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Zero energy at the neighbourhood scale: Regulatory challenges regarding billing practices in Norway

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06.11.2019

A power system in transition

- The energy law (1990s):
  - Increased competition among producers
  - Inelastic demand
- Transition towards more active consumers
  - Responds to outside signals
  - Potential for efficiency gains
    - → Reduced peak load
    - → Adapt consumption to renewable generation

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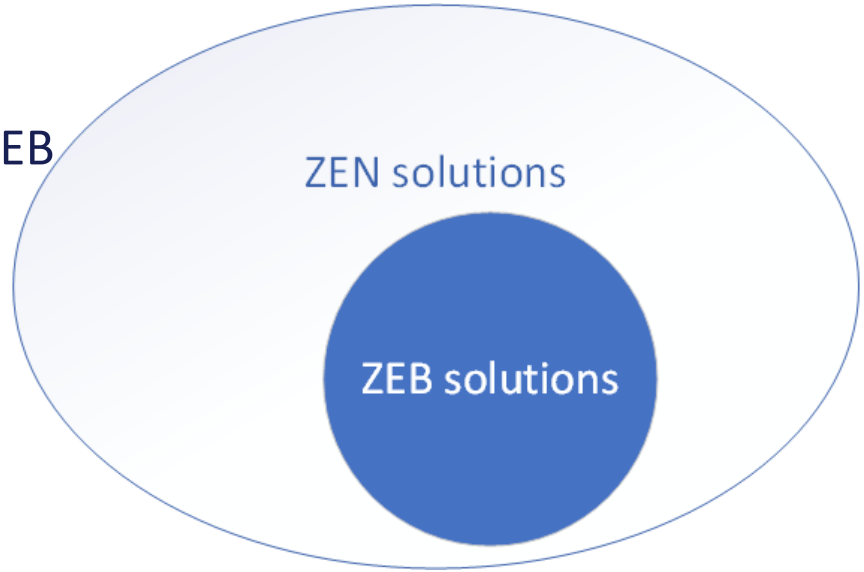
From ZEB to ZEN

- Larger scale → more possibilities
- Regulatory framework fits well with ZEB
    - Behind the meter optimization is incentivized
- What about ZEN?
    - Resources are not necessarily behind the same meter.



Owner structure: An important distinction

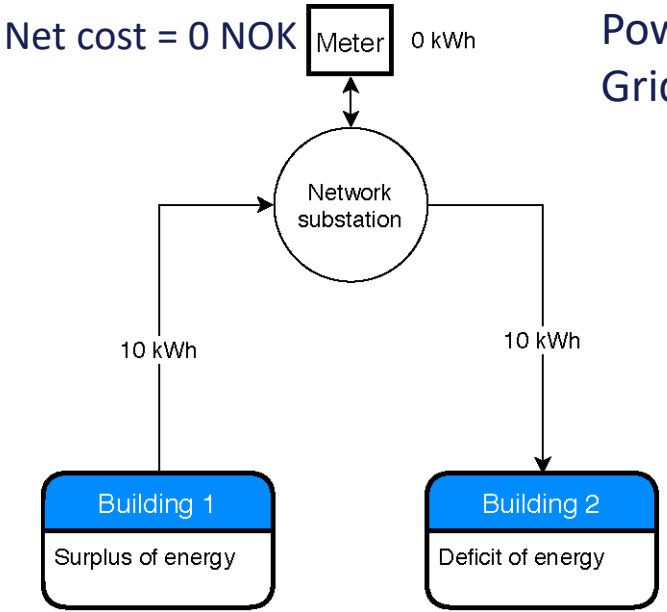
S-ZEN:

- "Single-owned ZEN"
- Several buildings/resources with the same owner
- Examples: Campus Evenstad, Mære Landbruksskole

M-ZEN:

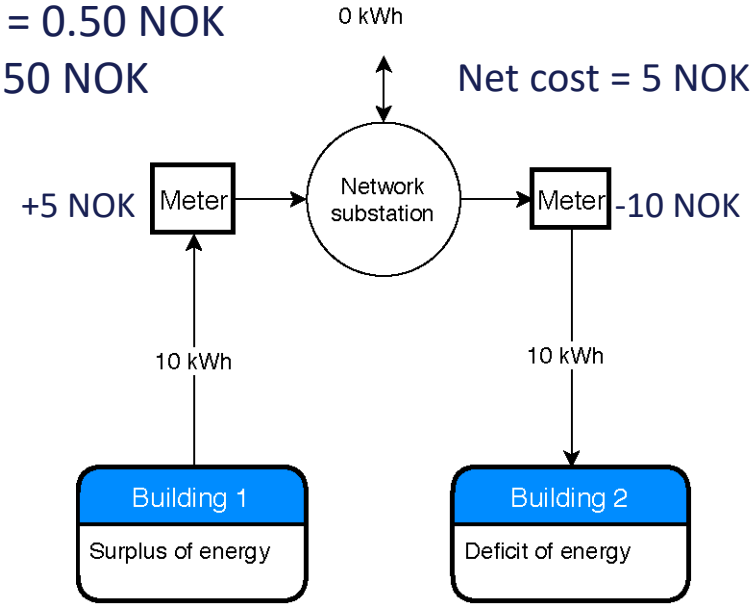
- "ZEN with multiple owners"
- Several buildings/resources and several owners involved.
- Examples: Ydalir and most others.

Balancing energy between buildings



S-ZEN

Power price = 0.50 NOK
Grid fee = 0.50 NOK



M-ZEN

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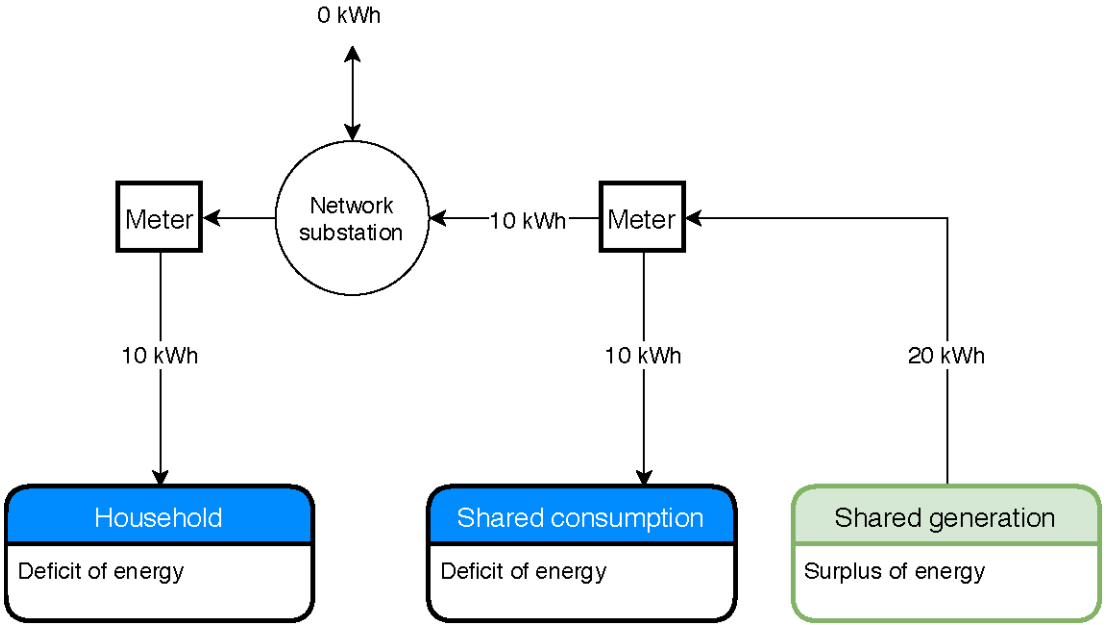
Shared energy resources



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Profitability for decentralized generation

S-ZEN:

$$\text{Spot price} \leq \text{LCOE} \leq \text{Spot price} + \text{grid charges}$$

M-ZEN:

$$\text{Spot price} \leq \text{LCOE} \leq \text{local energy price} \leq \text{Spot price} + \text{grid charges}$$

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Optimizing energy flows within a ZEN

S-ZEN:

- Several buildings behind the meter.
- Incentives in place for coordinated optimization.
- Incentives for reducing coincident peak.
- Similar to ZEB.

