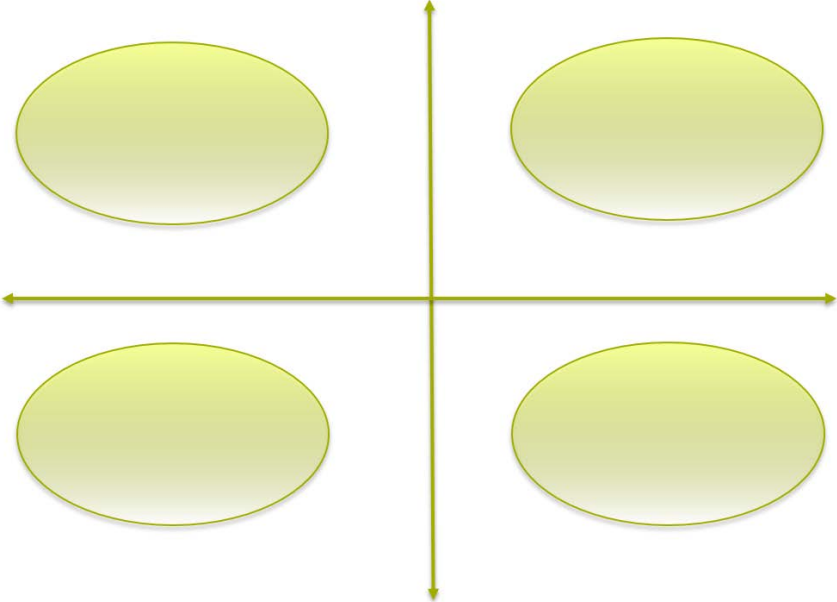


Trønderenergi's response to a digitalized and distributed future



Disruption
Ahead

TE 2030 – Scenario based approach



Industrial drivers affecting our future

Regulative

Technology

Climate targets

Market regulators and liberalization

Distributed production and storage

ICT Infrastructure & Services

- EU legislations
- Renewable energy production
- Transmission
- Electrification

- AMS Roll out
- Ownership regulations
- “Reiten” committee
- Market mechanisms
- Infrastructure

- Solar
- Storage
- Thermal
- H2
- Bio

- Smart Technology
- «Home» OS
- Demand Response
- New services
- Consumer behavior

EU Climate targets 2030

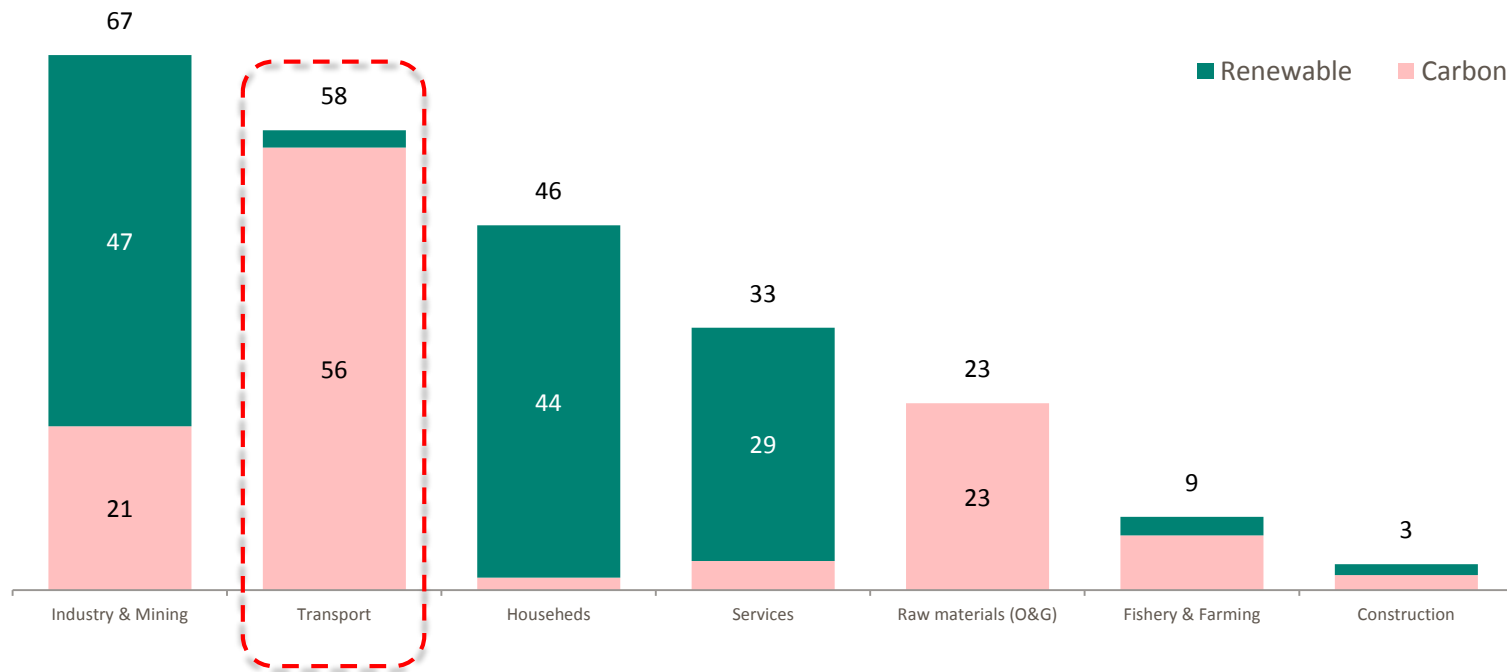
- 40% emission reductions
- 27% efficiency improvement
- 27% renewable energy
- 15% transmission capacity



