

# Smart grid-lock?

The role of ideas, interests and institutions in contestations over the future of electricity networks in Britain



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New Thinking For Energy

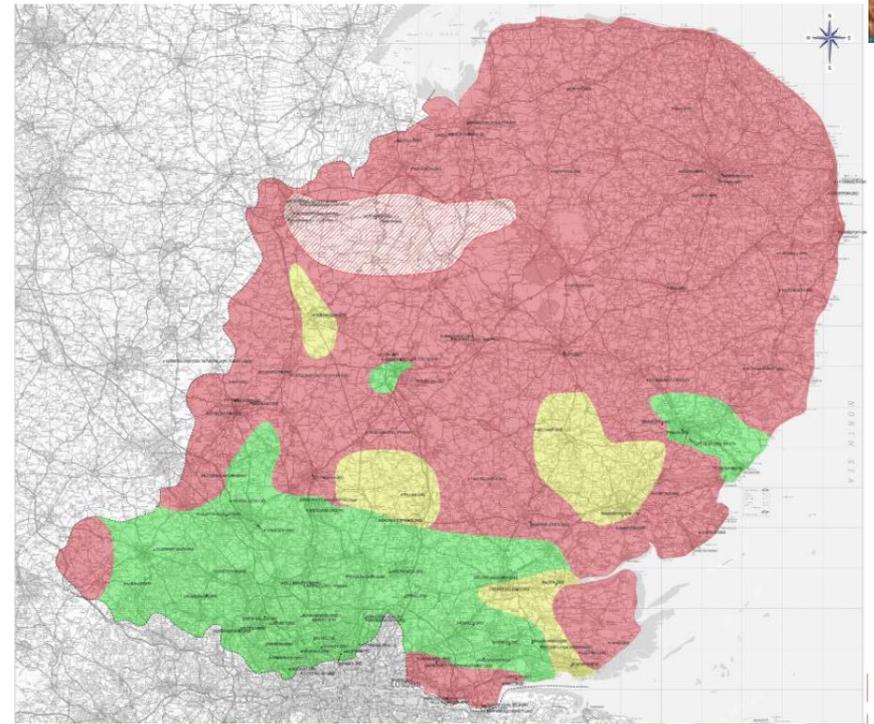


# Introduction

- Contesting and constructing space for innovation in sustainable energy: the case study of the ‘smart grid’ in the UK
- Three aims:
  - *Account of contestations over electricity distribution regulation since 2000*
  - *Evaluate how far regulation to date will foster a smart grid*
  - *Explore why regime not destabilised given landscape and niche changes*
- In regulated networks, selection processes created by regulation not competitive markets, but regulation also has to create niches, and incumbents have to undertake innovation in those niches.

