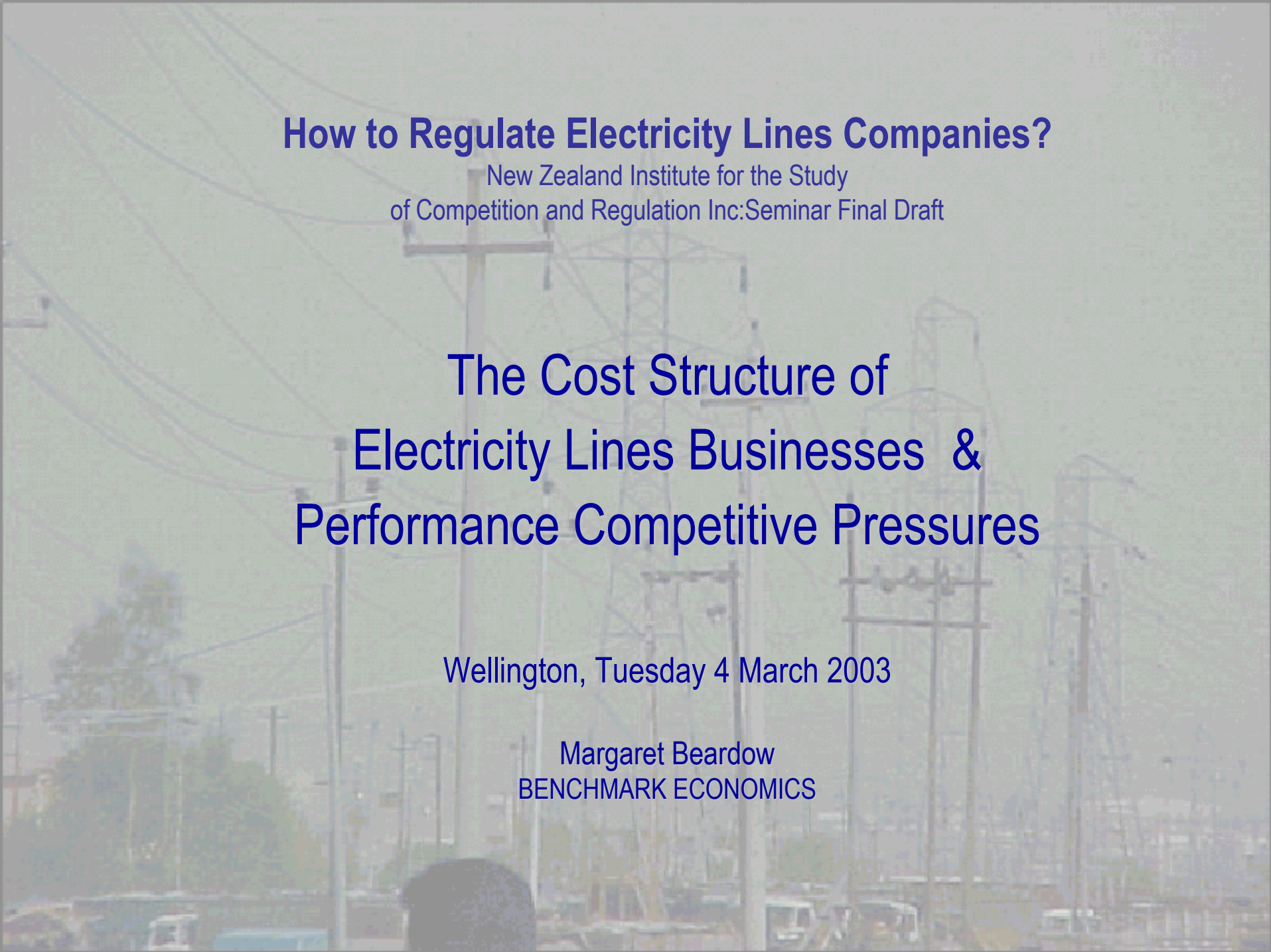


How to Regulate Electricity Lines Companies?

New Zealand Institute for the Study
of Competition and Regulation Inc:Seminar Final Draft

The Cost Structure of Electricity Lines Businesses & Performance Competitive Pressures

Wellington, Tuesday 4 March 2003

Margaret Beardow
BENCHMARK ECONOMICS


Who
Why
What
Whereto

Who

Margaret Beardow & Larry Kaufmann

Electricity Distribution Network Cost Cost Structures

A project for the National Electricity Distributors Forum

A fundamental review of the economic analysis of cost structures for electricity networks

Margaret Beardow & Leith Elder*

Eldow Engineering-Economics Model for electricity distribution Networks

Planning model for distribution networks with simultaneous costing in terms of regulatory framework

* Engineer, Country Energy

Why

- Reform?
- Incentive regulation?
- Efficiency thresholds?
- The great debate?

Economic growth	Through lower energy prices
Deregulation:	Competitive wholesale and retail markets Regulated monopoly networks
Regulation:	Incentive based pricing to promote efficiency, *not* discredited rate of return
Price path:	CPI-X: building blocks: (WACC/depreciation/opex), thresholds, efficiency targets, service levels
X-factors:	**?** *Hence the great debate*

There is no established theoretical framework for network cost structures

"The value of the asset alone makes it a national treasure, and we really must raise awareness of how valuable it is."

Will it serve tomorrow's customers? No.

We are walking away from maintaining the system because there is a very low return on investment for anyone to upgrade the distribution business"

……EPRI Report 2003

Appropriate investment levels require:

1. **Regulation**: that meets OECD standards for efficient regulation ie *outcomes* not *inputs based*

2. **Price path:** that develops X-factor/threshold criteria based on understanding of network cost structures

3. **Price/service:** that links level of service to agreed price

1. Efficient regulation and the OECD: *PUMA**

OECD principles and guidelines for efficient regulation:

- is government action justified?
- Is regulation best form of government action?
- focus on **outcomes not inputs**
- devise least cost compliance strategies
- regulatory impact assessment - cost/benefits

*Public Management Service

Why focus on outputs not inputs?

Operating philosophy of Henry Ford: "focus on prices (outcomes) not costs (inputs)"

"Our policy is to reduce the price…we do not bother about the costs.

The new price forces costs down…although one may calculate what a cost is, no one knows what a cost ought to be.

We make more discoveries concerning manufacturing and selling under this forced method than by any method of leisurely investigation"

My Life and Work" Henry Ford, 1923

"If costs aren't controlled what will happen to the consumers?" -

Valid q*uestion by Patrick O'Meara in interview last week*

"To the memory of

my father, who first taught me

about electrical and political power"

Dedication by Edward Kahn, son of Alfred Kahn

pre-eminent US scholar in electricity regulation,

in his book Electric Utility Planning & Regulation

You can privatise/regulate the financial risk

BUT

the political risk always rests with the government

2. Price path: Establishing criteria for X-factors

Cost analysis has failed regulators, customers, and investors- Why?

