Can telecommunications provide a role model for electricity (de)regulation?

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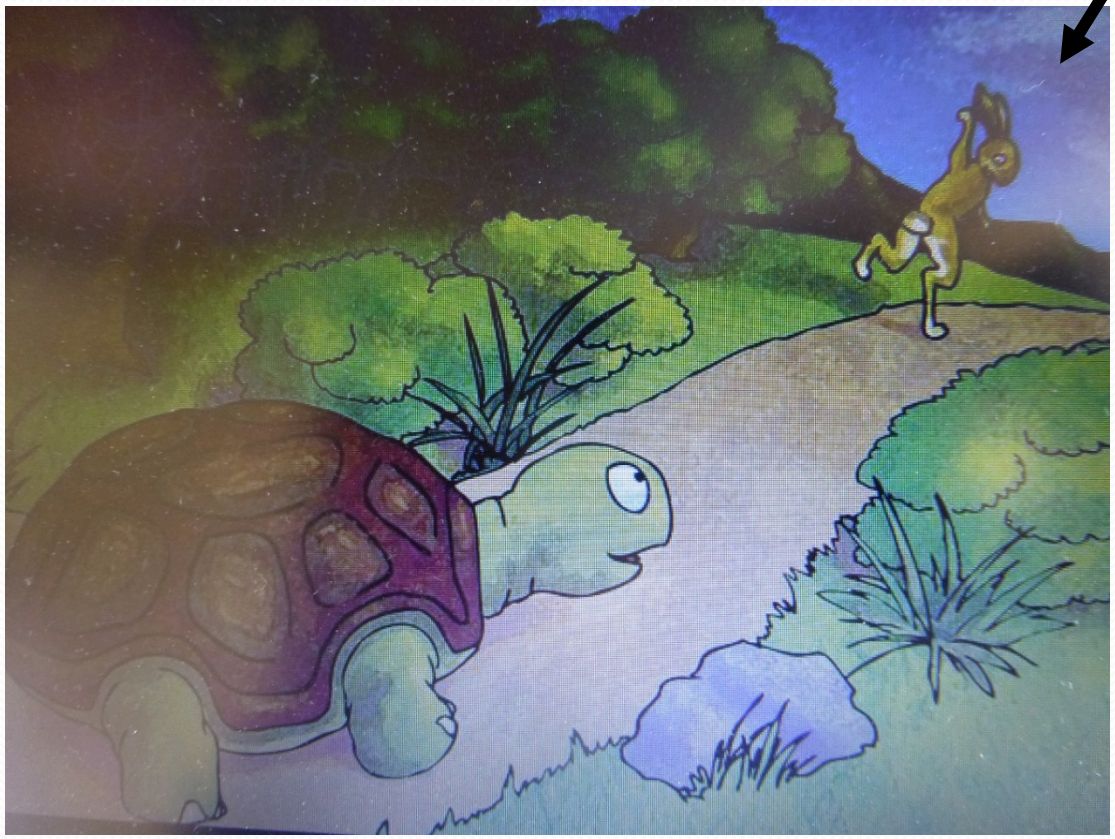
Motivation

- The telecommunications sector in NZ and internationally has changed significantly over the past 3 decades. There is a perspective that regulation of the telecommunications sector is less and less needed because competition between platforms and telecommunications services providers is delivering long-term benefits to end-users of telecommunications services. However, regulation is seen by many as an ongoing feature of the electricity sector.
- But perhaps competition will lead the electricity sector down a similar path to the telecommunications sector? As well as competition between service providers, might emerging technologies such as solar photovoltaics lead to competition between distributed generation and network delivered electricity?
- What was the perspective when competition was being introduced into the telecommunication sector versus now?
- What things should we look for or try to avoid to promote competition in the electricity sector between platforms and between electricity retailers?