EU 2030 : 40% emission reductions

Industry Sector Consumption, 2013

TWh/år (~250)

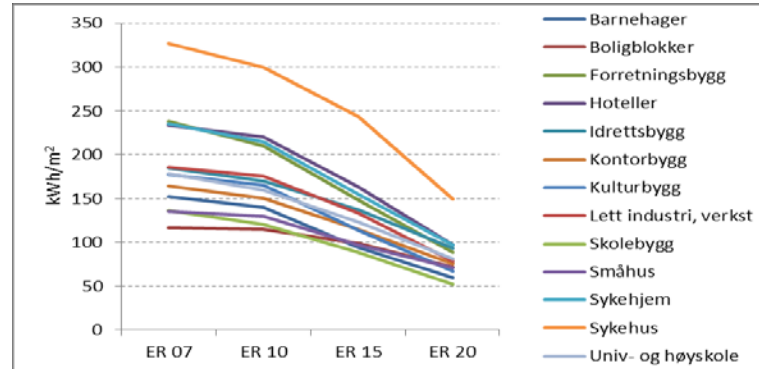


EU 2030 : 27% efficiency improvement

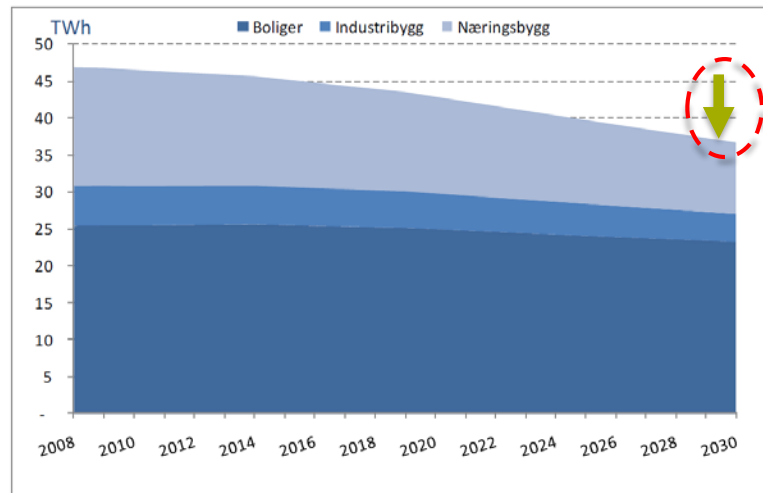


- EU Energy Performance Directive
- TEK 15 “Passive house”
- TEK 20 “Zero Energy”

Energy consumption, new buildings



Energy consumption (base load)



Norwegian regulation and liberalization

Regulation

REITEN-UTVALGET
Eivind Reiten varsler færre nettselskaper

Men vi ikke bruke grovaks der man kan bruke finere kniv.