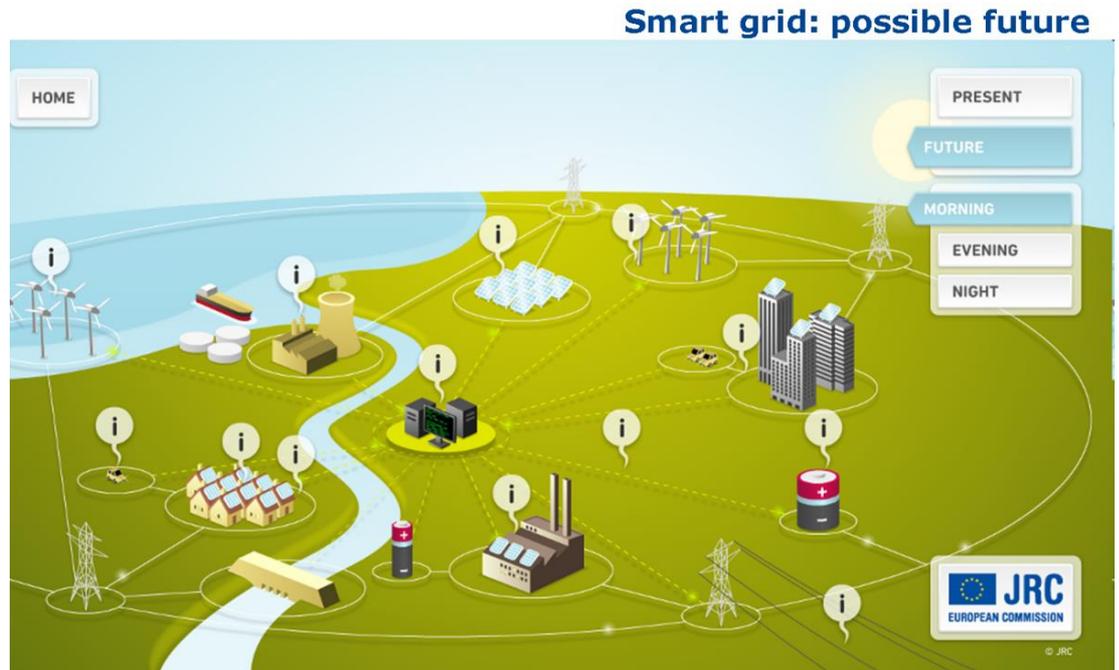
# The smart grid concept

- Applies to low-voltage distribution networks more than high-voltage transmission
- Renewable generation directly on distribution networks means accommodating 2-way flow of power
- Dealing with variable renewable generation by balancing through flexing demand rather than supply, requiring smart meters and appliances (including EV charging/discharging)
- Electrification of heat and transport will mean massive network reinforcement costs without smart solutions that can limit peak demand



# Requires technological and institutional innovation

- Involves major technological and operational innovation, from current centralised one-way power system
- From passive distribution network operators (DNOs) to active distribution system operators (DSOs), i.e. active network management
- Will require innovation in an historically un-innovative industry, and so major changes in governance



# Historical framework for network governance

- Since 1998 electricity distribution networks run by privately-owned monopolies, regulated by Office of Gas and Electricity Markets (Ofgem)
- DNOs regulated under 'RPI-X'; incentivises short-term cost efficiency but not innovation:
  - “It would be a crude but not an unrealistic simplification to say that the way energy networks are designed, built and operated has not changed significantly since they were built in the post war period.” (Smith 2010: 9)
- Bias towards capital-intensive 'fit-and-forget' solutions, as regime allows rate of return on regulatory asset base
- DNOs as risk-averse companies, focus on regulator, stable revenue



