Business Models for Future Energy Systems

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Outline

- With thanks to my Cambridge colleagues:
  Dr Karim Anaya, Dr Thomas Greve, Francisco Ruz and Dr Laura Richter.

- EPSRC Autonomic Power System Project and EPSRC Business, Economics, Planning and Policy for Energy Storage in Low-Carbon Futures (BEPP-Store)

- Business Models

- Business Models and Electrical Energy Storage (B to B)

- Business Models and Residential Consumers (B to C)

- The Challenge to Existing Business Models

BUSINESS MODELS IN THE CONTEXT OF THE FUTURE ENERGY SYSTEM

Business Models

(see Teece, 2010)

Business models are about:

Value Proposition –

what services being sold and to whom?

Value Creation –

how will the service be created and provided?

Value Capture –

how will the value be monetised?

Business models are not just about pricing strategy…

Some co-existence of business models likely…

Business models must add up in terms of basic economics of risk-return payoff…

Often they don't in smart (or even dumb) energy…

Business Models

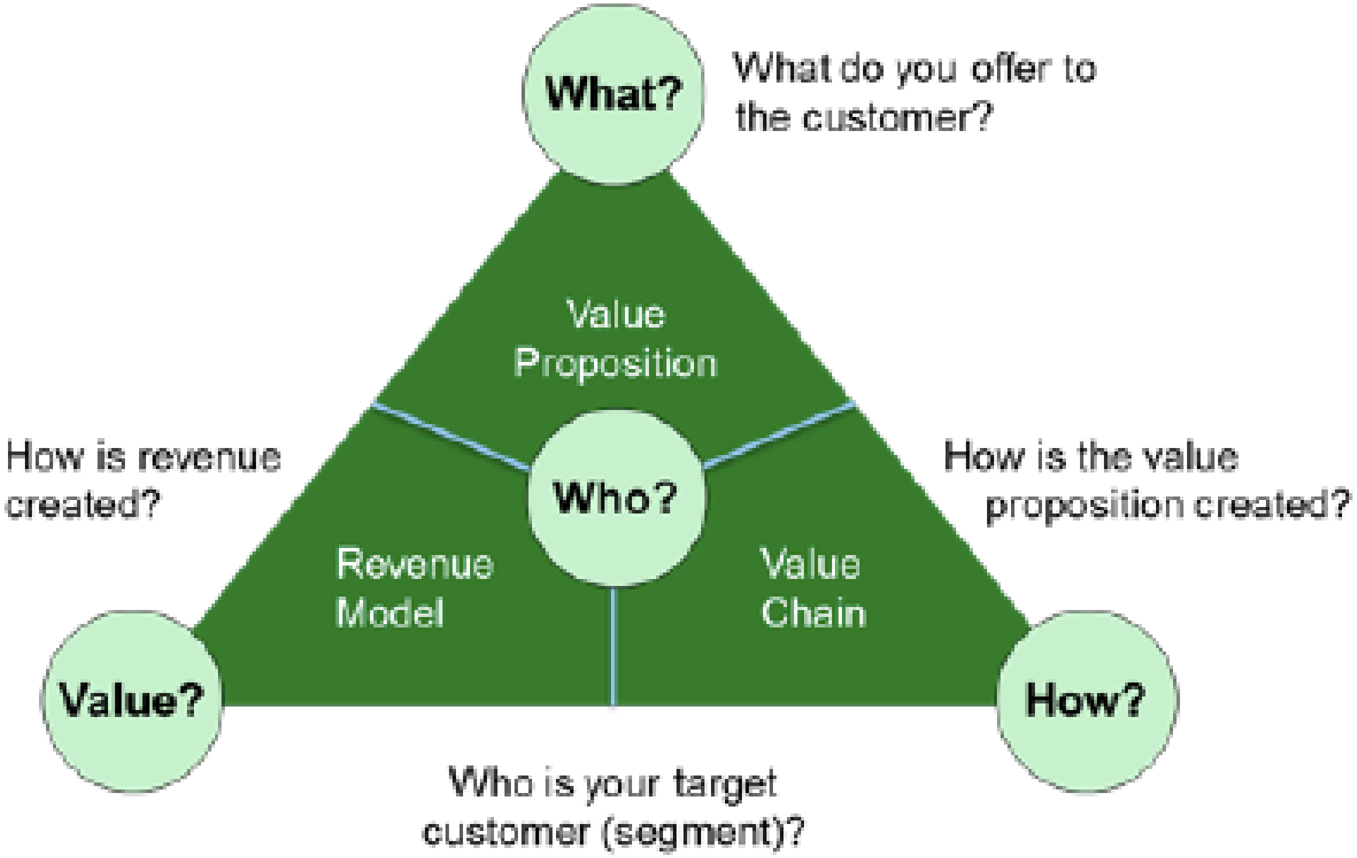


Fig. 1 Business model definition – the magic triangle

Source: Gassmann et al., 2014, p.2.