PRODUKTIVITETSKOMMISSJONEN

En offentlig kommisjon oppnevnt av Regjeringen for å fremme forslag som kan styrke produktivitet og vekstevne i norsk økonomi.



**KONKURRANSE-
TILSYNET**
The Competition Authority

- Functional separation
- New owners



Industry Structure consolidation

Tariffs



SOLENERGI
Vil nekte plusskunder elsertifikater: - Dette gir ikke mening

Nytt forslag fra NVE:
 Av Bymnet i EBL-Øyeblikk
 Publisert 01.09.2014 kl. 12:27 - Oppdatert 01.09.2014 kl. 12:32

- Plus “customers”
- Power demand tariffs



“Prosumers”

Technology

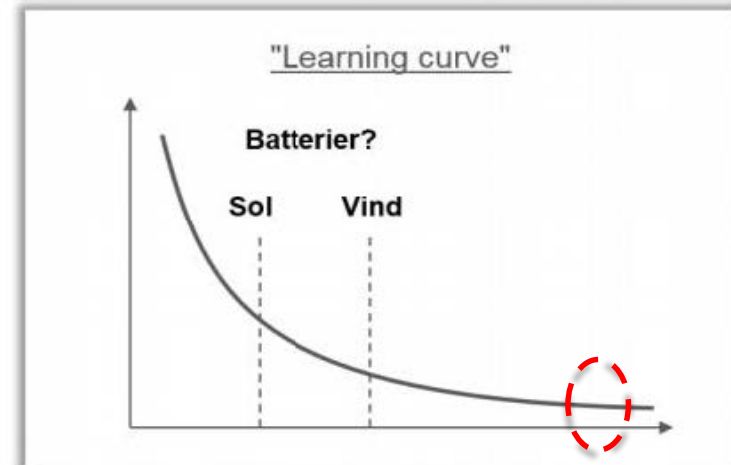
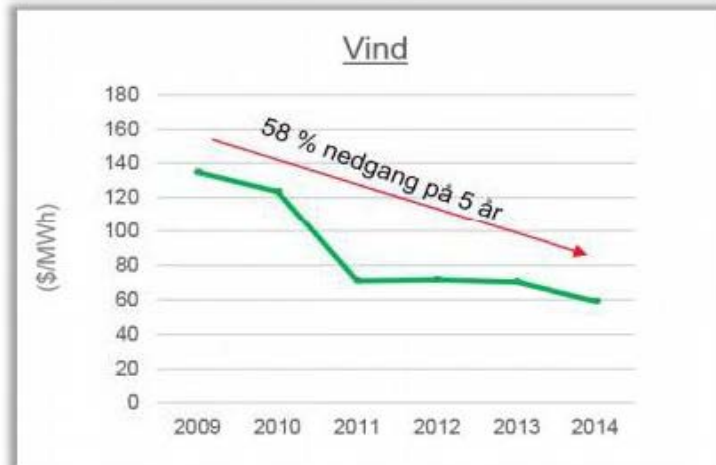
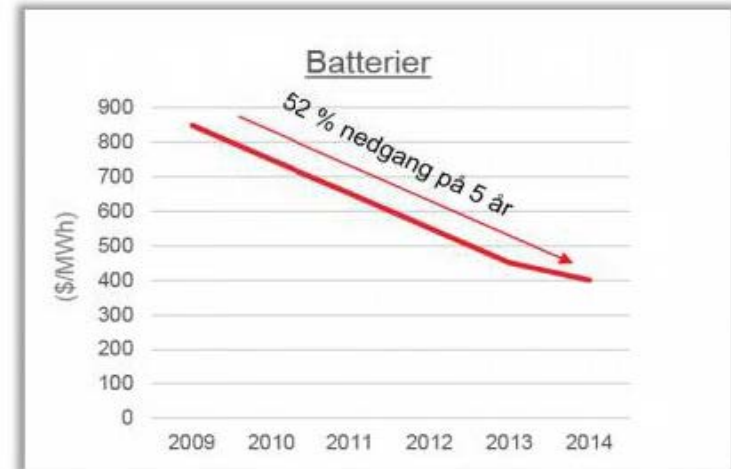
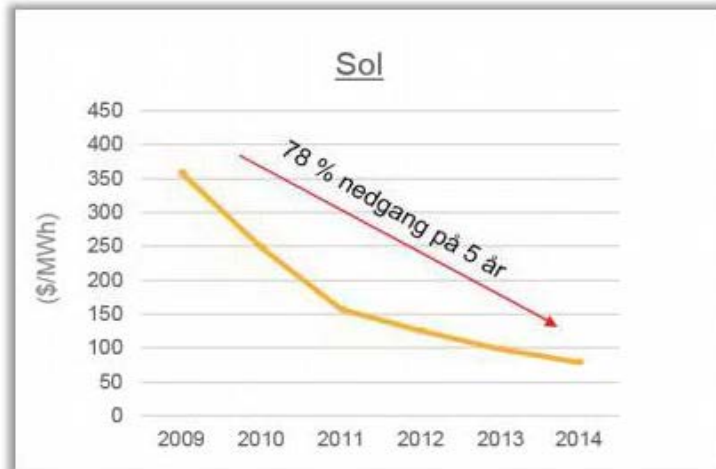