M-ZEN:

- Each actor optimized individually.
- No incentives for coordinated optimization.
- Incentives for reducing individual peak.
- No incentives to reduce coincident peak.

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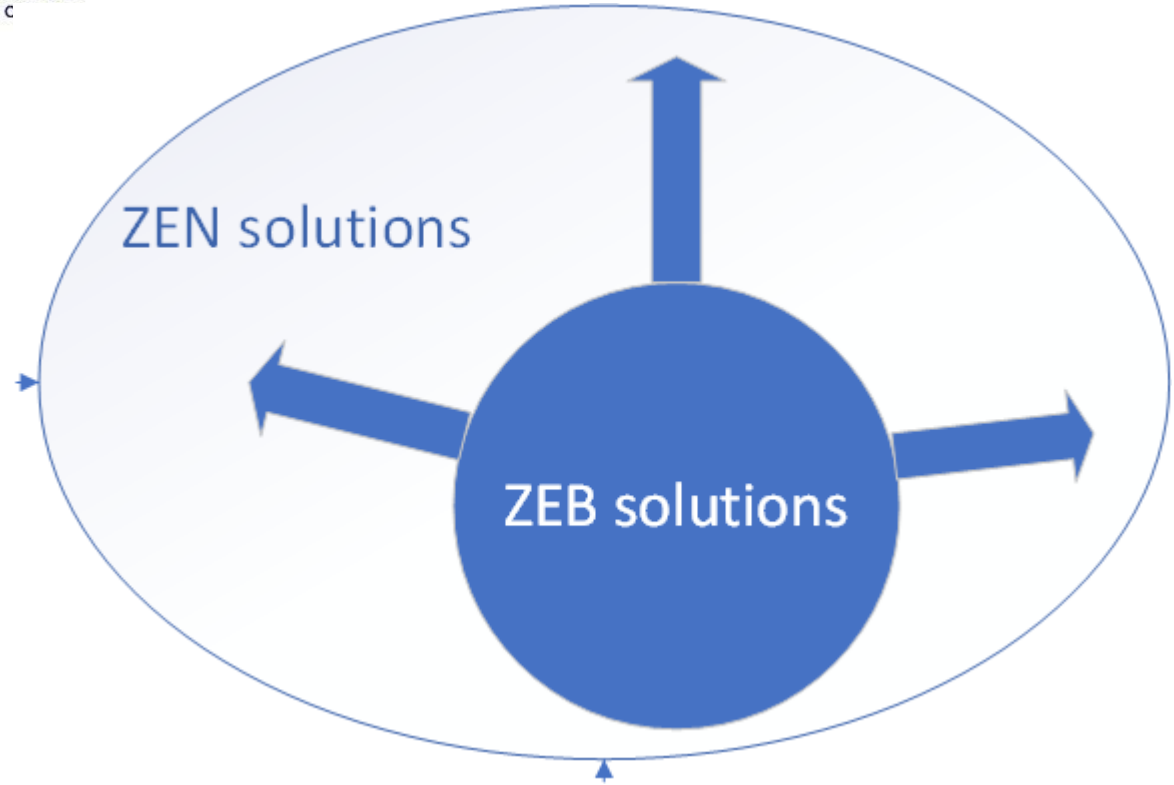
Conclusions

- Coordination of energy flows within ZEN is not facilitated by today's billing practices.
- The current regulatory framework need to be adapted for M-ZEN
    - Technical possibilities are ahead of regulation
    - Regulatory innovation is needed (NVE "sandbox regime")
- How to efficiently exploit locational value of energy resources?


ZEN solutions
ZEB solutions