Business model types (out of 55) that might apply to energy services…

- Flat Rate
- Fractional Ownership
- Franchising
- Guaranteed availability
- Hidden Revenue
- Integrator
- Leverage customer data
- No frills
- Open business model
- Pay per use
- Performance based contracting
- Revenue sharing
- Subscription
- Two-sided market

Source: Gassmann et al. 2014

Business models and future energy

- Value proposition for future energy services are often based on intermittency of energy supply and inflexibility of energy demand.
- Value creation is around whether new technologies can facilitate supply and demand matching in power, transport and heat.
- Value capture is about how future energy investments will be able to earn a return.

Some basic facts of economic life that new business models must recognise

- The decline of resource rents (and demand?) in the energy sector will reduce the aggregate profitability of the energy sector.
- A shift to manufacturing as the basis of the energy sector will reduce rates of return and the significance of energy companies in stock markets and, likely, government policy.
- Energy customers are interested in price (as low as possible), predictable bills and energy security (no worse than now) and they don't like complexity.
- Citizens (but not necessarily customers) are interested in environmental impacts to some extent.
- The world is not like California and Hawaii, e.g. in the UK electricity bills are lower ($60.39 vs $91.26 vs $187.59 per month, 2014) and renewables not as well matched to demand.

Some basic facts of economic life that new business models must recognise

- Average energy prices for households for heating and power will remain subject to economic regulation and oversight. Rates of return on energy companies will be effectively capped and the potential for high rates of return limited.
- The structure of energy prices will also continue to be subject to regulatory oversight and hence the scope for increased price discrimination will be limited. Certain types of price discrimination may not be allowed.
- Regulators will rightly be skeptical of new technological solutions which do not deliver proven customer benefits: because a technology is faster, cleaner or more secure it is NOT necessarily worth it.
- Regulators should also be skeptical of significant return of old business models which disappeared due to lack of scale economies (e.g.local grids).

