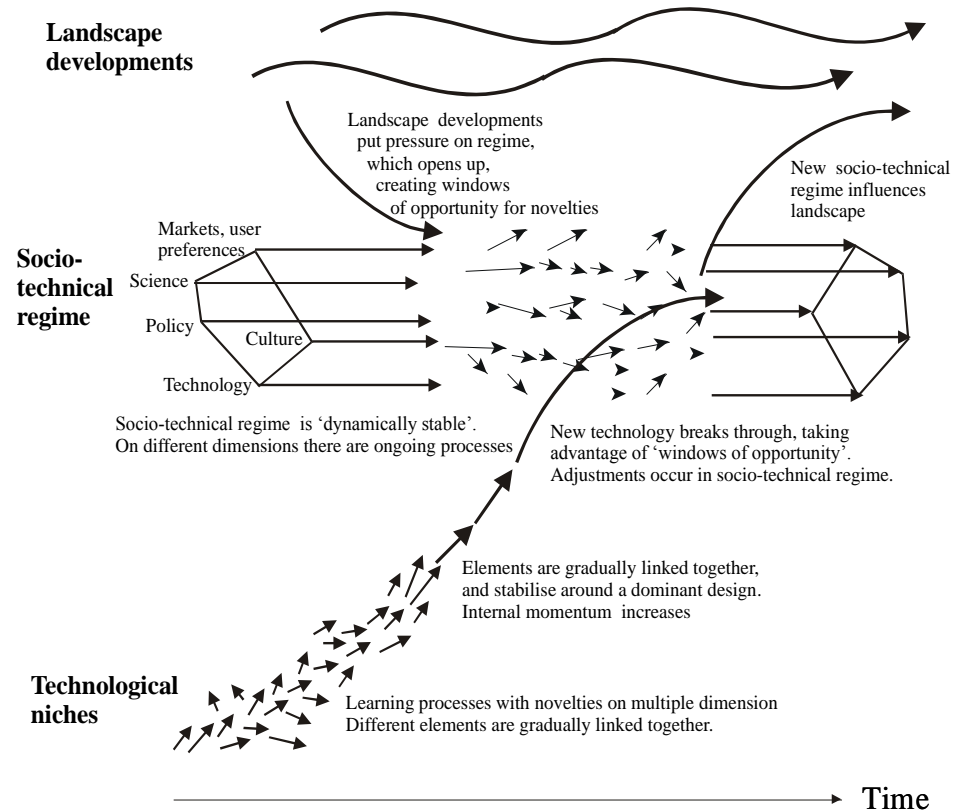
# Introduction: The multilevel perspective for transitions

Johan Schot (1998). *History and Technology*, 14(3): 173- 200.

Arie Rip and René Kemp (1998).  
In Rayner and Malone (eds.)  
*Human Choice and Climate Change*, p. 327-399

Frank Geels (2005 [2002]).  
*Technological Transitions and System Innovations: A Co-Evolutionary and Socio-Technical Analysis*.  
Cheltenham: Edward Elgar.

[Grin (2008), in Van den Bergh & Bruinsma (eds.), *Managing the transition to renewable energy* Cheltenham , UK : Edward Elgar Publishing]





## Introduction:

# The Nature of Energy Transitions

- Energy has a dual character
  - A domain in and of itself
  - Servant of other societal domains
    - Corollaries:
      - Multitude of practices, regimes involved
      - Interaction between lifeworld and systems of provision quintessential





# Introduction: the Dutch KSI network: not one thing

- KSI...
  - 10+12 M€
  - 10 universities + TNO
  - Complexity studies, STS, history, political science, sociology, (evolutionary) economics, innovation studies...
  - 85 researchers, incl. 38 PhD students
  - Interface transition-science, - practice & - policy
- ... is not one homogeneous thing, but an intellectually heterogenous and plural network, with diverse output ([www.ksinetwork.nl](http://www.ksinetwork.nl))...
- ... with a common mission: understanding transition
  - Dynamics
  - Governance







## Introduction:

# Dutch KSI is dead, long live intern'l STRN

- KSI has worked hard with int'l colleagues to turn transition studies into an international field
  - Exchange with other fields of social science (250 journal articles, special issues, presence at conferences) => T research has drawn on other fields, and *vice versa*
  - Sust. Transitions Research Network (330+ members): [www.transitionsnetwork.org](http://www.transitionsnetwork.org)
    - Opportunities for collaboration, comparative study
  - Book series with Routledge
    - First fives volumes: [www.sustainabilitytransitions.com](http://www.sustainabilitytransitions.com)
    - New ones welcome (and upcoming)!
  - New journal with Elsevier:

*Env. Innov & Societal Transitions*







## Three pillars...

Socio-technical approach	Complex systems approach	Governance approach
Strategic niche management	Transition management	Reflexive governance
STS (contextual history of technology; Evolutionary th (Social theory)	CAS; Integrated Assessment Evolutionary th (Governance th)	Political science Structuration th Modernization th (STS)
Johan Schot, Frank Geels, René Kemp (TU Eindhoven) and others	Jan Rotmans, Derk Loorbach, René Kemp (DRIFT, Erasmus University) and others	John Grin, Bram Bos, Carolyn Hendriks (Un. Amsterdam/Wageningen) and others





## Focus of this lecture

- Present findings & needs for further study from Duth KSI network...
- ... with due attention to
  - insights on multitude of practices, regimes
  - interaction production-consumption
  - results on energy





# Outline of this lecture

1. Understanding transition dynamics
  - Key generic insights from three pillars
  - Issues for further study
2. Transition governance- key insights from three pillars
  - Key insights (as relevant for energy transitions)
  - Issues for further study
3. Other efforts: outcomes, and issues for further study:
  - Practices approach
    - Gert Spaargaren (Wageningen Univ), Hans Mommaas (Tilburg Univ)
  - Innovation systems approach & system instruments
    - Marko Hekkert, Ruud Smits. and others (Utrecht University)
  - Energy Volume Routledge series (forthcoming)





# Understanding transition dynamics

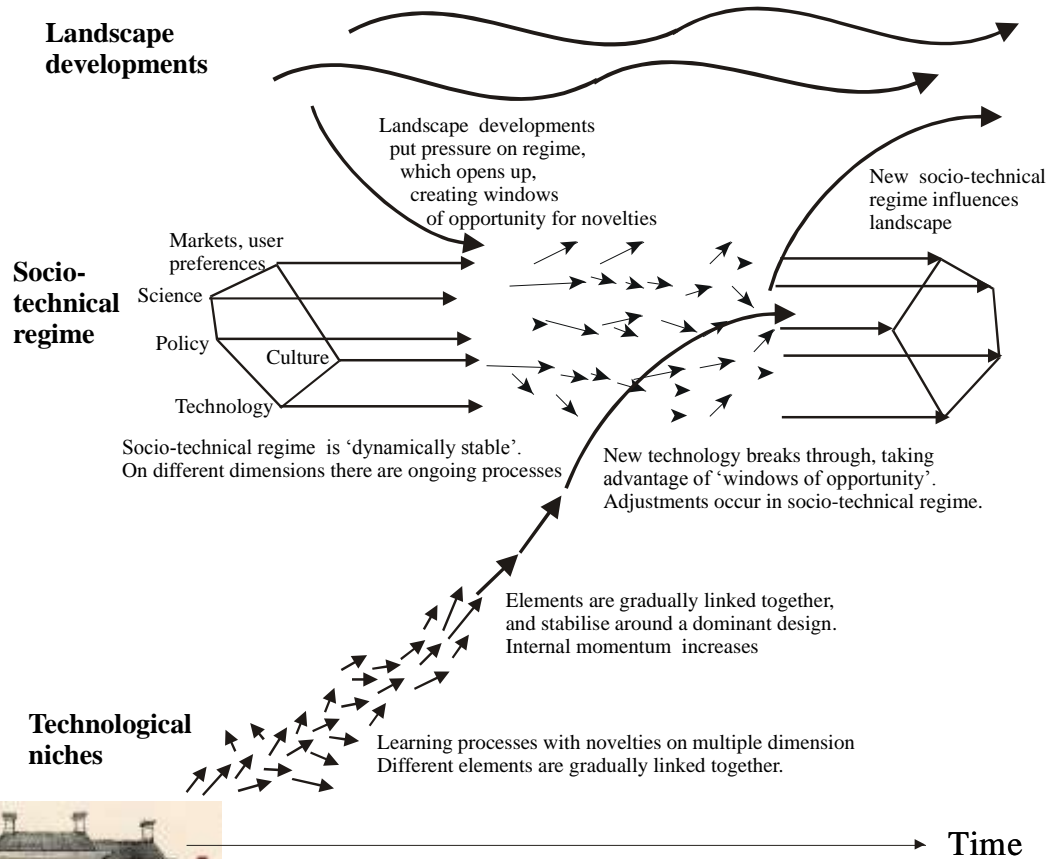
Want to read more?

Grin, Rotmans Schot (2010). *Transitions to Sustainable Development. New Directions in the Study of Long term Structural Change*. New York : Routledge.

Grin, Schot, Rotmans (2011). On patterns and agency in transition dynamics: Some key insights from the KSI programme. *Environmental Innovation and Societal Transitions* vol. 1 (1): 76-81.