- No one has investigated the actual *network* production process to establish cost drivers
- Analysis is based on precedent, but this was developed from analysis of generator efficiency in 1950-60s
- Networks – are regulated because of monopoly power based on economies of scale -- yet costs are not compared on basis of scale!

Investigating the production process

"Hopefully, someday functional form choice will grow out of a heuristic/theoretic investigation of the actual production process being modelled"

Neuberg, 1977

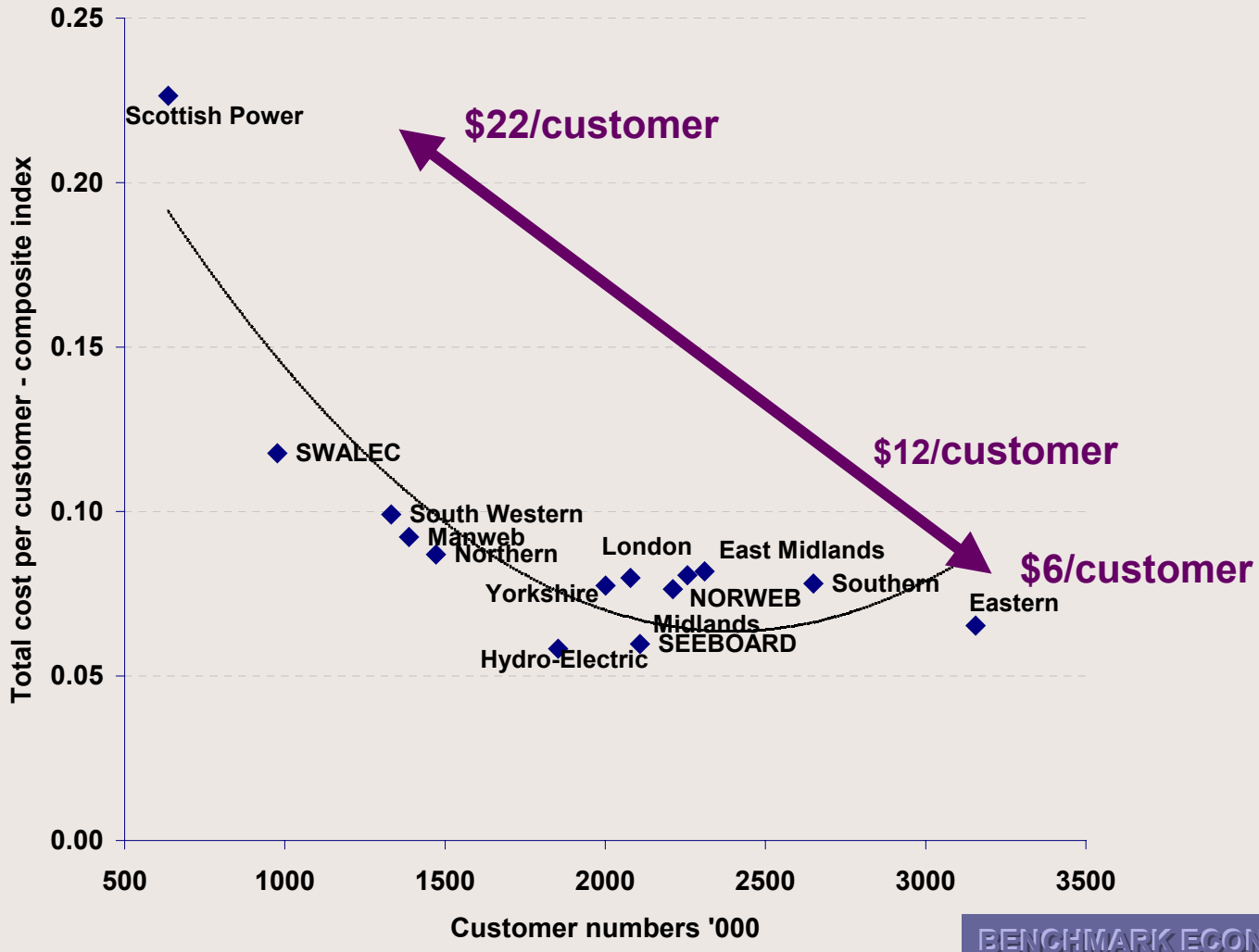
…the reason for the development of the Eldow Engineering-economic model of electricity networks

Precedent based – not fundamental network analysis

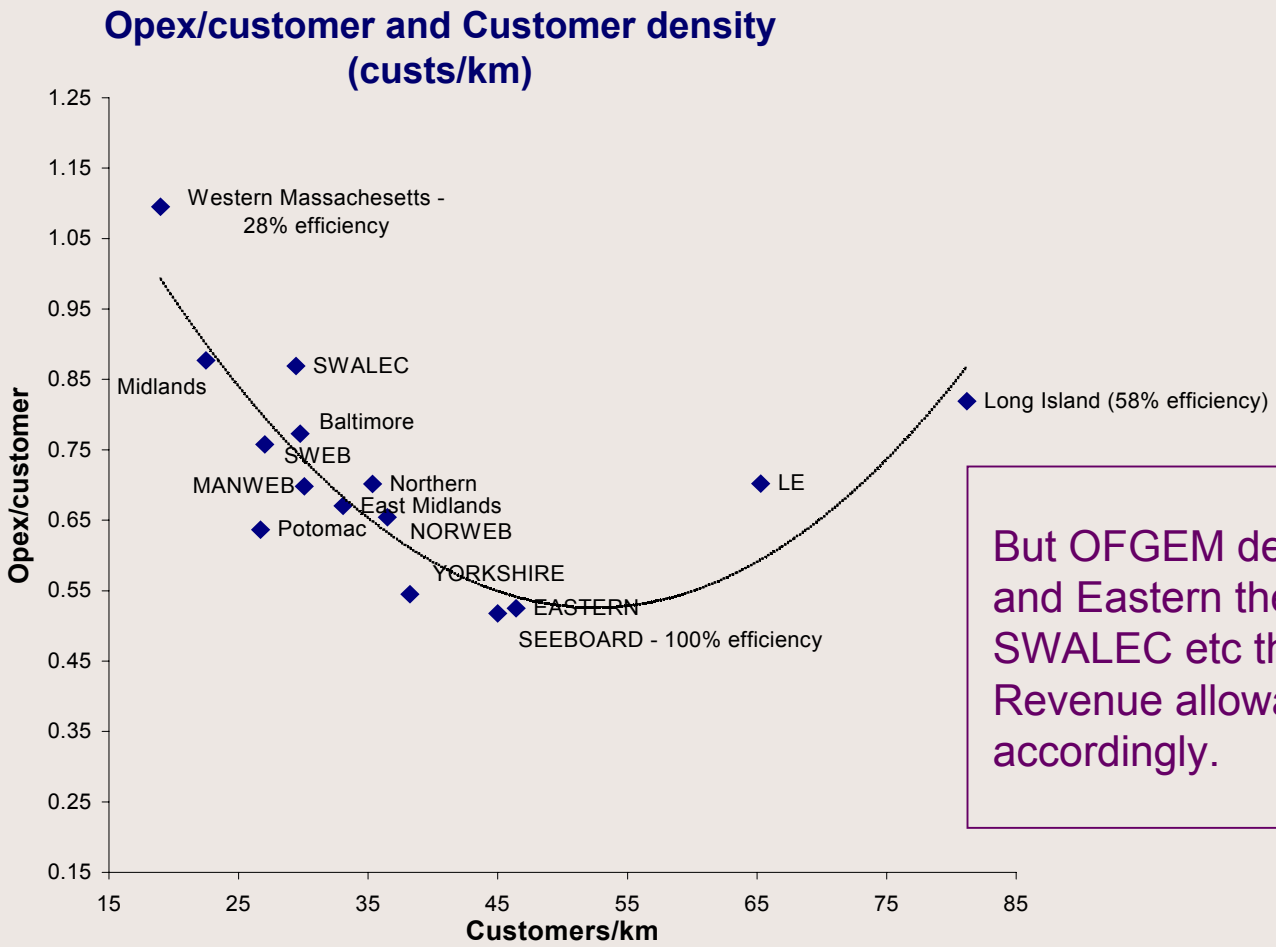
- Network cost models based on analysis of vertically integrated utilities – not standalone **networks;**
  - Inputs: MW generation capacity) **hardly representative of a spatially**
  - Outputs: MWh) **determined industry**
- Unbundling did little to change network cost model specification:
  - In modelling Asian networks in 1993: *"Model 2 with only generation MWh as output variable is the standard model …this is the most natural choice of output variable"……*