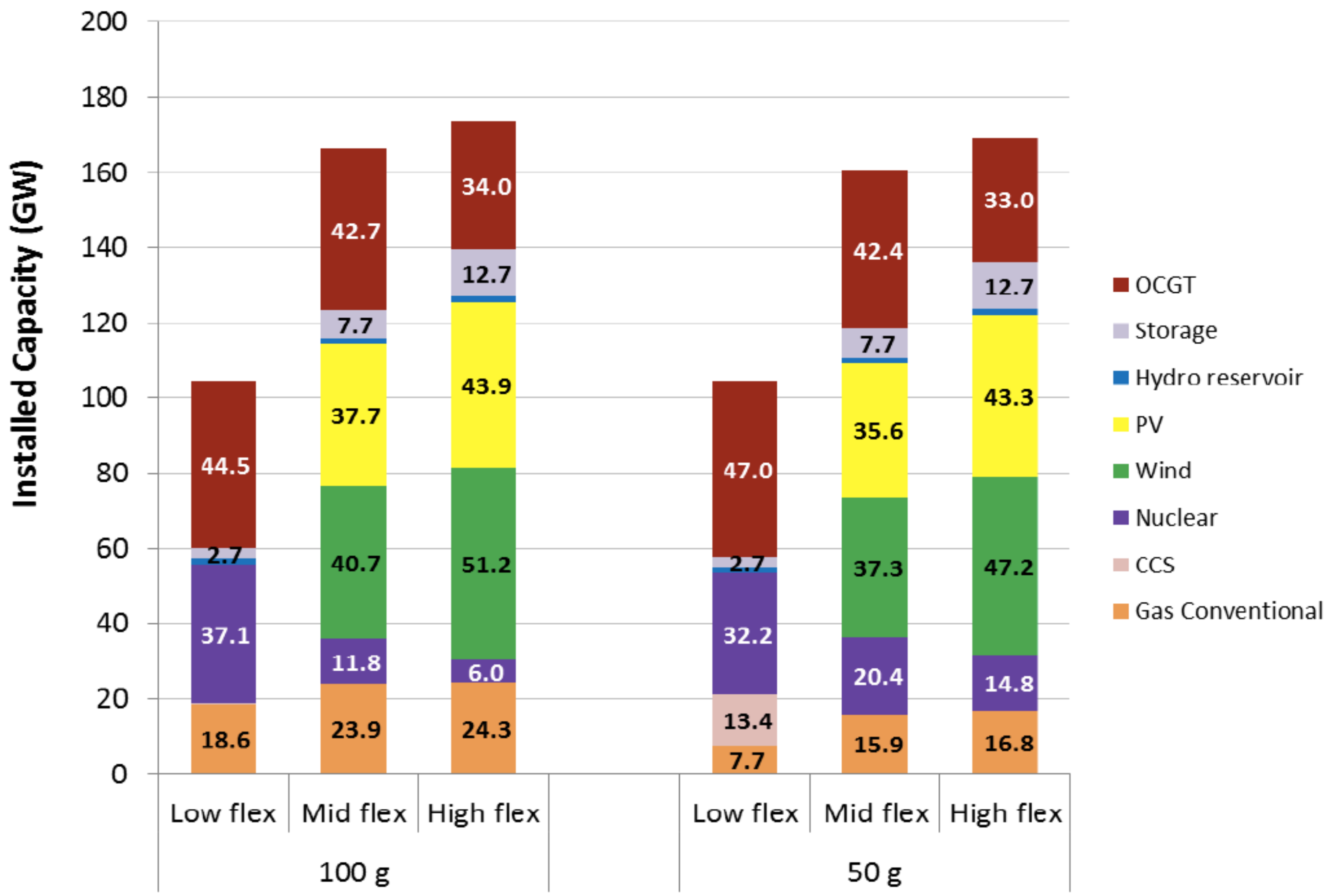
Some basic facts of economic life that new business models must recognise

- Stranding risks are high in energy and new investments create liabilities for current and future customers.
- Electricity sector should be expected to lag on implementation of both communications and financial innovation, given risk-return profile attached to sector by customers. Customers don't want existing energy system to be an expensive test-bed.

- BMs from new players (e.g. peer to peer) may be free-riding on default service provisions, option value of grid use and avoidance of fixed costs (e.g. triad avoidance benefits).
- Business models imported from other sectors into energy may be regarded as 'wreckless' if they impose extreme risks for shareholders and for the rest of the system.

BUSINESS MODELS AND ELECTRICAL ENERGY STORAGE

A value proposition for storage?
Impact of flexibility on the generation mix GB 2030



Source: Strbac et al., 2016, p.18.