# The evolving framework over the 2000s

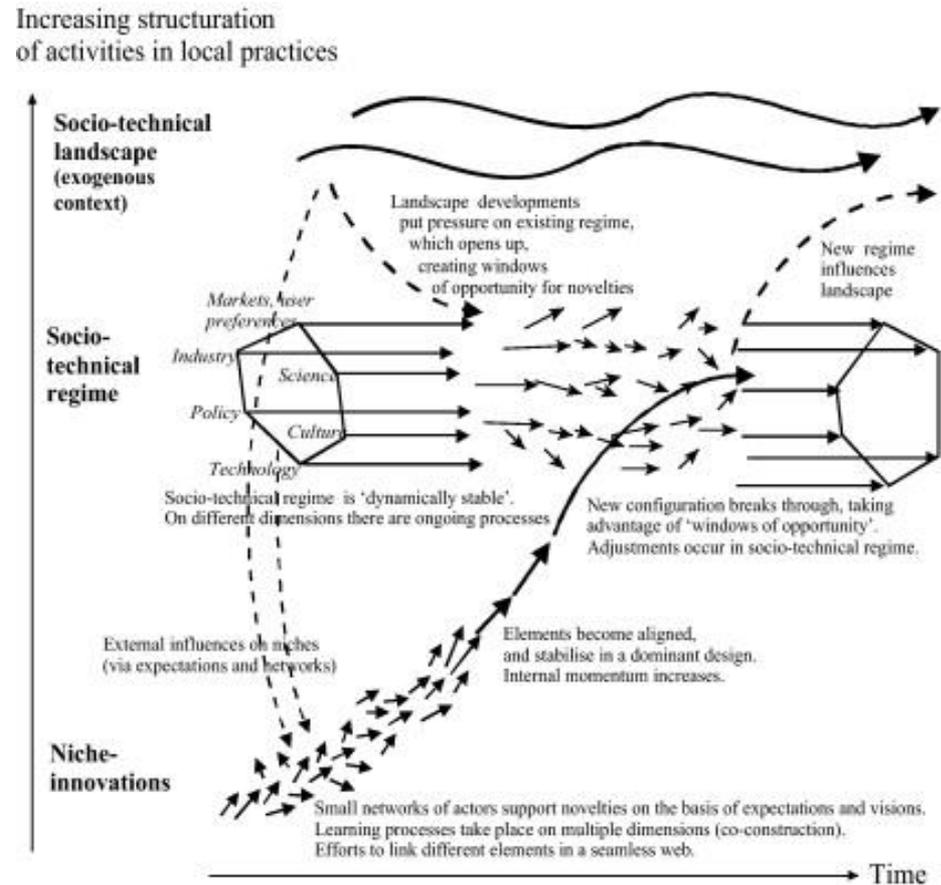
- Smart grid comes onto policy agenda from 2000 as climate change increasingly on the political agenda
  - Distributed generation
  - R&D on networks (especially LCNF)
- Major review in 2008-10: RPI-X@20
- Shift to new regulatory framework from 2011
  - ‘RIIO’: Revenue = Incentives + Innovation + Outputs
  - Aim was to produce “unprecedented” levels of innovation by network companies
- Smart Grid Forum 2010

# Areas of contestation

- Balance of costs and benefits
  - Difficulty in deriving an agreed range for CBAs: NPV from £1bn to >£32bn
- Handling uncertainty
  - Strategic coordination vs. delegation through regulation
- Potential tension between different uses of DG and demand response
  - Matching wind (supplier/generators) vs. peak lopping (networks)
- Ownership of networks
  - Uncertainty over DNO access to generation/storage and DSR; unbundling of networks from integrated supplier generators; introduction of competition

# How far is policy fostering innovation?

- MLP framework: niches, regime, landscape
- Innovation occurs when (protected) niches develop new technologies/practices and when regime is destabilised (by landscape factors)
- Historical case studies vs. assessment of policy in induced transitions (Kern 2012)
- How far and how might RIIO drive development of smart grid?



# Fostering innovation? Niche level

- Learning processes
  - Accelerated by LCNF
- Price performance improvements
  - Limited market so supply chain is embryonic (outside smart meters); costs must be risk-adjusted
- Creation of market niches
  - Learning from LCNF to become BAU? Innovation Roll-Out Mechanism? UKPN likely to roll out non-firm connection offers from trials in E. Anglia, DNOs experimentation with energy service offerings
- Bringing in powerful actors
  - Smart grids agenda slowly making way from engineers to boards; ICT industry as lobby; but secondary issue in Ofgem and DECC; covert opposition from National Grid



Low Carbon Networks  
Fund Conference 2013



# Fostering innovation? Regime level

- Changes in cognitive, regulative and normative rules
  - RIIO-ED1 as “RPI-X with bells and whistles”; still price cap incentive regulation, although with more attention paid to smart grid concept; culture in DNOs beginning to change?
- Growth in low carbon technologies
  - Move to allow anticipatory investment, but delegated coordination means depends on DNO forecasts of LCT growth; have taken lead from Government scenarios which all have low growth before 2020
- Driving change in social networks
  - From sole focus on Ofgem, DNOs to develop deeper relationships with customers, plus ICT industry via LCNF trials?