# Sociotechnical approach



## Objectives

- Learn from historical cases on T dynamics
- Yield sociotechnical (i.e. symmetric in social and technical aspects) understanding of transition dynamics

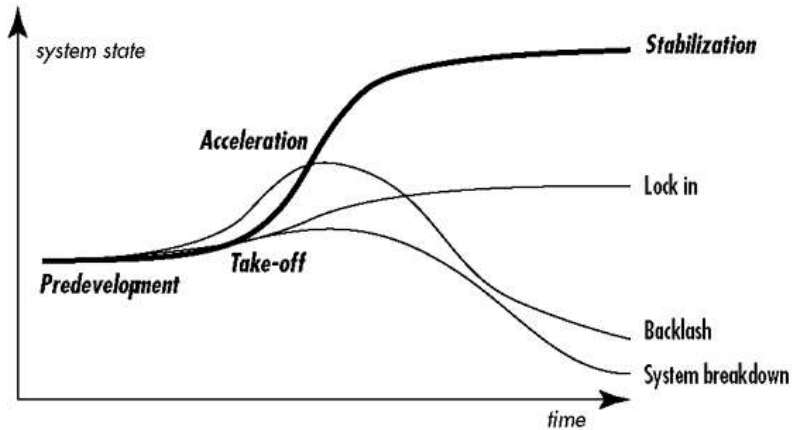
## Relies on

- Contextual history = historiography + STS
- Evolutionary theory
- (social theory)

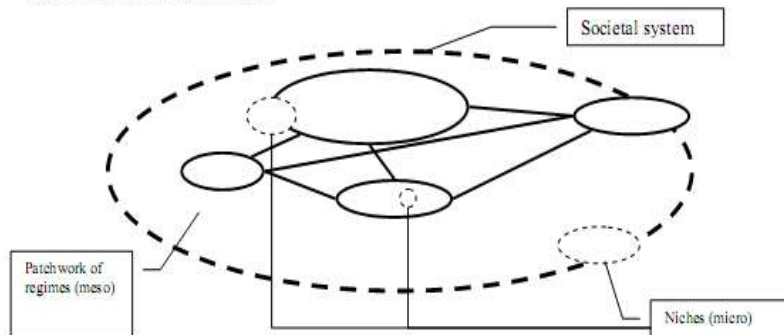




# Complexity Theory Approach



System environment (landscape)



- Objectives

- Understanding of systemic transition mechanisms
- Typology of transition pathways

- Relies on

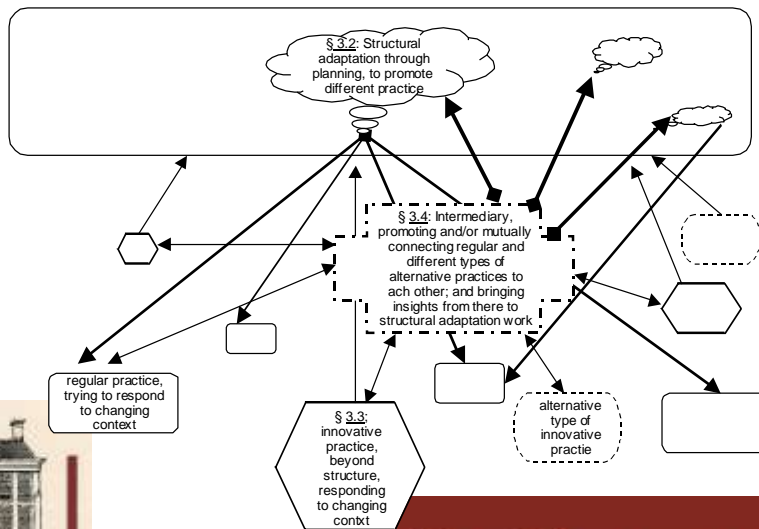
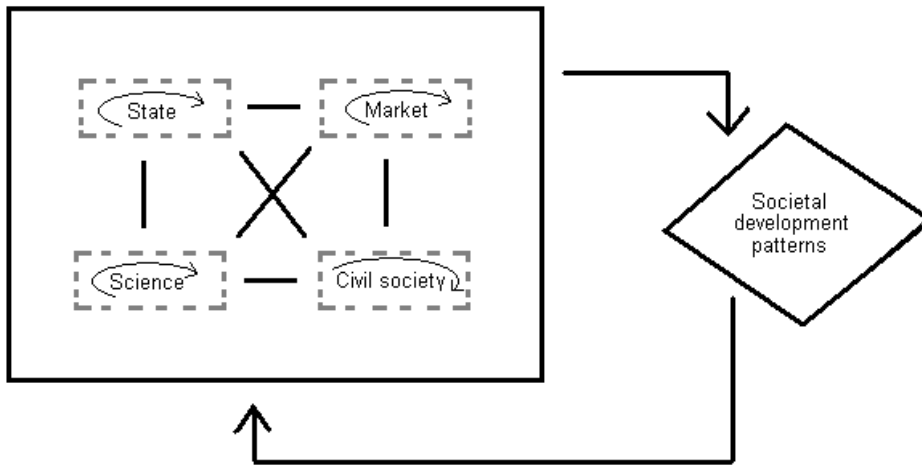
- Complex adaptive systems theory
- Integrated assessment
- Evolutionary theory







