Quality of Supply

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Quality of Supply

Well known set of problems

No complete set of solutions

Current thinking on regulation incomplete

Does not address future systems

- Smart grids
- Micro DSM
- Responsibility

Quality Standards and Regulation

CEER identifies three aspects of Quality of Supply:

- Continuity of supply (availability) *Partially regulated*

  engineering issue, a function of network design, state of maintenance and investment

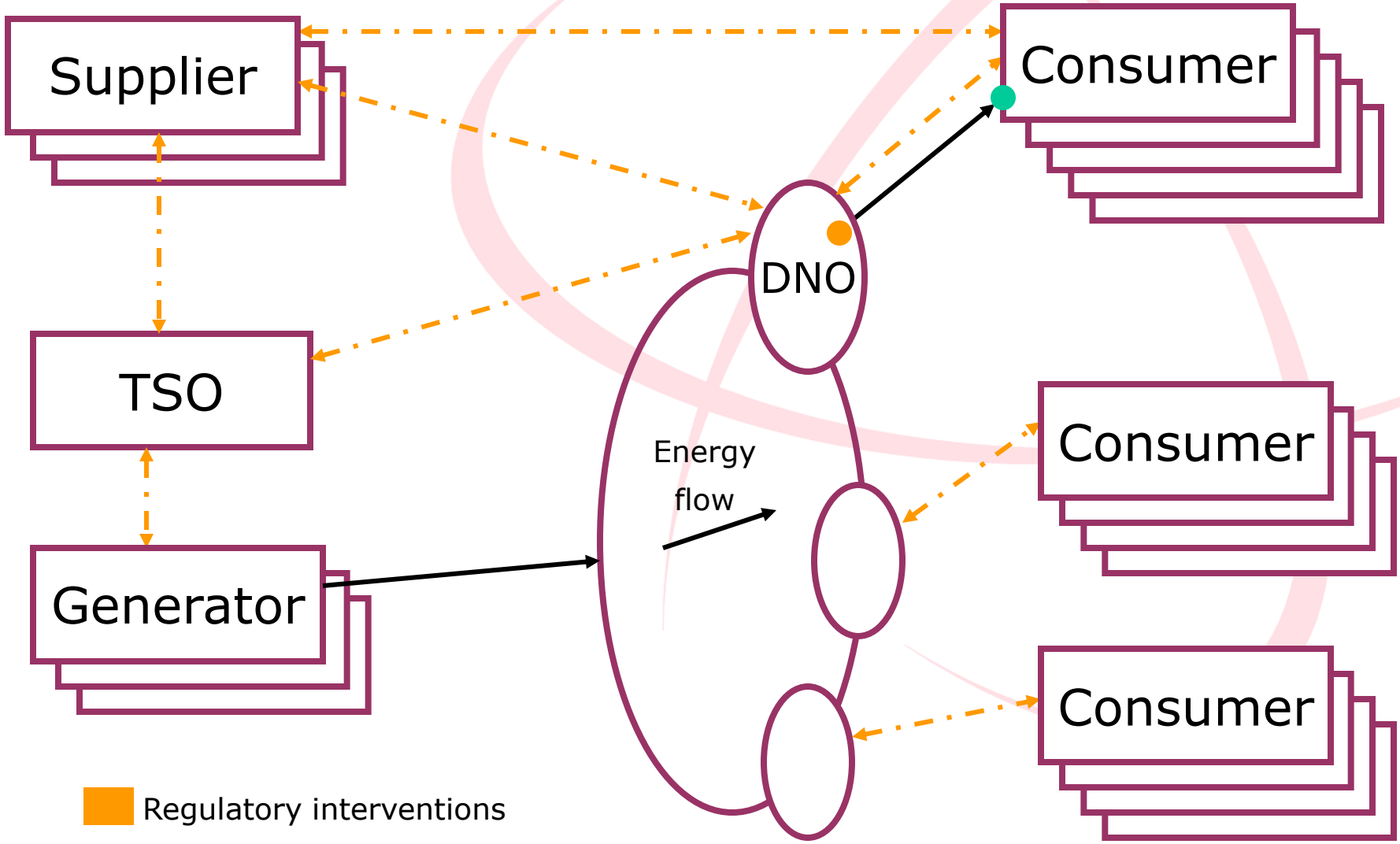
- Voltage Quality *Standardised, not regulated*

  engineering issue, function of network impedance, load distribution and planning

- Commercial Quality *Regulated*

  service response, customer relations, dispute resolution performance, price

The Need for Quality Standards and Regulation



Issues in the current system

For Consumers:

- Electricity is just another raw material
- QOS data relates to availability, but dips are equally or more important to consumers
- Consumers have different dependencies, cost bases and attitudes to investment
- Consumers' losses difficult to assess, even post event - published data tends to emphasise the extreme
- Published data is aggregated and distant. Customer effects are highly localised.

Issues in the current system

For Suppliers:

Ageing of infrastructure, cost of replacement

Change in industrial demographics and geography of energy consumption

Long feedback time to judge effectiveness of actions. The effect of local interventions may not be apparent in the reported data, financial justification is difficult.