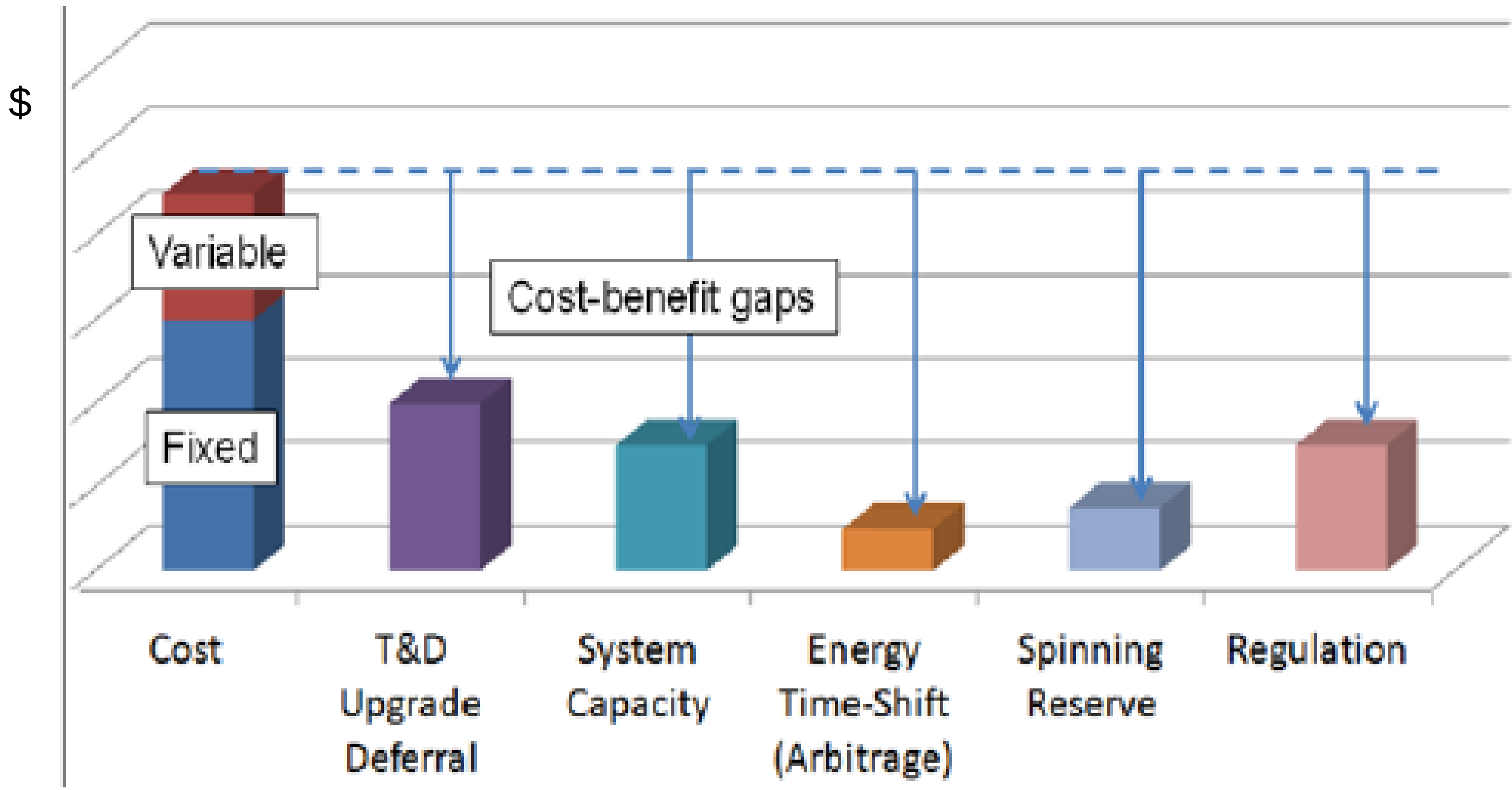
Economic challenge in energy storage

- Fossil fuel allows easy, flexible storage.
- No-one demands storage as a final consumption good.
- Production processes should minimise storage and aim for just in time delivery.
- High fixed up front costs.
- Stand alone storage businesses face higher costs.
- Market design and regulation important.

Some basic economics of energy storage

- High frequency of use storage is more profitable than seasonal storage, given high capital costs.
- Storage which relies on multiple sources of value faces higher transaction costs.
- More storage reduces the value of each additional unit of storage, meaning that if non-integrated storage is likely to be less than globally optimal.
- The value of storage will depend on what else is on the energy system in terms of storage, demand and generation.
- If storage is not about energy then residual fossil fuel systems will compete strongly with advanced forms of storage, in a so called sailing ship effect (see Geels, 2002).

Sources of Value Creation for generic battery storage



Source: EPRI (2013, 2-2).

Electricity product markets need to be redesigned…

Service	The UK		Germany		Spain	
	Procurement	Remuneration	Procurement	Remuneration	Procurement	Remuneration
Primary Frequency Control	Tendering	Pay as bid	Tendering	Pay as bid	Compulsory	None
Secondary Frequency Control	-	-	Tendering	Pay as bid	Spot Market	Clearing price
Spinning Reserve	Tendering	Pay as bid	Tendering	Pay as bid	Spot Market	Clearing price
Voltage Control	Compulsory and tendering	Pay as bid	Compulsory	None	Compulsory	None
Enhanced Voltage Control	Tendering	Pay as bid	Bilateral Contracts	Pay as bid	Tendering	Regulated price
Black Start	Bilateral Contract	Pay as bid	Compulsory	None	Compulsory	None

Table 1. Procurement and remuneration methods in the UK, Germany and Spain (Ministerio de Industria, 1998, 2009, 2014; Rebours et al, 2007; National Grid; regelleistung.net; Castro, 2013)

Source: Ruz and Pollitt (2016).