# Reflexive governance approach



## Objectives

- Understanding transition dynamics in the real world
- Understanding reflexive agency involved, incl. politics (legitimacy power, trust aspects)

## Relies on

- Political science
- Modernization theory
- Structuration theory
- (STS)







## Some generic insights: typology of transition patterns

- Sociotechnical and complexity approaches:
  - Typology of transition pathways
    - i.e. different routes along which changes at the three levels may reinforce each other
    - May start with
      - niche,
      - or
      - regime changes
  - Causal mechanisms of transition dynamics, in terms of flows and cycles (complexity)
  - Phenomenology transition dynamics i.r.t. middle-range theories (sociotechnical)





# Typology of transition patterns: what we do not know yet

- In general: comparative studies
- On the above typology:
  - Pathways derived from historical studies: what have globalization and emancipation of civil society meant for the mechanisms?
  - Relating complex dynamics more clearly to everyday experience
  - Further integrate both perspectives
- More insight in multi-domain transition dynamics





## Some generic insights: agency in transitions

- Power is partly implied in regime =>
  - Incumbent regime may imply barriers
  - power relations change during a transition > positive interference possible
    - *If* strategic agency through reflexive monitoring (< Giddens)
- Understanding planning as institutional adaptations (< Lindblom, Meadowcroft)
- Understanding reflexive design in niche experiments
- Legitimization tends to occur at interfaces between transition projects and other discursive spheres





## Agency in transitions: what we do not know yet

- In general: comparative studies
- Integration of agency of users, civil society actors
- Understanding of impact transition research on transition agency
- Further elaboration of the 'work' of reflexive monitoring, including its politics



## Transition governance - some key insights & issues

An overview of the following in:

Grin, Rotmans Schot (2010). *Transitions to Sustainable Development. New Directions in the Study of Long term Structural Change*. Routledge.

See also:

J.-P Voss, D. Bauknecht & R. Kemp (eds., 2006) *Reflexive Governance for Sustainable Development*, Cheltenham: Edward Elgar.

Bergh, J van den, and F. Bruinsma (eds., 2008) *Managing the Transition to Renewable Energy: Theory and Macro-regional Practice*. Edward Elgar.

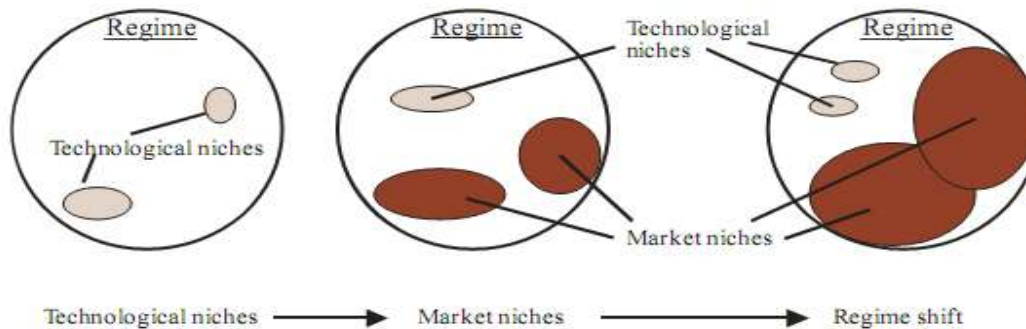
Geert Verbong and Derk Loorbach (eds., forthcoming): *Governing the Energy Transition, Reality, Illusion, Necessity?* Routledge





# Strategic niche management

[sociotechnical approach]



SNM v1.0: Incubation metaphor:

- Shaping expectations, learning, network formation

But: how to

- change a hostile world?!?
- take into account regime dynamics?

• Cf Raven, 2008). *Strategic niche management for biomass (NL, DK) Saarbrücken*





# Strategic niche management

[sociotechnical approach]

- SNM v2.0:

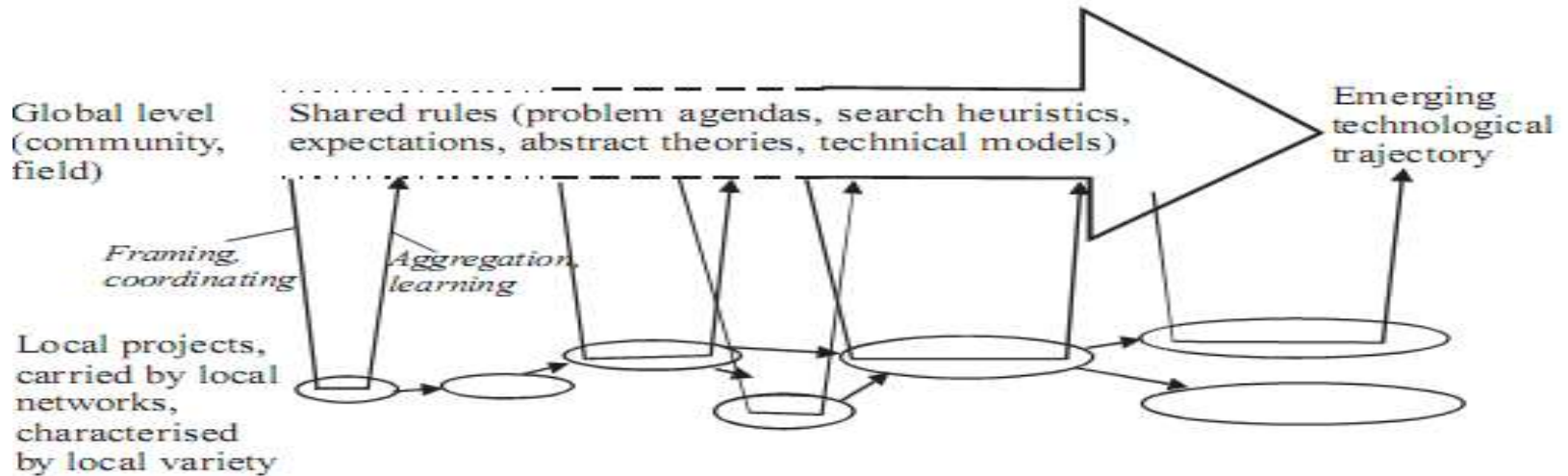


Figure 5.3. Emerging technical trajectory carried by local projects (Geels and Raven, *op cit.* Ref.33, p. 379)

Geels&Raven (2006) *Techn. Analysis & Strat. Mgt*, 18 (3-4): 375-92







# SNM and energy

(1): strategic action for transition dynamics



- Interactions between local experiments and global niches: not self-evident, not linear
  - May be conceived as **translation** (< Callon, Smith)
  - Six mechanisms of translation:
    - commissioning local designs,
    - publishing through local communication channels,
    - lobbying,
    - participating as a local stakeholder,
    - locals articulating additional demands
    - local resistance

• Cf. Raven, forthcoming in Loorbach & Verbong





# SNM and energy (2): niche protection



- Niche protection in biofuel development, NL & Sweden
  - different types of protection: legal exemption; granting resources etc.
  - Protection done by heterogeneous alliances
  - Protection is outcome of negotiation / deliberation / struggle
- Ulmanen, J.H., Verbong, G.P.J., Raven, R.P.J.M. (2009), *Renewable and Sustainable Energy Reviews*, 13(6-7), 1406-1417.





# SNM and energy

## (3): multi-domain transitions

- Two cases:
  - Bioenergy in the Netherlands: interactions between waste and electricity regimes
  - Combined heat and power plants: interaction between electricity and natural gas regimes
- Findings (tentative):
  - innovation with boundary crossing dynamics initially emerges against the backdrop of a single regime; after institutional adaptations in both regimes: successful border crossing dynamics & changed relationship between regimes.
- Raven & Verbong (2009), *Technology in Society*, vol. 31 (1): 85-93





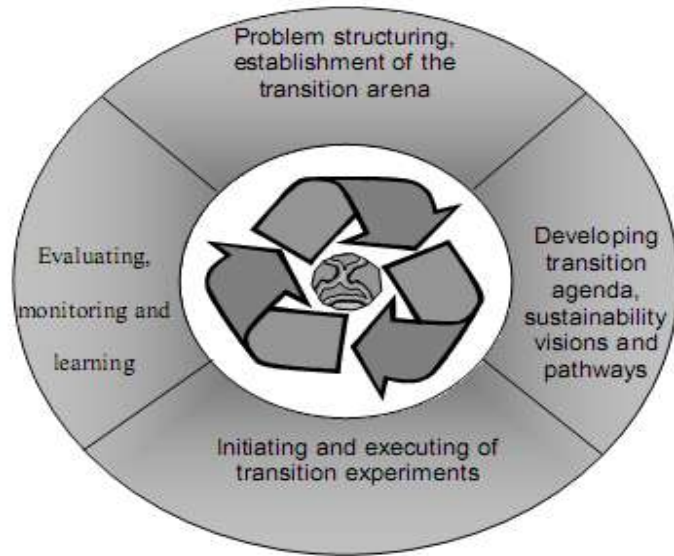
## SNM and energy: issues for further study

- Raven in Loorbach & Verbong (forthcoming):  
future issues
  1. Conditions under which SNM may be effective as governance concept
  2. Relation between local and global processes?
  3. Politics of SNM and niche building
  4. Resistance, especially from NGOs, citizens etc.
  5. SNM in developing countries





# Transition Management: general idea



Loorbach (2007), *Transition Management. New Mode of Governance for Sustainable Development.*

TM v1.0:

- Requires steering at different levels
- Politics needs be better accounted for





# Transition Management: general idea



- V 2.0:
- Derk Loorbach (2007):
  - Based, a.o., on evaluation Energy Transition Programme
  - Different levels of intervention
- Flor Avelino
  - Empowerment and transformative power
  - Role social movements
    - Cf Avelino, forthcoming dissertation ; and Avelino, *Policy Sciences* vol. 42 (2009), no. 4, Avelino & Rotmans, *Eur J. Social Theory*, 2009

## • Grin

- Power dynamics & transition dynamics

- Cf Grin et al, 2010; Grin forthcoming *Int. J. Sust Dev.*





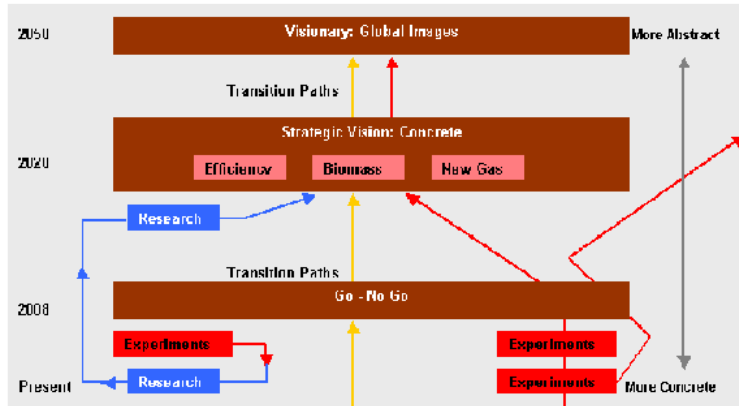
# TM in practice

- Netherlands:
  - Parkstad Limburg
  - Energietransitie
  - NMP-4
  - Transitie Programma Langdurige Zorg (Care transition programme)
  - Urgenda
- Flanders
  - Plan C (waste management)
  - DuWoBo (living & home construction)
- Finland:
  - care





# Dutch Energy Transition programme



- Now under re-construction:
  - leaner and meaner
  - More responsive type of government
  - More organic approach





# Dutch Energy Transition programme

## Scholarly evaluations (1: Hendriks)



- Carolyn Hendriks: Democratic qualities
  - Representative, accountable, responsive?
  - Improvement over existing systems?
- ==> two issues:
  - Inclusion of ET
    - high-profile people
    - In between directing platforms and being their ambassador
  - Influence on existing energy domain
    - Self-selection; discursive bias; public consent?
    - Also: deliberative capacity better than usual
      - Hendriks, *Public Administration*, 86 (4): 1009-1031.





# Dutch Energy Transition programme

## Scholarly evaluations (2: Kern & Smith)

- Three TM story lines:
  - Steering society towards SD
  - ... through experimentation
  - with main actors' co-operation
- ... were discursively presented as in line with liberalisation
- ... and institutionally organized with many incumbent actors in key roles
  - Less structural change than intended
  - Smith&Kern, *Environmental Politics*, 2009, vol 18(1): 78-98





# Dutch Energy Transition programme

Scholarly evaluations (3: Hisschemöller, Loorbach a.o.)



- Main findings:
  - Strong network, focus on industry,
  - SMEs at too large distance
  - marginal position of niche players > lack of pluralism





# Transition Management: issues for further research

- Issues:
  - Further understanding of powering and legitimization in TM networks
  - TM and social movements
  - Comparative studies > role of political structure and culture
  - TM and transnationalization
  - How to do visioning
  - Defining unit of analysis
- Cf. Grin et al (2010) Concluding chapter
- Spaeth & Rohracher, *Research Policy*, vol. 39(4), 2010





# Reflexive governance

## (1): Grin: rationale, power, institutional loci, role of objects in reflexive design of niches

- Rationale:
  - Deal with resistance & inertia in niche projects, rooted in incumbent regime...
  - ... by identifying 'guilty' regime factors...
  - ... and designing strategies for regime change
    - Grin, *Poiesis & Praxis*, 2004
    - Grin et al, *Int J. Foresight Innov Pol.*, 2004
- Power:
  - Rooted in incumbent regime
  - Enscribe novel regime elements in objects
    - Grin, paper 4S Annual Conference -2009
- Institutional loci
  - Legitimization at interfaces with established practices
  - Nurture diversity; promote connections
    - Hendriks&Grin, *J. Env Pol. Planning*, 2007
    - Grin, paper 4S Annual Conference -2010