Motivation

- **Who will win the race to competition and deregulation?**

Telecommunications



Electricity

Overview

- Criteria for the desirability of regulation
- Competition and deregulation in the telecommunications sector
- Competition and the potential for deregulation in the electricity sector
- Lessons from telecommunications liberalization and deregulation for the electricity sector
- Conclusions

Criteria for the desirability of regulation

- Today the scope for regulation and deregulation differs considerably between electricity and telecommunications:
  - Example EU: Telecommunications framework is based on steps towards deregulation, while electricity framework is not.
- In judging the prospective chances of electricity deregulation we have to establish, under what conditions deregulation may be in order and whether those conditions are likely to apply now or in the future.
- The measuring rod is whether competition policy can effectively replace regulation.

Properties of regulation relative to competition policy

Properties of regulation	Advantages	Drawbacks
• Ex ante remedies	• Immediacy, precision, dependability, prevention	• Reduction of freedom to compete, too much intervention
• Specialized agency	• Specialized knowledge, speed of intervention	• Influence of interest groups, (too little or) too much intervention

• Prescriptive intervention (affirmative duties)
  • Pricing
  • Quality
	• Strong influence on desired behavior, precision	• Reduction of freedom to compete, inefficient prescriptions because of asymmetric information; too much intervention

Inappropriateness of general competition law

Property of competition law	Competition law inappropriate if....	Relevant for...
•Requirement to show violation	•Large, irreparable damages *(compensated by large penalties?)* •Difficult to prove abuses •Frequent and repeated abuses	•Access to monopolistic bottlenecks •Predation against competitors
•Inability to set prices	•Lack of comparable markets •Economies of scale and scope •Long duration of intervention in a changing environment	•Access to monopolistic bottlenecks •Market dominance in access market •Monopoly in end-user market
•Inability of supervision	•Considerable information requirements •Continuous supervision requirements	•Access requirements •Price regulation
•Inability to deal with externalities	•Externalities unrelated to competition	•Interconnection •Environmental issues

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Forces driving telecommunications policy

- **Why was there regulation in the first place? → Economic rationales for telecommunications policy**
  - Economies of scale and scope (along with sunk costs) → market power related policies (asymmetric regulation)
    - Policy of enabling of competition via wholesale regulation of access to incumbents' "essential facilities" or "bottlenecks": Local access networks
  - Network effects → interconnection and universal service policies (symmetric regulation).

Forces driving telecommunications policy

- **Three original sources of telecommunications competition in the U.S.**
  - Microwave radio as a competing technology for long-distance transmission of telecommunications → long-distance entry feasible
  - Cross-subsidies of local by long-distance services → long-distance entry pressure, delay of local competition
  - AT&T had standardized everything about its network and equipment so that no other technologies would be compatible. AT&T's rigid technology for customer premises equipment (CPE) coupled with AT&T's insistence on CPE monopoly based on "network integrity" argument → Pressure for product differentiation entry.

Competition and deregulation in telecommunications

- Telecommunications has not seen a unified move towards competition and deregulation across service categories. Rather, it was a drawn-out and complicated process. There have been distinct developments for
  - Wholesale vs. retail
    - Almost complete success in retail competition/deregulation
      - because of parallel/competing infrastructures
        - Examples: parallel long-distance networks, cable against fixed networks (U.S.), mobile networks (worldwide)
      - because of wholesale regulation
  - Wholesale competition along the supply chain
    - Ladder of investment, starting with resale, so far ends with ULL
    - Differences between networks only in last segment: Competing core/backbone networks connect to different types of access networks (fibre, coaxial, mobile).

Competition and deregulation in telecommunications

- Successful examples of competition and deregulation:
  - **Long-distance telephony**
    - Starting with microwave, above 890 decision, split up of AT&T: Enough space for multiple efficient networks.
      - → ***Competition as joint result of new technology and cross-subsidization***
    - Separated through AT&T divestiture
    - Excess capacity early on
    - Perception of success exaggerated by access charge reductions → LTBEU