National Grid tendered for 200MW of a new service in April 2016 – Enhanced Frequency Response (EFR) – a product to provide frequency response within 1 second.

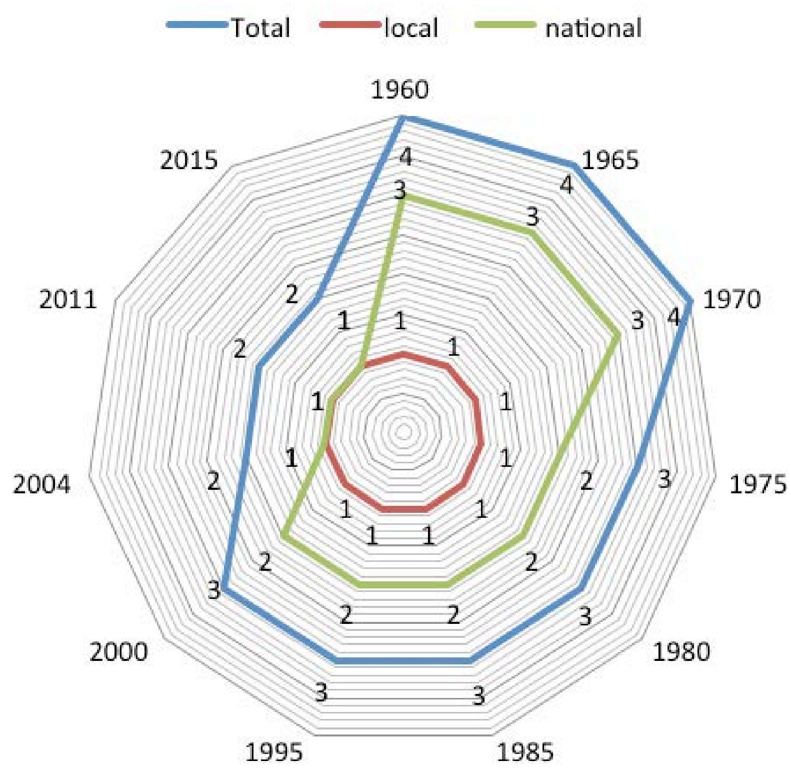
Regulatory barriers need to be addressed…

- These include definition of storage – is it generation or retail or something else?
- Regulated incumbent network companies may be able to include storage in their asset base, reducing the scope for non-regulated storage.
- Unbundling rules may mean that if network companies own storage they cannot dispatch it and must work through a third party.
- Existing network charging methodologies may over or under incentivise new investments (see Pollitt, 2016).

BUSINESS MODELS AND RESIDENTIAL CONSUMERS

The challenge of value proposition and value capture: lessons from 50 years of fixed line voice telecoms pricing

Figure 1: Number of distance/location based fixed voice telecoms



Source: Oseni and Pollitt, 2016.

We show, if anything time and distance price discrimination has declined since 1960.

This suggests that increasing price differentiation in final prices is unlikely.

What is the WTP/WTA for smart home service contracts?

Table 3: Willingness to Accept Smart Energy Service Contracts, among distinct groups of customers

	All	Cluster 1	Cluster 2	Cluster 3	Cluster 4
		Unremarkable	Private data	Risk averse	Open data
-£ 2.19 + £ 0.50 per exp. £ 1 saving	20%	21%	27%	13%	27%
-£ 2.19 + £ 0.33 per exp. £ 1 saving	24%	26%	33%	16%	34%
-£ 4 + £ 0.50 per exp. £ 1 saving	35%	36%	49%	26%	44%
-£ 4 + £ 0.33 per exp. £ 1 saving	46%	48%	60%	36%	59%

Source: Richter and Pollitt (2016), Table 9, p.33.