    …Hjalmarsson & Forsund
  - By 2002, *"Output is measured by customer connections and kWh"* **…Cronin and Motluk**

BUT - Cost performance can depend on scale



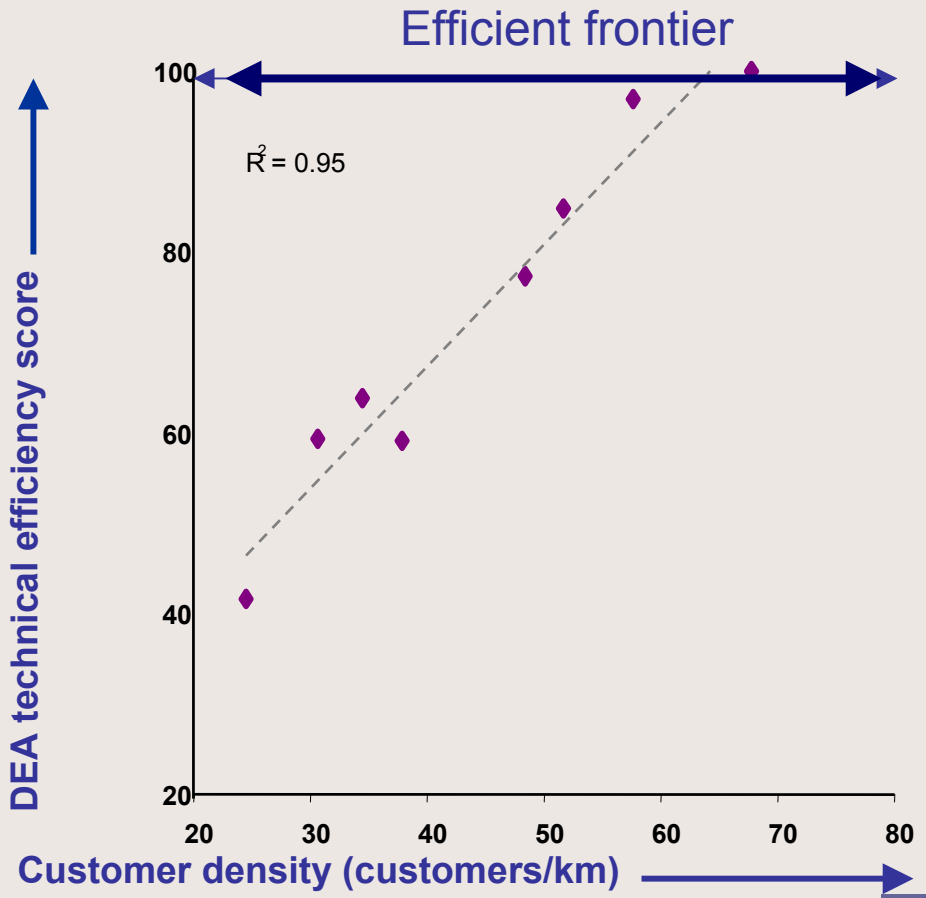
AND Cost performance can depend on customer density



But OFGEM declared SEEBOARD and Eastern the most efficient and SWALEC etc the least efficient. Revenue allowances were adjusted accordingly.

Misunderstanding network production process can give misleading results: DEA analysis NSW gas networks

"Length of main is not significant cost driver"…gas analyst



Model:

Inputs: km
O&M

Outputs: Customer Numbers
GJ

There are vast, but legitimate, differences in costs between electricity lines companies