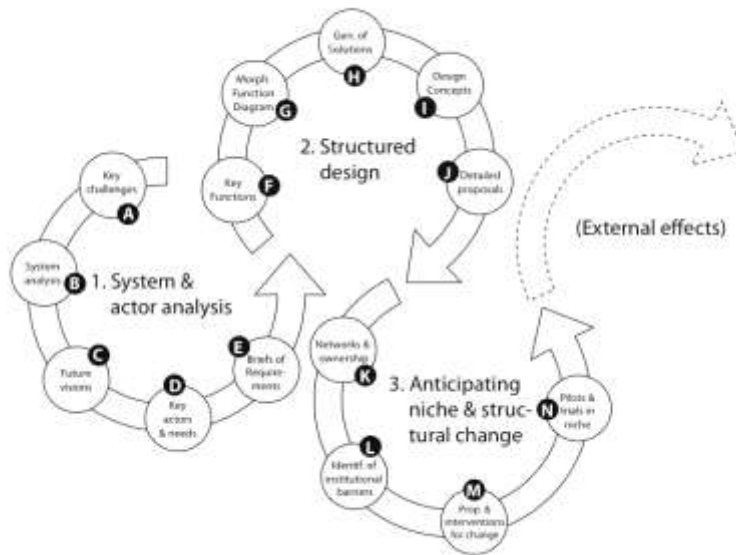






# Reflexive design

(2): Bram Bos - documented experiences, towards a systematic method



- Bos & Grin, *Science, Technology and Human Values*, 33 (4): 480-507.
- Bos (2009), *Social Epistemology*, 22 (1): 29-50.
- Bos et al. (2009), *Outlook on Agriculture*, Vol 38, No 2, pp 137-145







# Reflexive governance

## reflexive planning – lessons from Amsterdam Port



- Enza Lissandrello:
  - Emirbayer & Miche (< Bourdieu): reflexivity = re-ordering temporal dimensions of agency in practices
    - from: past experience > expectations > current action > future
    - To: future vision > re-evaluate past experience, re-define expectations > current action > different future
  - Then planning become a matter of proper designing institutional setting and method.
  - Cf
    - Lissandrello & Grin (2011). *Planning Theory and Practice*, vol. 12 (no. 2)





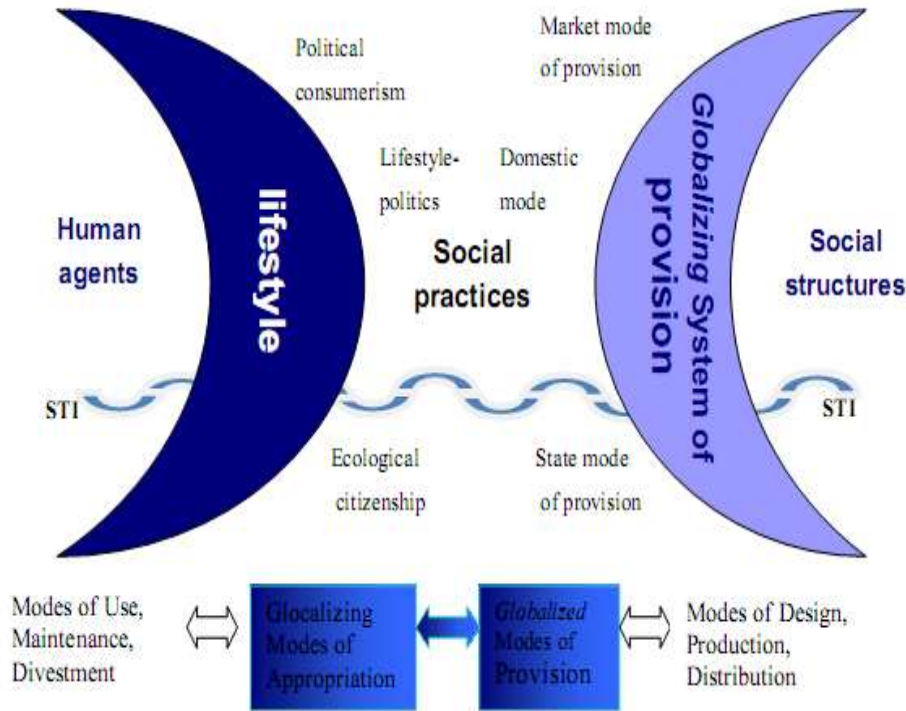
**Other efforts:  
outcomes, and issues for further study**





# Social practice approach: outline

Figure 4. Globalizing modes of provision and the appropriation of socio-technical innovations (STI) within social practices.