Competition and deregulation in telecommunications

- Successful examples of competition and deregulation:
  - **Customer premises equipment (CPE)**
    - The younger generation today wouldn't even know that it was ever regulated.
    - Starting with hush-a-phone and Carterfone, leading to standardization/ compatibility exemplified by phone jack and ending in separation of CPE and network services under FCC's Computer II decision
    - Competition now in global world markets
  - **Enhanced/information services**
    - Computer II: Separate enhanced services from basic services → No common carrier regulation for information services (value added services, Internet): **May be reversed shortly!**
  - **Mobile (except for termination)**
    - Spectrum auctions → Number of competitors: Enough space for 3-4 efficient networks
    - Issue of fixed-mobile integration

Competition and deregulation in telecommunications

- Success of competition in some areas led to the view that competition would become feasible everywhere and with it deregulation (low hanging fruit fallacy). However, deregulation has often been elusive.
  - Example: Littlechild (1983) thought that his "local tariff reduction scheme" (= RPI-X) would only last for a few years and that therefore the formula would never have to be revisited.
- Largely uncompleted examples of competition and deregulation:
  - **Interconnection and termination?**
    - Network provider or ISP as gatekeeper for access to end-user
    - No equivalence in electricity
  - **Local (ultrafast) broadband access?**
    - Resale, bitstream and ULL have allowed for multi-service competitors.
    - Infrastructure competition from cable and mobile

Competition and deregulation in telecommunications

- **Why do local (ultrafast) broadband access bottlenecks persist?**
  - Duplicating new access networks is too costly (strong natural monopoly property): Cost models by WIK etc. show that duplicate infrastructures could be viable in dense areas but would be costly. However, competition simulation models raise doubts about viability of duplication.
    - Nevertheless in LTBEU?
  - Incumbents have strong economies of scope advantages in moving from legacy networks to UFB networks.
- **Exceptions**
  - Economies of scope with other infrastructures, such as ducts from electricity networks, allow for cheaper duplication.
  - Convergent other infrastructures, e.g., cable TV
  - These exceptions create a path dependence for policy choices (different counter-factuals, see Cave, 2015)

Forces driving telecommunications policy

- **Three developments → end game for telecommunications regulation ?**
  - IP convergence
    - Creates multi-service players (triple play, quadruple play; bundling), net neutrality issue → ambivalent effect on competition
    - Increases the number of players in each market → potentially increases facilities-based competition
  - New fiber access networks (next generation access = NGA)
    - Decreases number of infrastructure-based players → potentially decreases competition
  - Broadband mobile networks (LTE) combined with fixed-mobile substitution (FMS) and fixed-mobile integration (FMI)
    - FMS increases number of infrastructure-based players → potential increase in competition
    - FMI partially compensates the effect of FMS.
  - }→ Infrastructure competition and deregulation likely for the future, but there will be regional variations

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Forces driving electricity policy

- **Economic rationales for electricity policy are not dissimilar to those for telecommunications policy**
  - Economies of scale and scope (along with sunk costs) → market power related policies (asymmetric regulation)
    - Policy of enabling of retail competition via wholesale regulation of access to incumbents' "essential facilities" or "bottlenecks": Transmission and distribution networks
  - However, electricity has less network externality issues. Their place is taken by environmental aspects of electricity conservation and pollution (electricity as the problem and as the solution)
    - These are not originally an integral part of public utility regulation→ Should they be? More central planning?
    - Example: Decoupling of electricity revenues from usage (Brennan, 2010)

Areas for electricity liberalization/deregulation:

Generation ≈ long distance in telecommunications

- Currently potentially competitive in contiguous areas with large populations
- Electricity generation is famous for market power problems even with low market shares due to inelastic (short-run) demand
  - Not enough price response at the retail level
  - Not enough substitution possibilities
  - Solutions:
    - Responsive short-term pricing at retail level → increases demand elasticity
    - Long-term contracts between generation and retailers/loads → increase number of competitive alternatives
- Problem of collusion in auction markets (similar accusation for long-distance telephony by MacAvoy in 1990s)
- Investment/missing money problem → capacity markets? 2-part tariffs? Long-term contracts?
- Potential for competition depends on free transmission capacity.
  - Transmission constraints create 'pockets' of market power. → benefits of excess network capacity