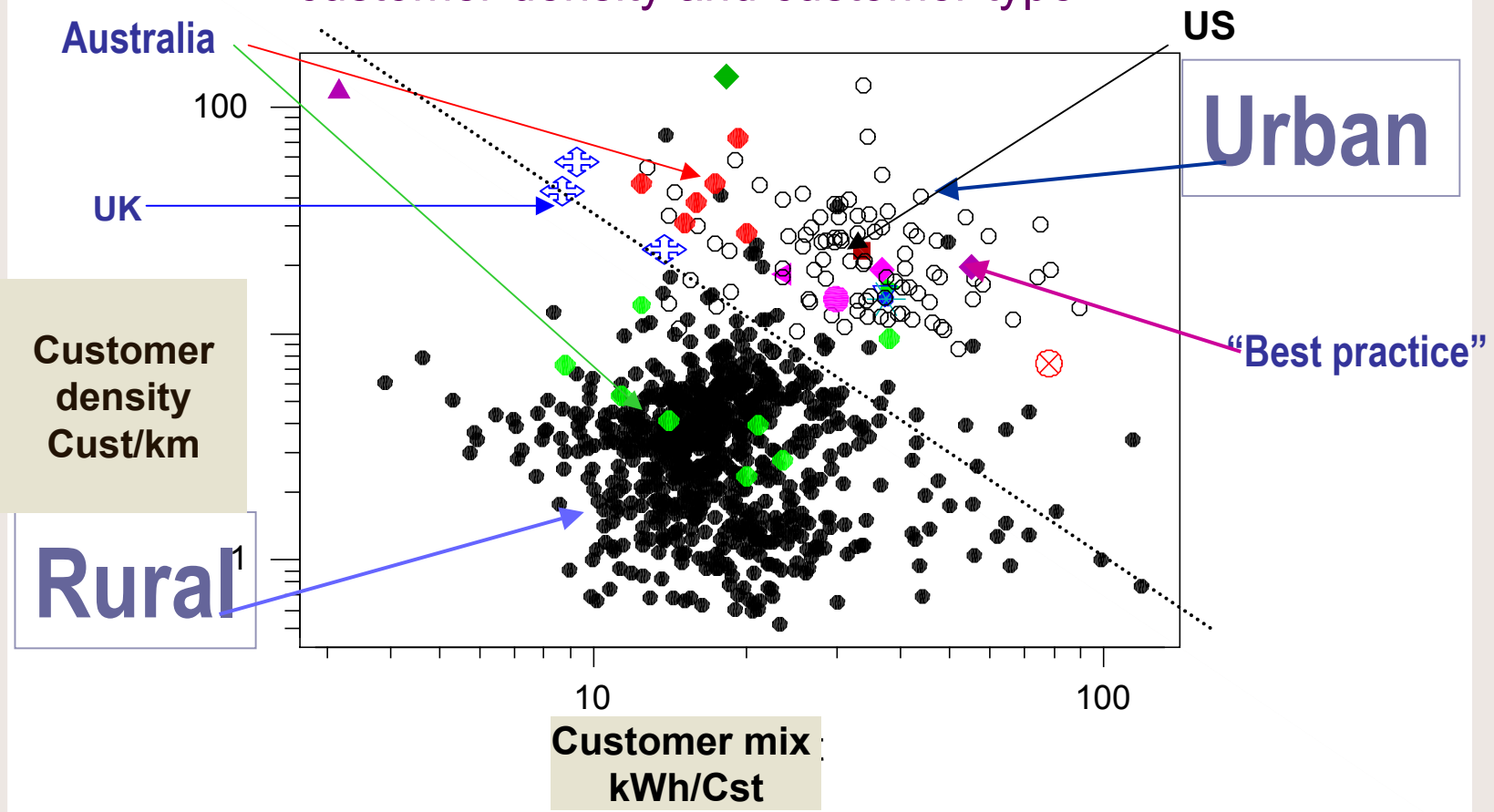
Rankings of operating cost per km from one cost structure analysis

"Worst"
$9,822 / km

"Best"
$888 / km

…Finally, international benchmarking faces substantial variations in operating environments

Comparing Australian, US, UK, lines companies – customer density and customer type



What?

Comparisons are possible but we have to go back to the beginning:

- Develop soundly based network cost structure model by:
  - Investigating network production process to identify the product – at this stage there is no general agreement
  - Proposing economic theoretic framework
  - Identifying major cost drivers
  - Quantifying impact of major cost drivers

What did we do?

1. Investigated and developed economic theoretical underpinnings for cost model structure

2. Examined network production process to identify “product”

3. Having defined the “product” -- identified inputs, outputs

4. Investigated the operating environment to determine any key cost drivers outside control of management *eg business conditions*

5. Examined impact on comparative costs of interrelationship between inputs,outputs, and business conditions

6. Proposed cost structure model for lines companies cost analysis and comparison

1. Economic underpinnings

- Economies of scale
  - ✓ Natural monopoly exists if service can be provided more cheaply by one firm
  - ✓ As scale of network rises the unit **cost** of providing service declines *ie* cost of supplying 1 MW capacity falls as level of capacity rises
- Economies of density
  - ✓ Delivering more capacity/energy per length of network; energy density
  - ✓ Delivering more capacity/energy per customer: customer mix, type, class,

In high fixed cost industries, capacity utilisation is the main lever for driving prices

For electricity lines companies, 70% of total cost relates to fixed capital

Selling more "product" from that fixed capital lowers the price of the product

Ultimately, it is the productivity of capital that determines the price to the consumer

2. The network "product"

- ✓ Provide *connection* between bulk supply point and end user consumer for transport of electricity *ie* similar service to road, rail, canal,
- ✓ Connect *directly* to premises of end users as electricity is consumed on-site
- ✓ Provide sufficient capacity to meet *peak demand* of end use consumers
- ✓ *Reduce voltage* of bulk power supplies to levels used in end-use equipment
- ✓ Provide *continuous supply* as electricity is essential in functioning of modern economy

Lines companies do not produce electricity -- only the means by which it is transported

Lines companies provide capacity (MW) not energy (MWh)

Production cost refers to output -- not its usage

Customers control the usage of the network not the lines company

Therefore, lines companies set the costs and customers determine the price!

A digression: Difference between costs and prices

Purpose of regulation:

Section 57E of subpart 1 of Part 4A:

"…to promote the efficient operation of markets…by ensuring suppliers improve efficiency …and share the benefits of efficiency gains with consumers"

Economic efficiency:

"Output is produced at minimum cost"

….*Collins Dictionary of Economics*

From this we assume that the focus of attention for regulators is the cost of production

Cost is measured by dividing output by cost of inputs: $/km, $/customer connection, etc

Using price $/MWh to measure cost is not only wrong, it provides misleading comparisons:

A MW of capacity can provide 8760 hours of electricity in a year. The cost is "fixed"but price will depend on how many units are transported each year.

Two Australian networks: One transports 650 hours/MW, the other only 434/MW – same costs but different prices – $28/MWh and $37/MWh.

3. & 4. Inputs, outputs & business conditions

In economic theory,

Inputs — Resources purchased for conversion in the production process into outputs

Outputs — Resourced by paid inputs

Business conditions — Constraints affecting cost of providing outputs, *eg:*

- Customer / energy density
- Customer class / mix

Model specification - inputs

- Poles
- Transformers
- Substations
- System control, monitoring
- Maintenance, etc

Measured by values or quantities:

$ total cost, opex, capex, or km, MW, etc

Model specification: outputs

Outputs

- Connectivity/transport
- Connections:
- Capacity:
- Reliability/quality

Measured by:

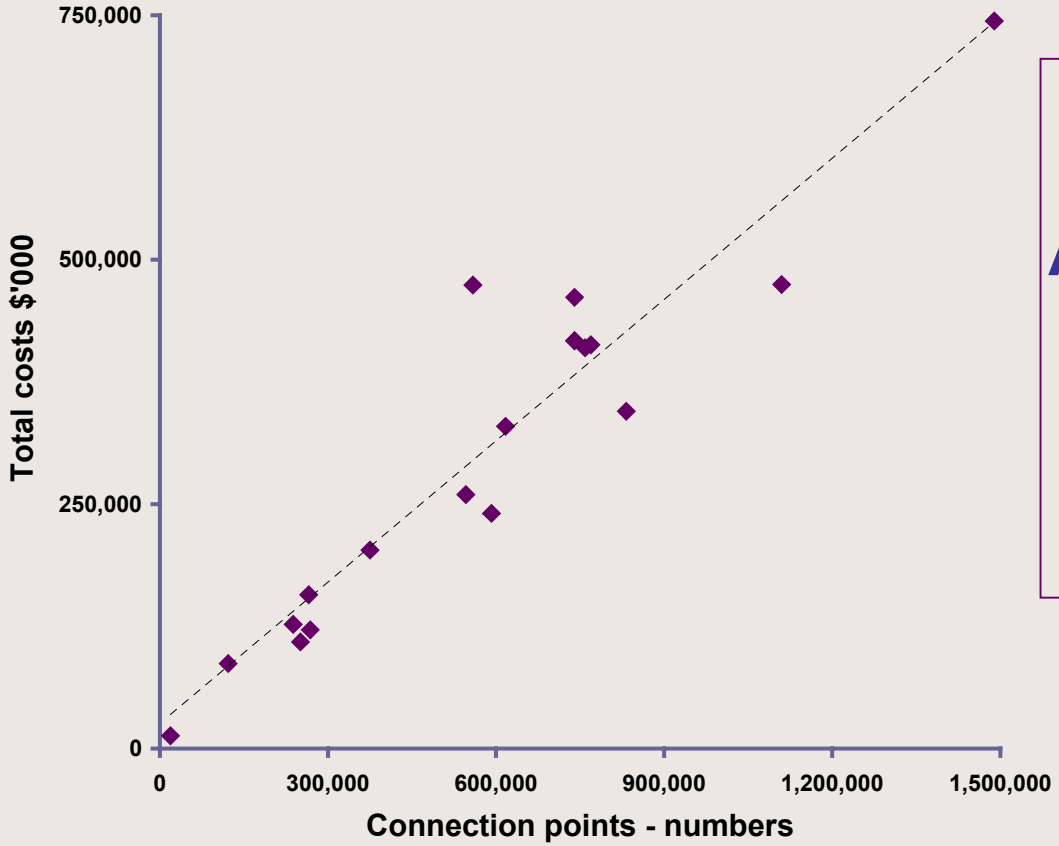
- Line length – km
- Number of end use consumers
- Peak demand – MW
- SAIDI (preliminary)

Business conditions:

- Customer/energy density
- Customer class

- Customers/MW / km
- kWh/Cust and/or MW/cust

5. Examine interrelationship between inputs, outputs, and business conditions

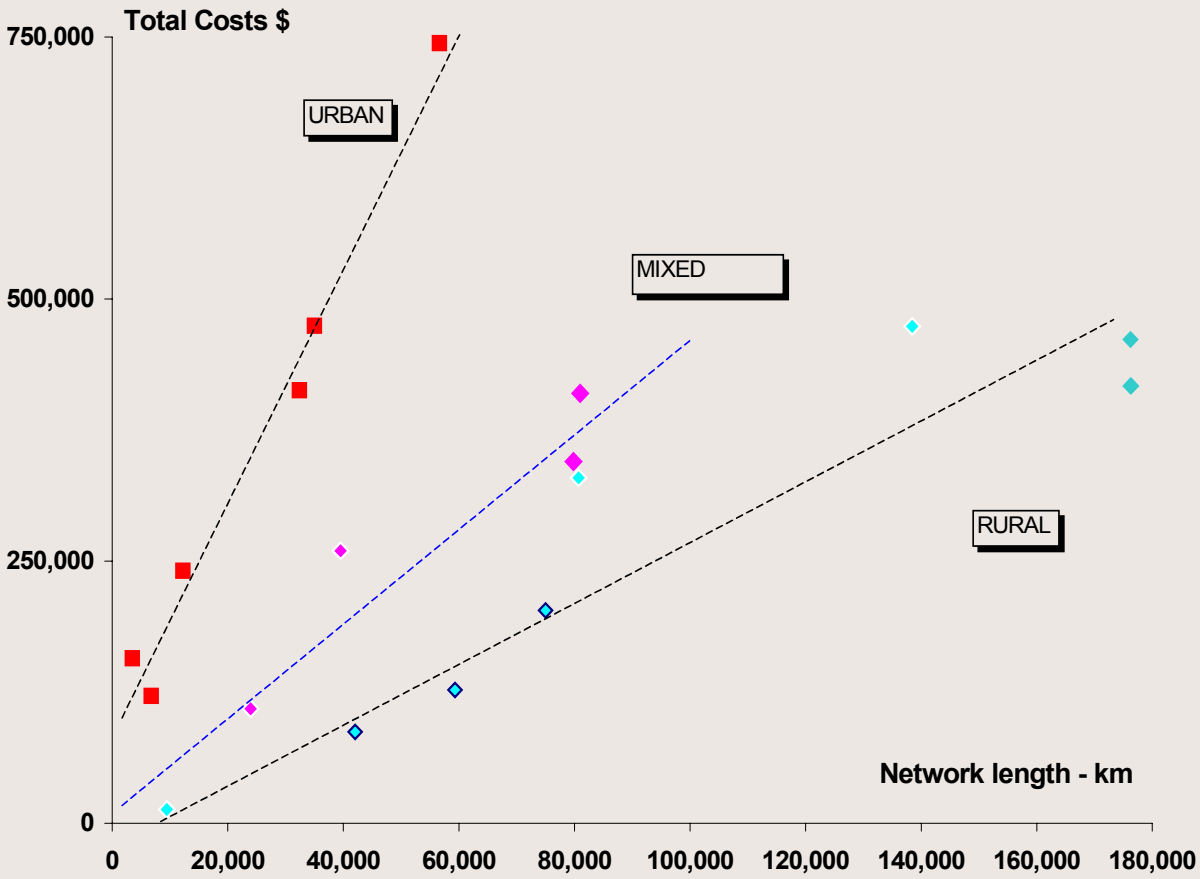


SCALE

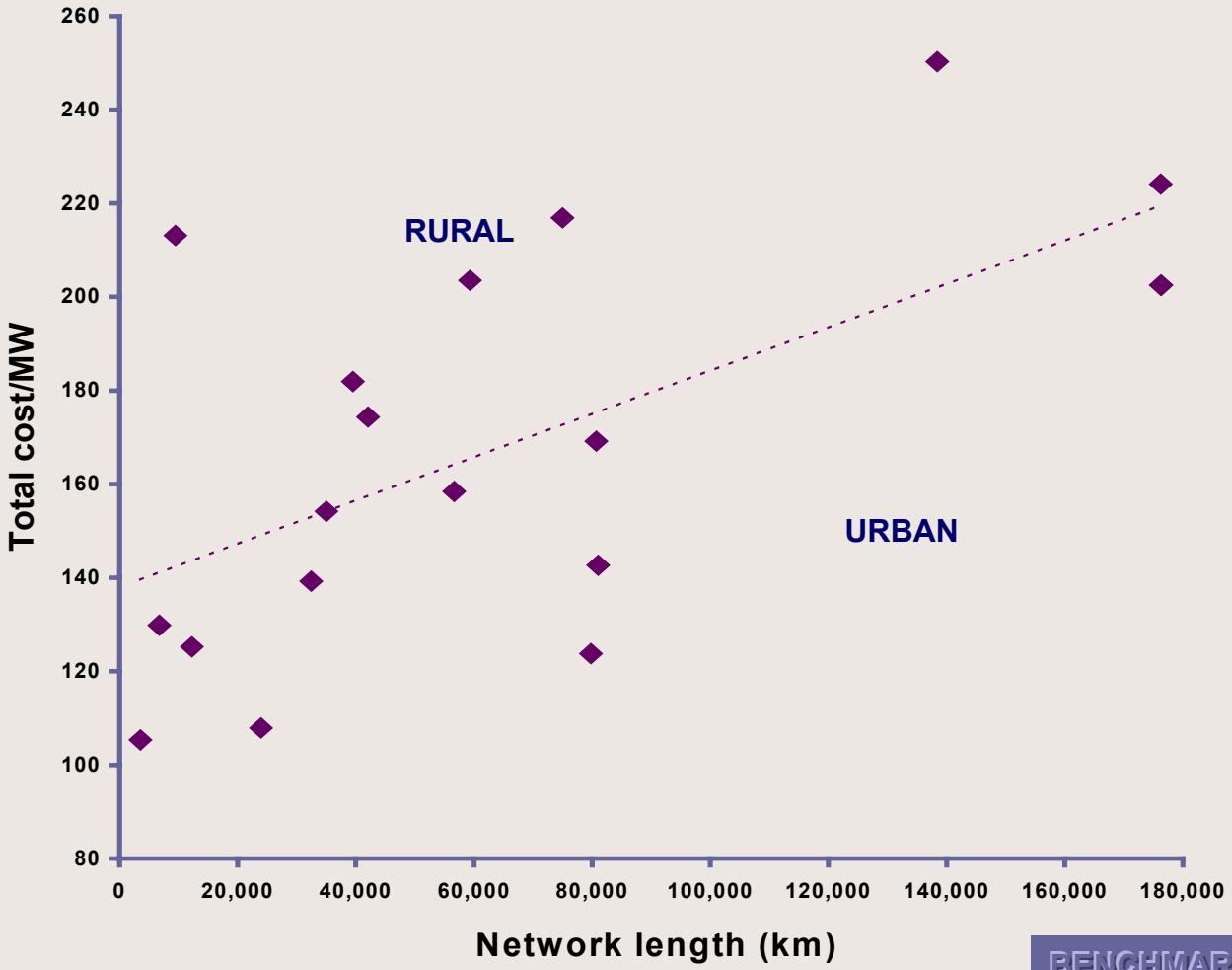
Australian distribution networks

Total costs and customer numbers

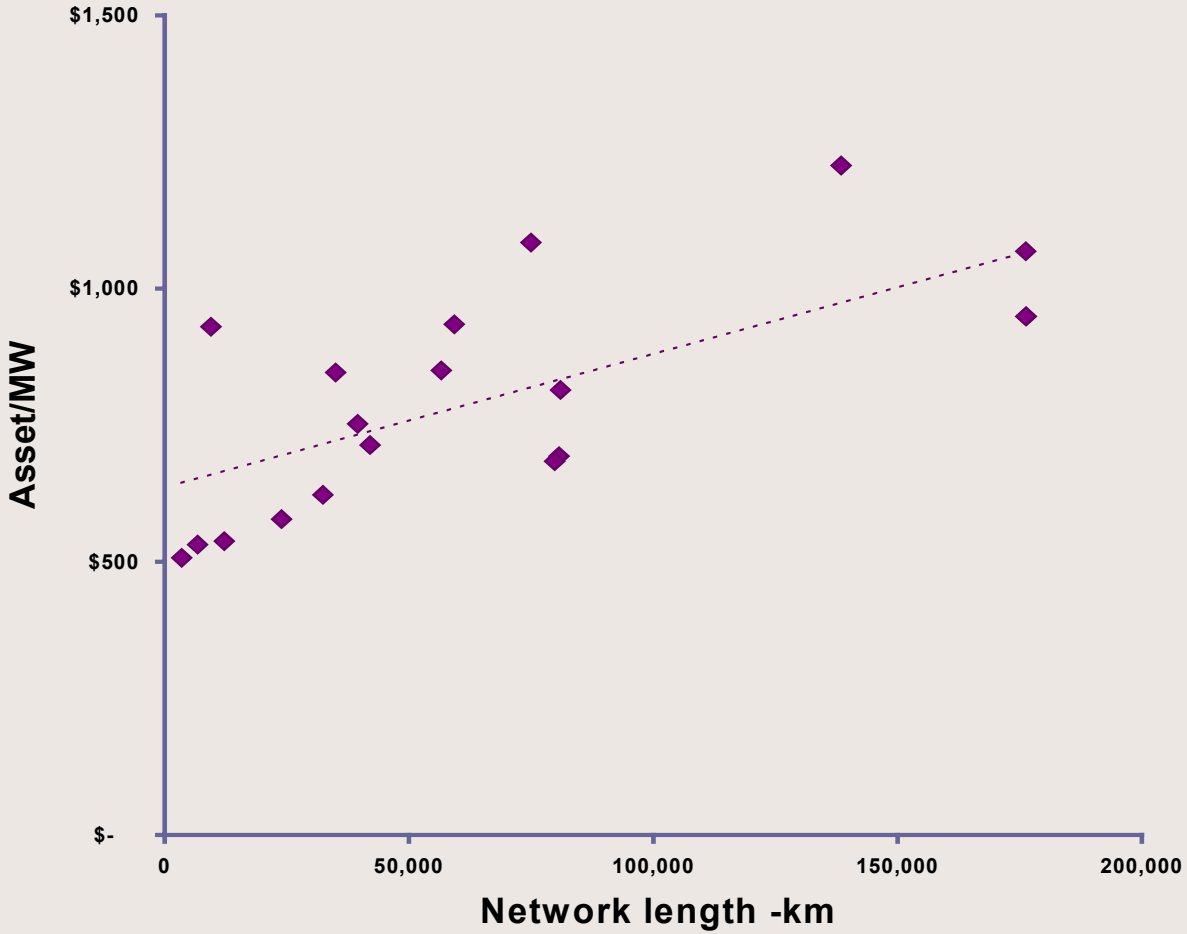
5. Scale: network length defines three groups of networks with different costs