- Objectives

- Add to structuration theory the role of objects and infra
- Synthesize with MLP

- Relies on

- Structuration theory, especially Giddens + Warde, Reckwitz, Schatzki)
- Reflexive modernization, globalization theory
- (MLP)





# Social practice approach: outcomes & what next

## Outcomes

- Conceptual scheme on
  - practices between lifestyle and SoP
  - Idealtypes of citizen-consumers
- Empirical studies food, home maintenance, tourism
  - Differences between housing (supply-led) and food (more understanding of meaning of food consumers) markets
  - Idealtypes differ in appropriation
  - Role of transnationalization
- 'Holistic' study of agrofood system
  - (discursive) power of consumers; dynamic and ambiguous roles retail; role physical infrastructure; transnationalization

## Issues for further study

- Further development of connection to MLP
- Studies with > 1 SoP (e.g. housing + energy)
- More (comparative: < transnationalization!) empirical studies





# Social practice approach: further reading



## Main publications:

- Spaargaren, G. & C.S.A. van Koppen (2009), Provider Strategies and the Greening of Consumption Practices; Exploring the role of companies in sustainable consumption. In: H. Lange (eds.) Bremen: Springer Verlag. @ [www.ksinetwork.nl](http://www.ksinetwork.nl)
- Verbeek, D.H.P. (2009), *Sustainable tourism mobilities; A practice approach*. PhD thesis, Tilburg University. @ [www.ksinetwork.nl](http://www.ksinetwork.nl)
- Spaargaren, G. & Oosterveer, P. (2010), Citizen-Consumers as Agents of Change in Globalizing Modernity: The Case of Sustainable Consumption, *Sustainability* 2010, 2, 1887-1908
- Spaargaren, Gert, Anne Loeber, and Peter Oosterveer (eds., forthcoming) (2011). *Food Practices in Transition. Changing Food Consumption, Retail and Production in the Age of Reflexive Modernity*. Routledge.







# Innovation System Approach

Marko Hekkert, Simona Negro, Ruud Smits, Stefan Kuhlman



- IS literature: IS fulfill seven functions
  - Stimulate learning, Manage interfaces in networks, Provide resources, Develop knowledge...
- Systemic instruments (intermediary organizations) may fill gaps

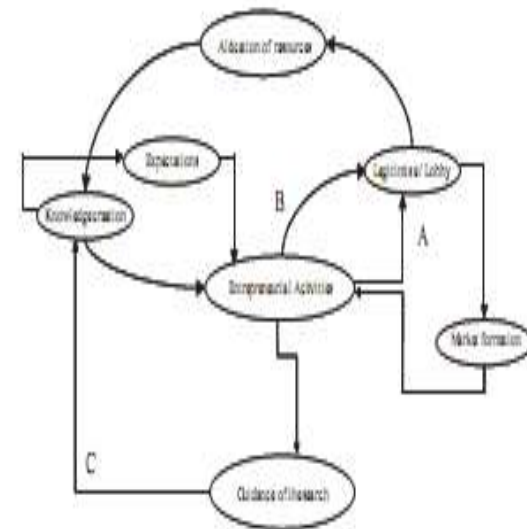


Fig. 1. Three typical motors of change.





# Innovation systems approach: outcomes & what next

## Outcomes

- Application to a wide range of energy cases
- Functions matter
- Functions interact
- There are patterns around 'motors' for transition: knowledge-legitimacy; resources-rule creation

## Issues for further study

- role of power in systemic instruments
- Power strategies of incumbents and niche players
- Relations between changes in IS and pressure towards sustainable development







# Innovation system approach: further reading

- Smits & Kuhlman, Int J. Foresight Innov Pol, 2004: Sstemic instruments;
- Hekkert, Suurs, Negro, Kuhlman Functions apporach, *Technological Forecasting and Social Change*, vol. 74 no. 4, p. 413-432
- Negro, Hekkert, Smits (2007), Explaining the failure of Dutch biomass digestion, *Energy Policy* 35, 925-938.
- Negro, Suurs, Hekkert, biomass gasification *Technol. Forecast. Soc. Change* 75 (1) (2008) 57-77
- Suurs Hekkert, Smits, (2009) Hydrogen and fuel cell technologies, *International Journal of Hydrogen Energy*, 34 (24), pp. 9639-9654.
- Suurs, Hekkert, (2009) Biofuels *Technological Forecasting and Social Change*, 76 (8), pp. 1003-1020.





## Energy Volume Routledge series

- EU's energy policies are varied and diverse, but overall tend to stabilize current regimes in for instance electricity production and distribution.
- Supply security, climate change and internal market policies are major drivers that in general reinforce current strategies, patterns of investment and power relationships within the regime.
- Yet, policies in fields such as innovation and renewable energy have gained increasing clout and contribute (often at the member state level rather than the EU level) to challenging, if not destabilizing, the regime
- Still an open question whether a low carbon energy transition is really contingent on a regime destabilization.





## Energy Volume Routledge series

- Issues for further research:
  - How may innovations within and outside the regime start to reinforce each other
  - How could a diverse, secure future energy system combine different options?
  - How to better align user practices and supply system?





## In one slide: issue for further study

- Further development needed:
  - Typology of transitions pathways
  - The politics of transitions
  - Interaction between societal practices and supply systems
  - Embedding transition studies in social theory
- Largely unexplored:
  - Transnational transitions
  - Multi-domain transitions
  - Influence of national polities/IS/markets on transitions > comparative analysis
  - Role of social movements in transitions