Areas for electricity liberalization/deregulation:

Retail ≈ Resale in telecommunications

- Retail competition widespread worldwide
- Competitive market structure
- → Retail deregulation, provided wholesale regulation is effective
- Main effect of retail competition is on tariff choice and consumer education (similar to telecommunications)
  - Innovative tariffs
  - Tariffs more responsive to wholesale conditions
  - Problem with innovative tariffs (e.g., 2-part tariffs) for low-income customers (Florio, 2013)

Areas for electricity liberalization/deregulation:

Transmission ≈ backbone network in telecommunication?

- **Competition at the edges of geographically distinct networks?**
- **Merchant transmission: Differentiate between**
  - Cooperative approach by all affected parties (Littlechild): Complexity of transmission investment may require the involvement of all affected parties.
  - Open market entry into transmission investment approach (criticized by Joskow/Tirole, 2005)
    - Try to capture congestion rents from differences in locational prices created by capacity constraints
    - Missing money problem → 2-part tariffs?
  - Flexible AC transmission system (FACTS) could control desired power flow from one point to another point on a specific link and thereby would facilitate merchant investment and interconnection between networks.
- **Competition for investment but monopoly for operation (ISO)?**

Areas for electricity liberalization/deregulation:
Distribution ≈ local access in telecommunications?

- **Only competition at the edges:** Competition from independent networks at the local level (Decker, 2015)
- **Yardstick competition for electricity distribution** rather than price caps/cost models in telecoms.
  - → Quasi-competition possible between distribution networks
  - However, benchmarking may lack consistent methodology and data (Filippini).

Areas for electricity liberalization/deregulation:
Distribution ≈ local access in telecommunications?

- **Why are distribution networks stable bottlenecks?**
  - **High cost of duplication and no alternative networks**
    - Cost models or econometrics to prove it?
- **Distributed generation (DG) as future source of competition for distribution networks?**
  - DG can provide more competition in generation and may substitute for transmission and distribution networks → potential competition in those natural monopoly areas.

Electricity policy: Potential effects of distributed generation (DG)

- Because of intermittency DG currently depends on those very networks and complementary generation facilities, with which it is supposed to compete.
  - Is this different for DG that is not intermittent? Mini-gas generators (combined heat and power), micro-hydro?
- DG can only exert competitive pressure on generators and the grid, when it produces, while it is dependent on other generators and the grid, when it does not produce.
  - "Prosumer" supplies electricity into the grid and demands electricity from the net (≈ Internet consumer).
  - Grid can shield itself by refusing to deal with prosumers.
- → Potentially extra regulation needed to accommodate DG

Electricity policy: Potential effects of distributed generation (DG)

- **How does DG increase competition in electricity markets?**
  - Free or easy market entry by end-users ("prosumers")
  - DG reduces market power of generators even at low market share
    - Generator cannot block supply or charge non-competitive price to DG, because DG can enter into long-term contract.
  - Effect on market power of distribution grid more dubious
    - Distribution grid still has monopoly position for back-up of grid services. Hold-up issue; DG currently can only have counter-vailing power if aggregated and if sufficient market share.
    - Similarity to mobile telephone service, which originally was complement of fixed telephone and only became substitute at high market share
    - }→ Regulatory framework needed for DG to exert competitive influence.

Electricity policy: Potential effects of distributed generation (DG)

- **In the future, storage capacity could increase DG's competitive effects on electricity markets.**
  - Cheaper and more potent batteries owned by prosumer
    - Generate excess electricity from solar during the day and use the excess to power the battery that is used, when the sun does not shine.
  - DG owners pool resources to run gas-fired generators or micro-hydro as backup and to build mini-grids
  - Both these strategies would increase the share of DG and make it independent of current grid-based electricity.
  - The main question is how competitive these storage possibilities are or will be in the future.