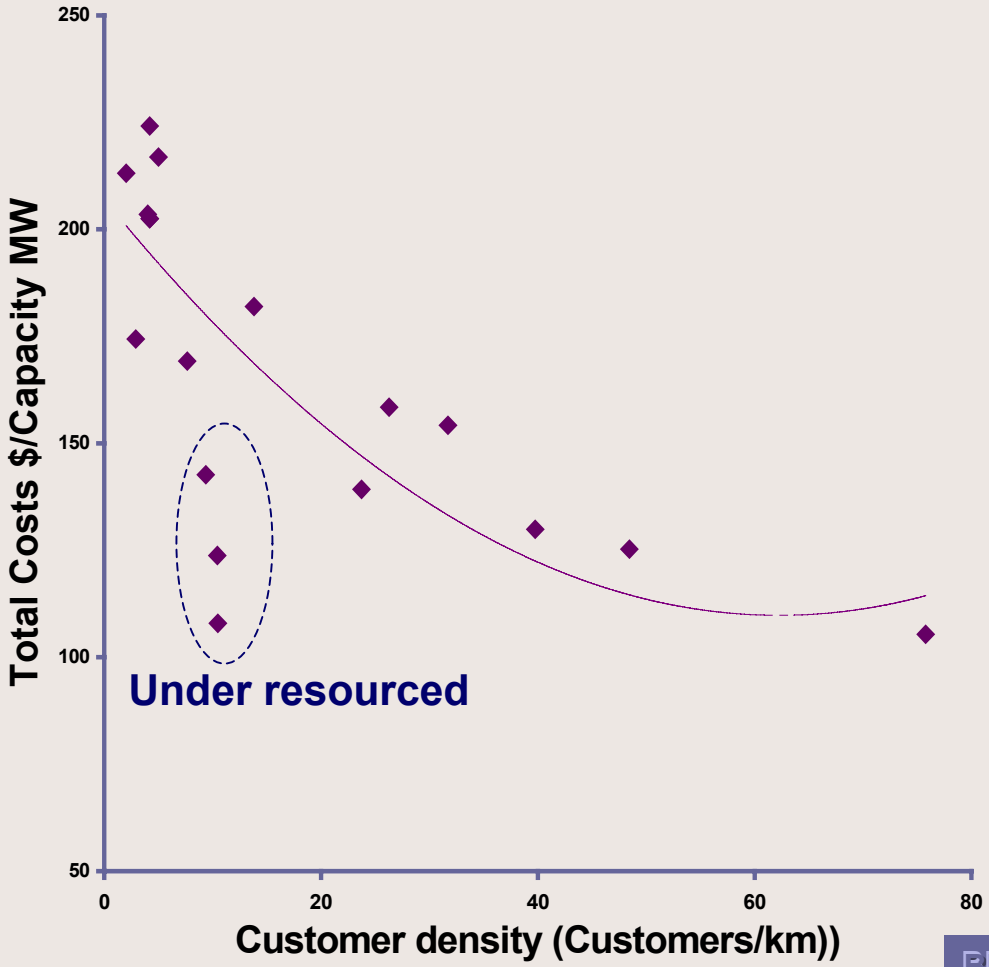
5. Scale and unit costs: Total cost per MW is driven by network length



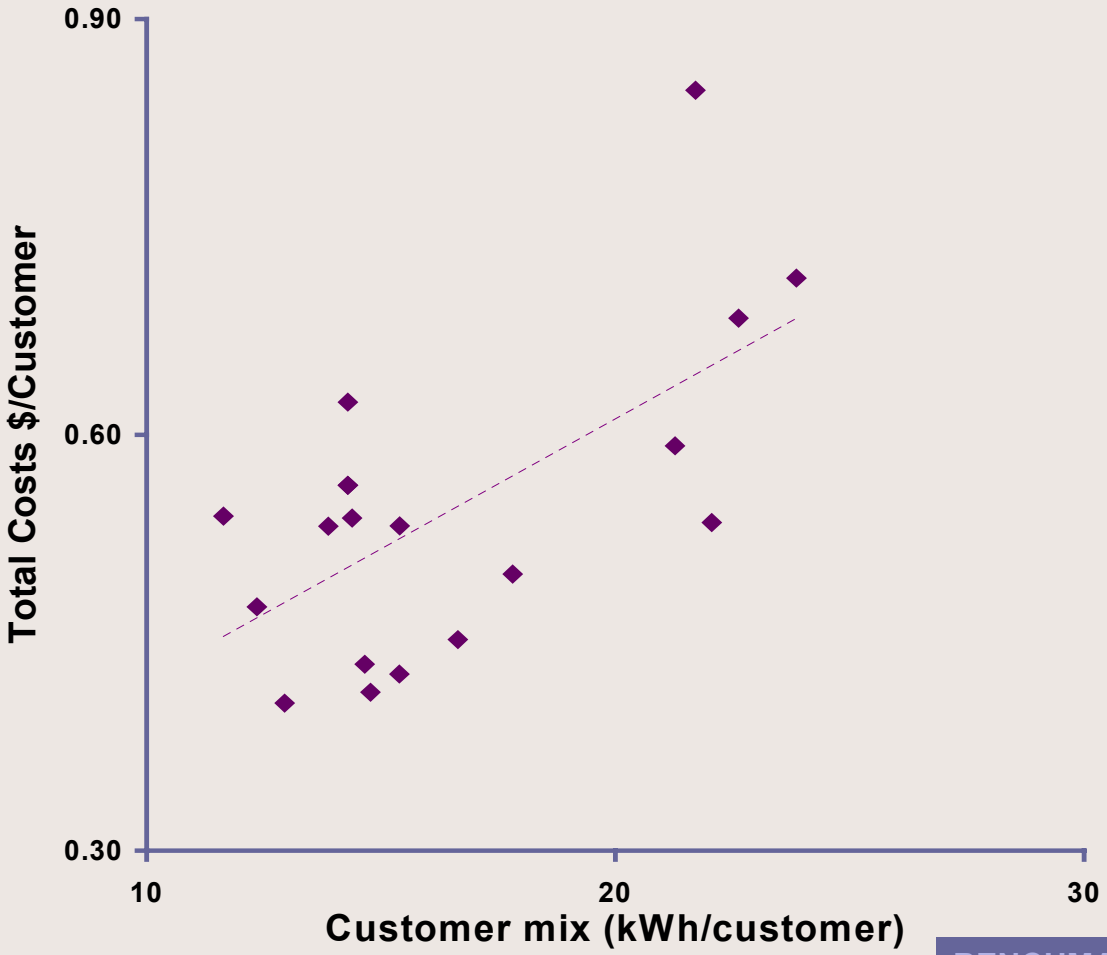
5. Scale and unit costs: Assets drive costs