Discrete choice survey of 1800+ customers. Need to offer £26.28 (2.19*12) up front, and then give 50% of savings, <u>so if company saves customer £100, then it gets £23.72 gross revenue.</u>

THE CHALLENGE TO EXISTING BUSINESS MODELS

The death of the utility? Solar PV and distribution of network charge payments in South Queensland, Australia

	Household A	*Household B*	*Household C*	*Household D*
	No air-con	*Air con*	*No air-con*	*Air-con*
	No Solar PV	*No Solar PV*	*Solar PV*	*Solar PV*
Maximum Demand (kW)	1.41	2.14	1.40	2.09
Metered import (kWh)	6253.4	7560.6	3820.1	4707.1
Solar Export (kWh)	0	0	2259.1	1838.8
Gross Demand (kWh)	6253.4	7560.6	6253.4	7560.6
Number of customers	283849	694643	26151	235357
% of customers	23%	56%	2%	19%
Base Network Tariff	$1006.14	$1171.37	$698.57	$810.69
Differences	A-C	B-D		
	$307.57	$360.68		

Note: Solar PV took off in 2009; charging basis 20% fixed, 80% per kWh import.
Source: From Simshauser (2014), p.22, Table 3. Modeled impact for 2014.
(See Pollitt, 2016).

Clearly there is a case for regulatory action to change charging basis.

In summary…

- <u>The fundamental economics of the smart, low carbon, renewable energy future still looks challenging.</u>
- <u>Regulatory and market design changes</u> will be necessary to support new business models in energy.
- Good business models should <u>focus on creating value for customers</u>, not satisfying 'system' requirements.

- <u>Little historical precedent</u> for type of dynamic pricing many assume is needed at the retail level.
- <u>Household participation will be costly</u> to induce.
- <u>Traditional business models are under attack</u> but there are signs of change.

However…

- <u>Technological hubris, limits of picking winners, understanding the final customer and nature of scale economies</u> remain important, for the energy economist, as we envisage what is an exciting energy future of possibilities.

- <u>Comprehensive cost benefit analyses of market and regulatory design changes are necessary</u> to avoid vague justifications in terms of environment, renewables, security, jobs, industrial strategy, international relations…

References

- Anaya, K. and Pollitt, M. (2016), *Business Models for Electrical Energy Storage*, paper for IPEMC 2016 conference, China.
- EPRI, 2013. Cost-Effectiveness of Energy Storage in California, Available:http://www.cpuc.ca.gov/NR/rdonlyres/1110403D-85B2-4FDB-B927-5F2EE9507FCA/0/Storage_CostEffectivenessReport_EPRI.pdf.
- Eisenmann, T.R., Alystyne, G.P. and Alystyne, M.V. (2011),, ‘Platform Envelopment’, *Strategic Management Journal*, 32: 1270-1285.
- ETI (2013), Smart Systems and Heat: A perspective from the United Kingdom. Energy Technologies Institute.
- Gassmann, O., Frankenberger, K. , Csik, M. (2014), *The St Gallen Business Model Navigator*, Working Paper University of St Gallen.
- Geels, F. (2002), ‘Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study’, *Research Policy*, 31, pp. 1257–1274.
- Oseni, M.O. and Pollitt, M.G. (2016), *The prospects for smart energy prices: observations from 50 years of residential pricing for fixed line telecoms and electricity,* EPRG Working Paper No.1611.
- Pollitt, M.G. (2016), *Network Charging for Flexibility*, EPRG Working Paper, forthcoming.
- Pollitt, M. and Anaya, K., ‘Can current electricity markets cope with high shares of renewables? A comparison of approaches in Germany, the UK and the State of New York’, The Energy Journal, 2016, Volume 37, Bollino-Madlener Special Issue, doi://10.5547/01956574.37.SI2.
- Richter, L. and Pollitt, M. (2016), *Which Smart Electricity Services Contracts Will Consumers Accept? The demand for compensation in a platform market*, EPRG Working Paper, No.1616.
- Ruz, F.C. and Pollitt, M. (2016), *Overcoming barriers to electrical energy storage: Comparing California and Europe*, EPRG Working Paper, No.1614. Forthcoming in *Competition and Regulation in Network Industries.*
- Simshauser, P. (2014). *Network tariffs: resolving rate instability and hidden subsidies*, AGL Applied Economic and Policy Research Working Paper No.45 – Demand Tariffs.
- Strbac, G., Konstantelos, I., Pollitt, M. and Green, R. (2016), *Delivering a Future Proof Energy Infrastructure*, Report for the National Infrastructure Commission, Imperial College London and University of Cambridge Energy Policy Research Group, February
- Teece, D. (2010), ‘Business Models, Business Strategy and Innovation’, *Long Range Planning***,** Volume 43, Issues 2–3, April–June 2010, Pages 172–194.