Electricity policy: Potential effects of smart grids on DG and competition

- Intermittency of DG ("prosumers")
- Vertical separation of generation, transmission, distribution and marketing
- Sophisticated pricing and metering methods

} Complexity

- Complexity could be resolved by ***smart grid***: Intelligent use of grid to coordinate all users connected to it (generators, load centres, end-users, other grids).
- Smart grid raises major organizational and standardization problems

Electricity policy: Potential effects of smart grids on DG and competition

- German industry association (BDI) sees smart grid as "Energy Internet", consisting of physical layer (generation, networks, end-users, prosumers), ICT, and markets
- → new business models with key roles for distribution network operator or operator of metering system.
  - Monopoly function that requires regulatory supervision
  - If moderator function is fulfilled by owner of distribution network → conflict of interest if DG substitutes for distribution net
  - Moderator could be independent system operator (ISO), who "regulates" distribution net
- }→ Issue of competition for distribution net not resolved via smart grid

Electricity policy: Potential effects of smart grids on DG and competition

- Smart grids as basis for smart markets.
  - Experiments conducted in Germany (Müller/Schweinsberg, WIK, 2012).
    - Based on platform approach: Market organized around smart grid (2-sided market with platform as the market organizer/intermediary) to deal with DG, intermittency, smart meters etc.
    - Objectives to achieve economic efficiency, reliability/QoS and environmental goals.
    - Prosumers can participate directly in the markets or use other agents as brokers.
- }→ Again, platform with monopoly function needed

Electricity policy: Potential effects of smart grids on DG and competition

- Smart grids could facilitate otherwise very complicated competition models.
- However, they are likely to introduce new platforms as players with potential monopoly power.
  - These platforms could be independent of networks but could also grow out of increased responsibilities of networks.
  - → Potential new roles for regulation
- The development of smart grids is still open and may lead to a competition between different models.

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Lessons from telecommunications restructuring

- **New technologies as driving forces for competition**
  - Unless there are scope economies between old and new infrastructures (e.g., DSL or DOCSIS 3.0), new technologies threaten incumbents' existing infrastructures, in particular, if they show less economies of scale or are advantageous for particular customer groups.
  - Growing markets and declining costs over time spur competition.
    - Growing markets make space for entrants/reduce effect of economies of scale.
    - Declining costs are often credited to competition even if competition only changes the cost allocation
  - Electricity conservation and fast growth of DG can disturb electricity networks and traditional generation sources. Example: Germany

Lessons from telecommunications restructuring

- **Old inefficiencies as driving forces for competition**
  - Cross subsidies as the very common starting point (also inefficient operation)
    - Inefficient pricing policies are unsustainable against efficient entrants. "Cross-subsidies are the enemy of competition, because competition is the enemy of cross-subsidies". (Lawrence White)
    - → Cherry picking that overcomes switching costs
    - }→ Potential entrants push for liberalization and try to prevent incumbents from being able to react.
    - }→ Allow competition and eliminate distortions
    - **Price distortions in electricity markets?**
- **Asymmetric regulation prevents incumbent responses**
  - → flexibility needed for such responses without abuse (Briglauer/Vogelsang, 2011)

Lessons from telecommunications restructuring

- **Regulatory policies on wholesale services can jump-start competition**
  - Interconnection and open access as keys to competition
  - Resale
  - Splitting up AT&T
- **… but may hinder infrastructure investment**
- **Liberalization/competition leads to at least an interim increase in regulation**
  - Complex regulation of competition
    - → Vertical separation to facilitate regulation? Give up coordination economies?
    - Complexity of regulation increases in the type variety of competition/technologies.
  - Parallel regulation of wholesale and end-user markets
  - Externality regulation may increase: Termination charges, net neutrality

Lessons from telecommunications restructuring

- Regulatory mistakes on the way to competition and deregulation:
  - Wholesale access products that made entrants' investments superfluous and discouraged incumbents' investments
    - Example: UNE-P in the U.S. provided all network services in one.
  - Pricing that stymied investment by incumbents and entrants
    - Example: Exaggerated efficiency standards for cost-based pricing
    - Benchmarking regulation for electricity networks?
- Over optimism: Consensus reforms have winner's curse property
  - U.S. 1996 Telecommunications Act created some nightmares (UNE-P, etc.)
  - 1990s California electricity restructuring was approved unanimously.
  - Attempts to please all interest groups simultaneously