Many desirable actions have long financial payback times

Price regulation v. investment

Issues in the current system

For Regulators:

- Interruption duration data is not accurate - especially start time
- Very short interruption and dip data is not generally available
- Relationship between cost/benefit of improvements is far from clear
- Long feedback time for improvement initiatives
- Price regulation v. investment

Current Regulation is incomplete

Limited ‘quality’ indices reflect average interruption performance

- SAIDI - System Average Interruption Duration Index
- (UK: CML - Customer minutes lost)
- SAIFI - System Average Interruption Frequency Index
- (UK: CI - Interruptions per 100 Customers per year)

Information on voltage quality is sparse

- poor harmonisation of measurement approaches
- small number of measurement points
- many investigations complaint driven

CEER suggests building VQ monitoring into smart meters

The optimum supply?

Society requires an adequate supply at a reasonable cost

Ideally, regulation would seek to optimise investment in the 'system' to achieve the greatest benefit for the greatest number of consumers for the least amount of money.

The current quality level has evolved - is it optimum?

The optimum supply?

In practice, sensitive consumers can:

- survey site to determine quality level, consider cost of failure
- take steps to ‘harden’ equipment and processes
- add equipment to prevent or reduce effects of failure

PQ Survey

LPQI European PQ Survey found losses equivalent to €150 billion per annum

- Survey samples drawn from 16 industries which together account for 74% of EU-25 financial output
- 68 face to face interviews in 8 countries

Short Conclusions

- Lack of awareness of need to measure and monitor
- Poor correlation between observed problem and the chosen solution
- Investment in preventative measures is estimated at about €13 m - less than 10% of the cost of PQ losses

PQ Survey Sector Briefs

Sector-specific PQ Survey briefs

- 2 pages, not too technical
- outline of main problems
- scale of costs
- business impact
- contact invitation

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The Future

Current wisdom, according to our Prediction Market, says:

Future reliability of service will improve as electricity becomes dominant energy carrier.

True or false?

Inform and educate

Consumers need information to inform their expectations

- Baseline quality assurance
  - by technical standard, not compensation
- Classification of supplies
  - classification of major PQ parameters against compatibility levels -eg Cobben and van Casteren
- Plan installation and investment accordingly

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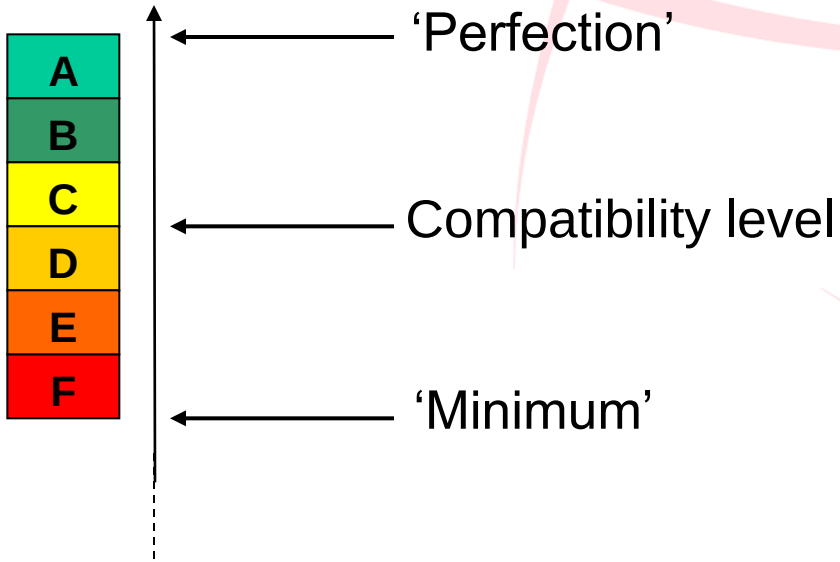

Challenge the assumptions

Equipment, systems and processes will continue to become more sensitive.

True or false?

Equipment can be made more resilient

- electronic equipment with wide input voltage range
  - improved voltage tolerance
  - better dip resilience when used at high end of range
- use of ultracapacitors
  - viable now for consumer products (eg cameras)
  - 'D' cell sized capacitor supports a PC for 10 seconds
- use of 3-phase supplies for control equipment
  - 3-phase dips are relatively rare

Future issues impacting QOS and regulation

Frequency response

- already required for large wind, etc
- non-rotating sources have zero momentum so system frequency slew rate is increased
- supply response must be faster to arrest frequency drop - risk of hunting

Future issues impacting QOS and regulation

Despatchability

- need for rapid-response generation to replace spinning reserve
- more generators to control, greater diversity of operating characteristics
- opportunity for service providers - ‘bundling’ of small generators

Future issues impacting QOS and regulation

Storage

- large scale
  - slow response - rotating generator, electrolyte pumps, etc
  - relatively few in number, easy to manage
- small scale
  - fast response - static converters
  - very large number, distributed ownership, difficult to manage
  - storage elements ‘on loan’ - not always available to system or to owner - non-despatchable
  - need to ‘hand over’ asset in usable condition (charged)
  - owner to be adequately compensate for use (charge/recharge cycles, deep discharges, storage in non-optimum state)

Future issues impacting QOS and regulation

Distributed generation

- CHP often not despatchable (controlled by heat demand)

Renewables

- need to make maximum use of available renewable resources despite intermittent nature - need storage
- variety of response characteristics
- integrated (thermal) storage mandatory for non-despatchable generation? (e.g. CSP in Spain)
- voltage tolerance

Communications and control are critical

- fall-back options
- graceful degradation

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