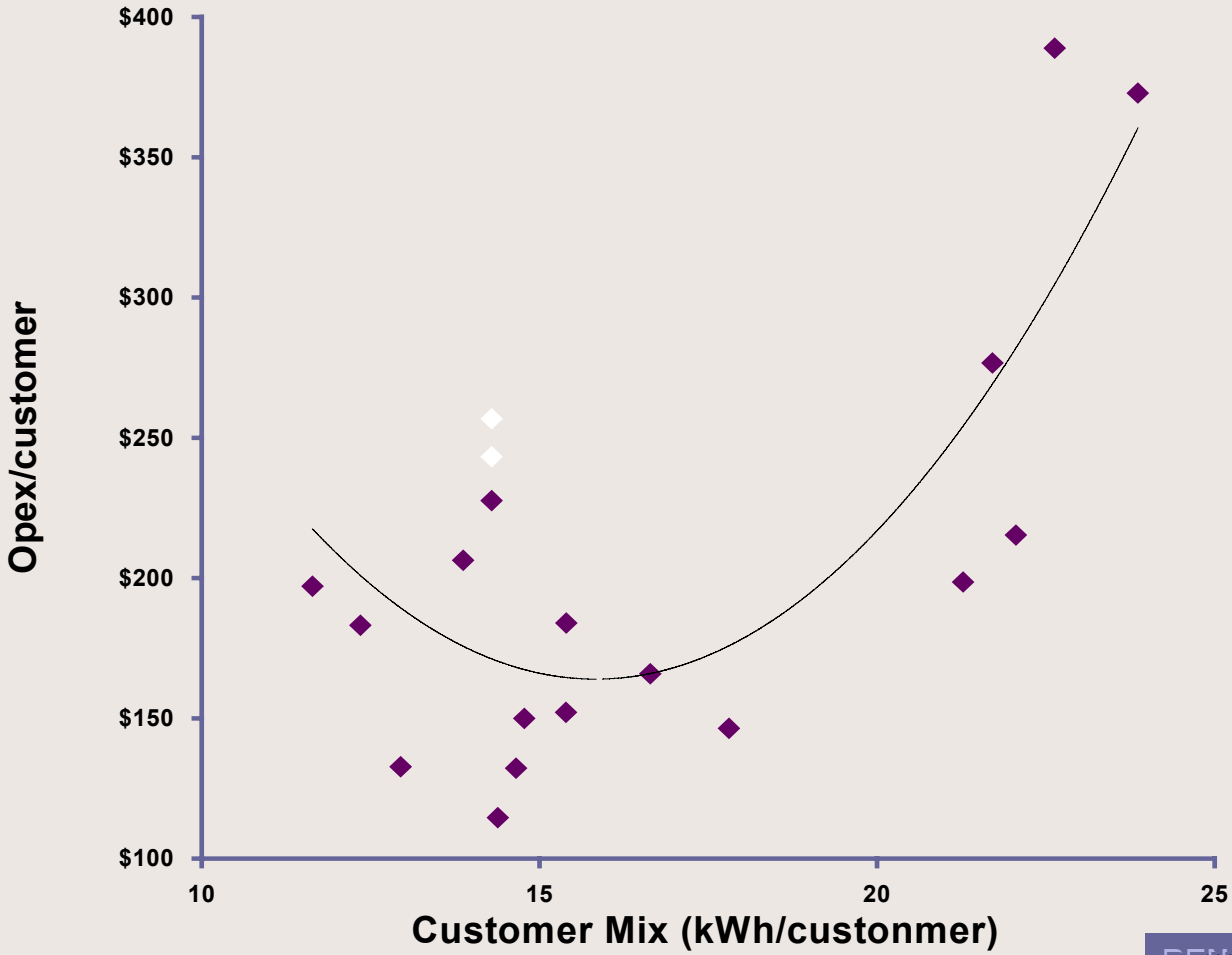
5. Business conditions: Customer density



5. Business conditions: Customer mix: Customer consumption level drives costs



5. Business conditions: Customer consumption level also drives OPEX per customer



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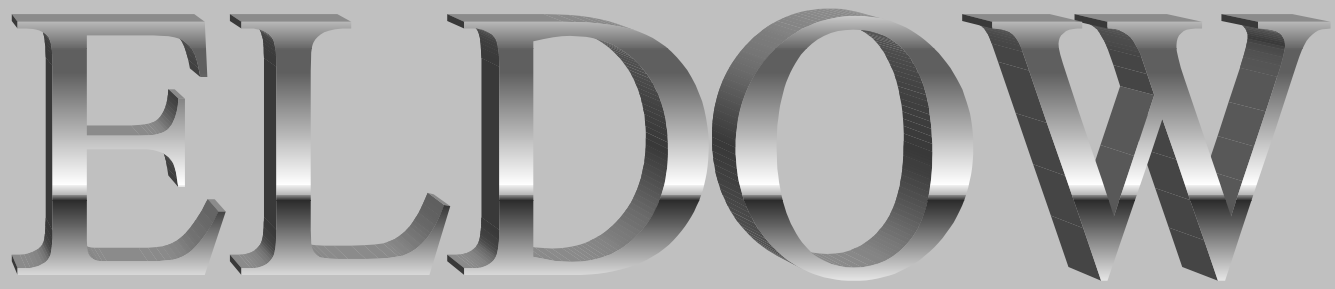
Costs: A technical perspective



ENGINEERING-ECONOMIC
NETWORK SIMULATION MODEL

VERSION 1.59
1 February 2003

Whereto

- Open the door for competition
- Establish fact based X-factor/threshold criteria

An open door for competition

- Conventional view of networks as monopolies has obscured opportunities for competition:
  - Retailers/large customers – should be able to negotiate price/service arrangements
  - Distributed generation – compete for specific customers, or develop industrial parts within franchise areas *or* peak load/demand management
  - Too much structure in setting the price path can remove the "ego-element" in wanting to do better than other networks
  - New areas: infill distribution (Melbourne docklands), greenfields – establish the rules in advance.
  - Gas vs electricity – a big issue in some areas
  - Keep an open mind – change is endemic in this industry

Is asset stranding an issue?

- **Now:**
  - Distribution: Little evidence of asset stranding for distribution lines companies in any of the countries under review
  - Transmission: Though little evidence as yet, its nature leaves it more open to competition – from other lines or generation
  - Problems in Australia with mixed regulated/entrepreneurial

- **Future**
  - Both – structural and technological change in industry and in end-use equipment and customer lifestyle leave open the prospect.
  - As DG is embedded within distribution system there is ample scope for lines companies to restructure the way in which energy **demand** is met
  - Flexibility is the key

Fact-based X-factors / thresholds:

- Timing: objective of the reforms is "long term" customer benefit
  - Regulation should have a similar focus
  - 70% of cost is capital with 30-50 year lives --short term gains come may come at expense of maintenance & replacement

- Fact-based criteria can help to avoid mis-reading of comparative efficiency. It can be done but has rarely been tried – incorporate a technical reality check

- Lessons from the UK Constant sales/acquisitions/vertical re-integration suggests that the UK may not have established the "efficient" industry that Ofgem likes to promote – no one sells "a nice little earner"

Thank you