Conclusions

- There is less of an endgame for telecommunications regulation than I would have thought two years ago.
- Regulatory holiday for established electricity networks are out of question as long as there is no alternative electricity sources that generators/users can reliably turn to.
- Predict more complicated rather than less electricity regulation, even with more areas of competition. Takes the form of organizing and running markets (e.g., through ISOs).
  - This type of regulation may eventually subside, as competition becomes more established and the rules of the game become routine.
- DG has to overcome intermittency problem in order to compete with networks.
- Environmental aspects may come to dominate electricity regulation.

Backup 1: Competition and deregulation in telecommunications

- Successful examples of competition and deregulation:
  - Service resale
    - Its initial regulatory basis was provided by the principles of just and reasonable tariffs and nondiscrimination against customer groups, in this case against resellers. → arbitrage function, because regulated prices were not cost based
    - Since AT&T's competitors initially had only partial network coverage, the FCC's original resale order was indispensable for the growth of nationwide competition in the US long-distance sector.
    - A second wave of resale emerged and continues, this time based on excess capacity in the networks.
  - All retail services to end-users
    - Largely due to successful wholesale regulation

Backup 2:
Competition and deregulation in telecommunications

- Remaining telecommunications regulations are largely in wholesale services
  - One-way access issue } Bottleneck-type market power
  - Two-way access } Termination monopoly, network effects
  - Net neutrality
  - Spectrum management } Primarily not market power issues
  - Universal service

Backup 3:
My recent literature review changed my views on the endgame for telecommunications policies.

Policy areas still under regulation	Prior view that deregulation or simple steady-state policy will be efficient	Current view that deregulation or simple steady-state policy will be efficient
One-way wholesale access	Yes	Very dependent on specific conditions
Termination monopoly	Yes	Yes
Net neutrality	Yes	No, light regulation (externality issue)
Spectrum management	Probably yes	No
Universal service	Yes	Yes, except for low-density areas and the poor

- Not specifically covered:
  - International roaming
  - Technical policies [e.g., standardization]
  - Legal policies [e.g., security and privacy]

Backup 4:
Local access: Three main forms of NGA deployment

1. FTTH:
   - Future-proof NGA technology - GPON vs. P2P
2. Cable TV with DOCSIS 3.0:
   - QoS very similar to GPON FTTH, but substantially lower incremental investment required than for GPON
   - → Decisive advantage of DOCSIS 3.0 over GPON in countries with a large cable TV footprint.
   - In New Zealand cable has small/moderate footprint and UFB is installed independent of cable penetration.
3. Mobile broadband (4G, LTE)
   - moves ahead in strides, driven by the incredibly high popularity of mobile apps.

Backup 5:
Local access: Efficient regulation depends on population density and prior infrastructures

- Countries/regions with high cable penetration and/or alternative GPON/P2P providers with or without cooperative investment
  - Fixed-network duopoly for NGA
  - FMS with 4G could turn the NGA duopoly into wider oligopoly.
- Countries/regions with only the incumbent GPON/P2P provider
  - Only infrastructure competition comes from 4G.
- Rural regions without land-based NGA
  - Only 4G will exist as a competitive force for ultra-fast broadband.
- } → implicit or explicit geographical differentiation of one-way access regulation necessary in the future.