# Fostering innovation? Landscape level

- Macro-political developments

- Wave of heightened concern about climate change 2004-2009; series of changes to Ofgem remit and guidance from 2000 onwards



- Socio-economic trends

- Stagnant real wages in lower-mid part of income distribution + rising energy costs => reinforces imperative of S-T efficiency

- Changes in cultural patterns

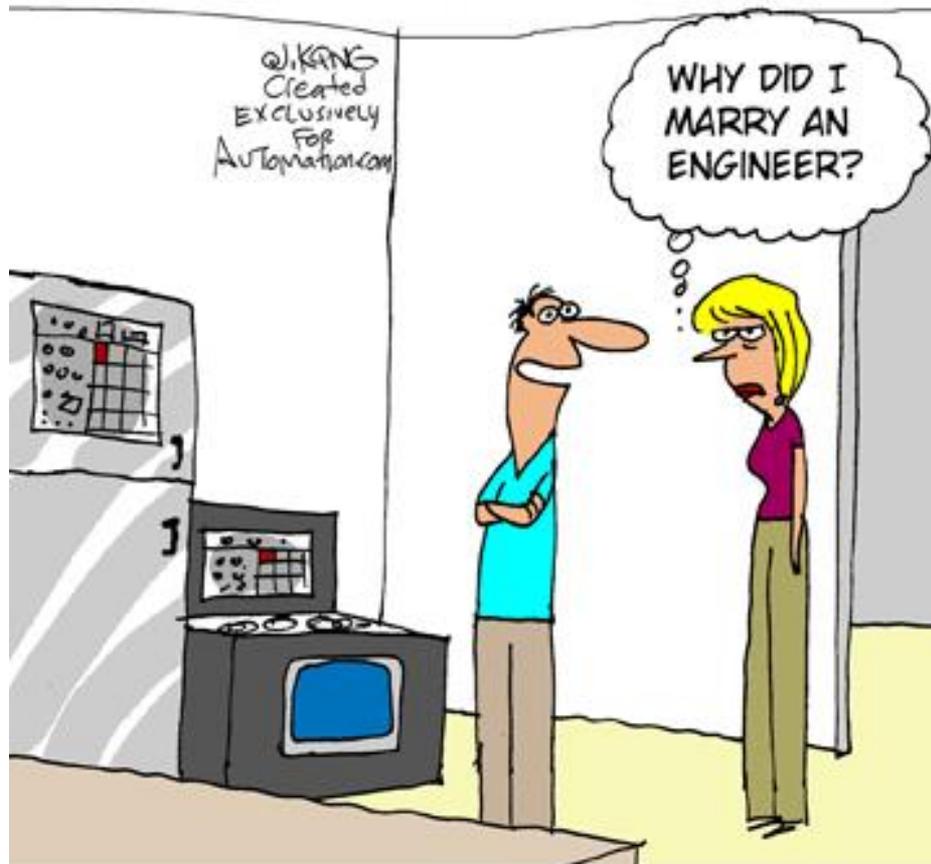
- Concerns about but also increased acceptance of data sharing and privacy

# Explaining the persistence of the regime

- Exogenous shocks ('critical junctures') as source of change in institutionalist theory...but the relationship is contingent (Cappocia and Kelemen 2007)
- Why did the critical juncture in the 2000s not lead to more radical change?
- Nature of 'exogenous shock'
  - Political pressure on climate change not matched by policy pressure on low-carbon technologies
- Effects of path dependence on institutional relationships
  - Original institutional design (rules but also discretion) has meant regulatory inertia

# Conclusions

- Critical juncture in landscape has created and expanded protective space for smart grid development, but has not destabilised regime
- Shielding but not empowerment (Smith and Raven 2012)
- Not yet clear what LCNF will yield – may lead DNOs to innovate, although they still have material incentives to grow network assets and avoid risk, and have no culture or infrastructure for interfacing with customers
- MLP framework good for organising description of change but limited when it comes to explaining political processes (including regime persistence and change)



*"Honey, I converted all our appliances to smart devices. Now I'm just waiting for the SmartGrid infrastructure to come online so we can start paying higher energy rates."*