Backup 6:
Local access: Efficient policies

	Current stage: NGA penetration begins	Future stage: Wide NGA penetration
High density areas with cable or other NGA competitor	Deregulation possible if cooperative investment or no market dominance; otherwise ULL/bitstream for copper and non-discriminatory access (retail minus) for NGA	Deregulation for sure only if **no market dominance**; wholesale access to copper if run parallel to NGA
High density areas without other NGA competitor	ULL, bitstream access for copper; potentially non-discriminatory access (retail minus) for NGA, as long as competitive pressure from copper	Deregulation only if **independent 4G with sufficient capacity** available; otherwise ULL/virtual access regulation for NGA (end of regulatory holiday); wholesale access to copper if run parallel
Low density areas	Bitstream access	Potential deregulation, once **independent 4G is widely available by more than one operator**; otherwise wholesale access to copper

Backup 7:
Electricity policy: Potential effects of storage and switching

- **Storage can make electricity look more like commodities.**
  - Increases flexibility and allows for compensation of intermittencies.
  - Can substitute for grid capacity (distribution mostly)
  - Examples: Cold stores, electric car batteries work both ways. Mechanical, chemical and electric storage options
- **Switching could make electricity transmission grids look more like long-distance telecommunications or gas networks.**
  - Would facilitate merchant investment and interconnection between networks
  - Flexible AC transmission system (FACTS) could control desired power flow from one point to another point on a specific link.

Backup 8:
Will DG make electricity markets more competitive?

- **DG is attractive because it is largely based on renewables**
  - Governments like to subsidize renewables, because they tend to be clean and they save natural resources (fuels).
- However, most renewables have two properties in common
  - Zero marginal cost of generation, once the capacity is built (exception: Biofuels)
  - Intermittency in supply (possible exception: Hydro)
- These two properties complicate regulation
  - Renewables need non-renewable (or hydro) or storage backup when not available: Extra generation/storage and network capacities needed
  - Renewables with zero marginal costs should always run when available
  - } → Increase in market volatility
- → Potentially extra regulation needed to accommodate DG based on renewables

Backup 9:
Electricity policy: Potential effects of distributed generation (DG)

- Virtual power stations through aggregation of decentralized units
  - Advantage: smoothing of problems of intermittency
  - Disadvantage: Individual supplier may lose specific advantages in times of scarcity.
  - Tradeoff between reduction in volatility via aggregation and the advantages of decentralization via market interactions
  - Solution could lie in smart markets.

Backup 10: Electricity transmission regulation and investment

- Investment vs. usage: Vogelsang, JRE 2001
  - Investment by transmission company
  - Independent system operator (ISO) calculates congestions prices.
  - Explicit use of two-part tariffs in wholesale price caps in order to induce balanced network expansion and network utilization

Backup 11:
Two Part Tariff for Investment and Capacity Utilization

Vogelsang (2001) proposes the following approach:

1. The transmission company (Transco) should be allowed to price in a way that capacity is best utilized

2. The Transco should raise enough money to invest

$$\frac{p^t q^w + F^t N^w}{p^{t-1} q^w + F^{t-1} N^w} \leq 1 + i - X$$

p	**transmission price**	***q***	**transmission output**
F	**fixed fee**	***N***	**number of consumers**
i	**interest rate**	***X***	**regulatory X-factor**

Backup 12:
Electricity policy: Potential effects of smart grids

- Tension between regulation and innovation?
  - Two arguments for deregulation of or regulatory holidays for innovative infrastructure:
    - Patent argument: You get more innovation, and that is more valuable than the potential deadweight loss from monopoly pricing.
    - Error argument: Regulation of innovative infrastructure is inherently more complicated than regulation of legacy infrastructure. Also, potential benefits from innovation are much higher than benefits from regulation. The error from false and distorting regulation is therefore more likely and more severe than in the case of legacy infrastructure.
  - Extra return granted for certain types of investment? How to categorize and monitor? (Müller/Neumann)

Backup 13: Lessons from telecommunications restructuring

- Keys to success of competition and deregulation:
  - Economies of scale not too large relative to market size
    - New technologies with less economies of scale
    - Growth of market size
  - Lack of strong vertical economies allows for separation of potentially competitive production stages
    - Requires successful wholesale regulation
  - Development of sufficiently simple and manageable wholesale products
  - Externalities can be dealt with separately
    - Interconnection requirements
    - Environmental regulation