- AMS & Elhub
- Digitalization



End customer reach

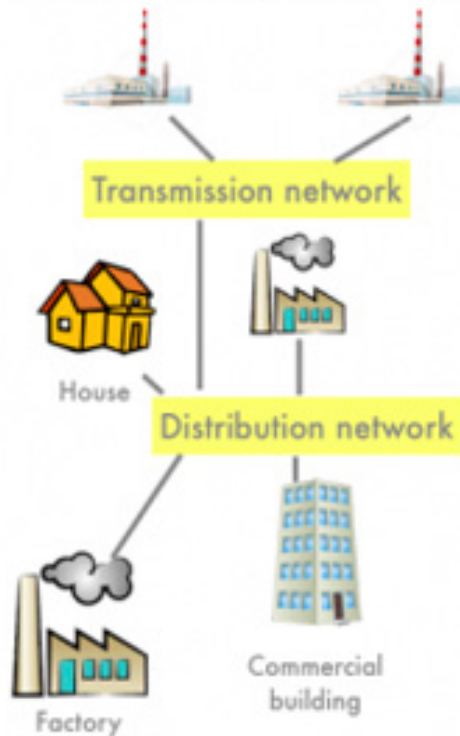
Decreasing technology costs



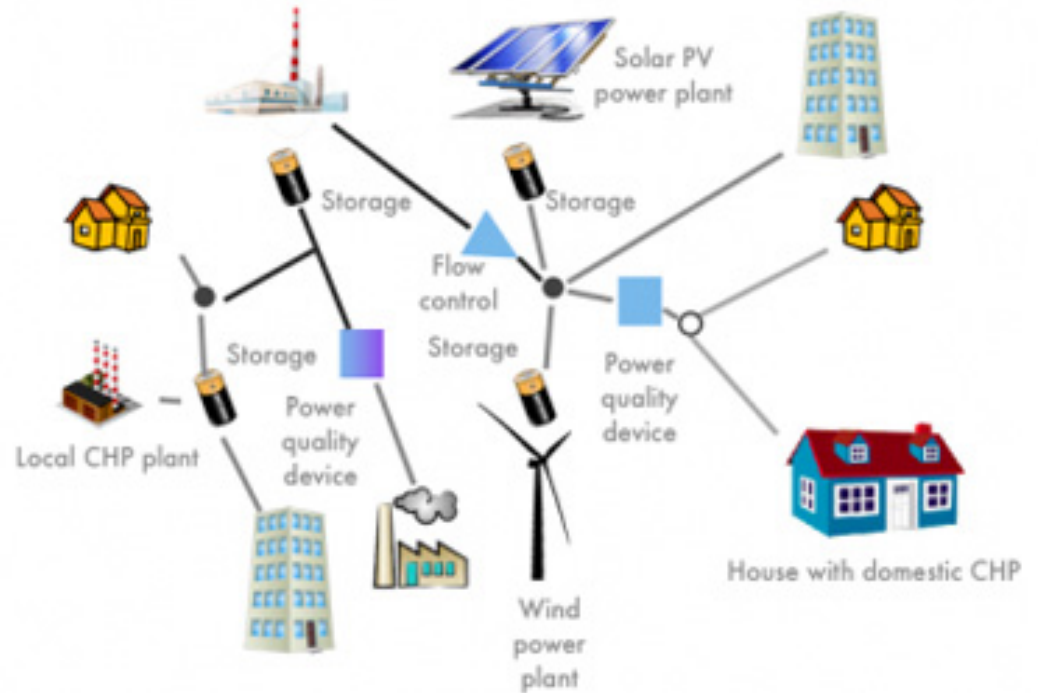
«Distributed» Energy system

Tomorrow

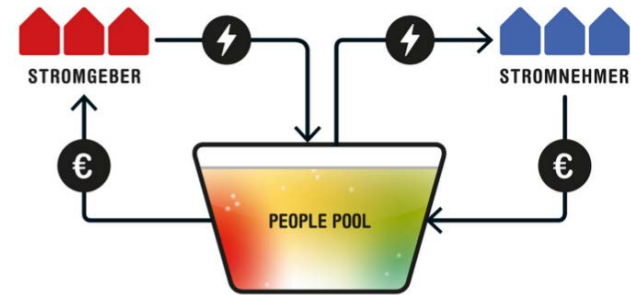
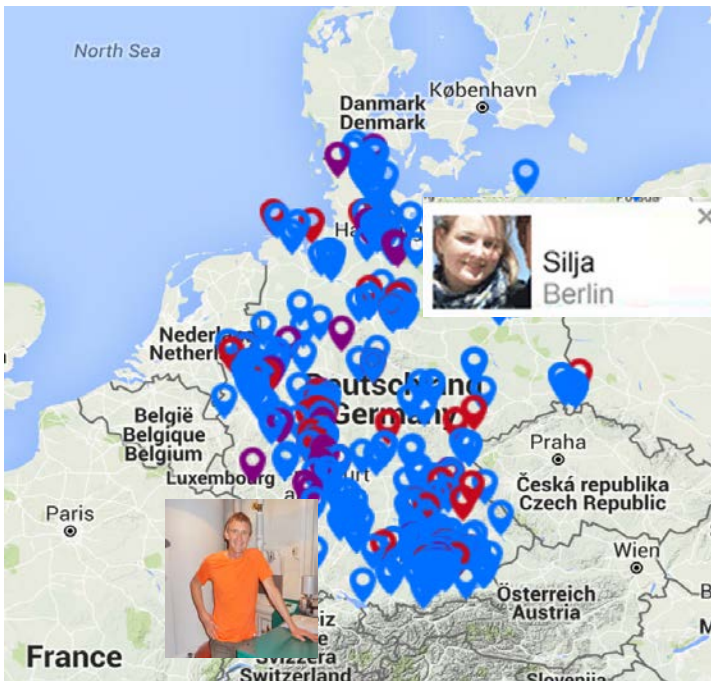
Centralized Power



Clean, local power



Private Residential Markets





ENVIRONMENT

Here's Why Elon Musk Might Have Just Really Pissed Off Your Utility Company

By Darren Ankrom

May 4, 2015 | 11:30 pm



Google & Apple – heading where?



We've invested in the following projects:

1. **Peace Garden Wind Farms:** opening up more financing for wind
2. **Atlantic Wind Connection:** a superhighway for clean energy transmission
3. **Shepherd's Flat:** one of the world's largest wind farms
4. **Ivanpah :** concentrated solar power at scale
5. **Photovoltaics in Brandenburg:** investing in clean energy in Germany
6. **Alta Wind Energy Center:** harnessing winds of the Mojave
7. **SolarCity:** investing in residential rooftop solar
8. **Clean Power Finance:** financing for rooftop solar
9. **Recurrent Energy:** large scale photovoltaic (PV) projects in California
10. **Rippey Wind Farm:** financing wind power in Iowa



Inside Nest's 50,000-Home Virtual Power Plant for Southern California Edison



Nest builds a plan to quickly replace power plants with smart thermostats.

by Jeff St. John
September 14, 2016



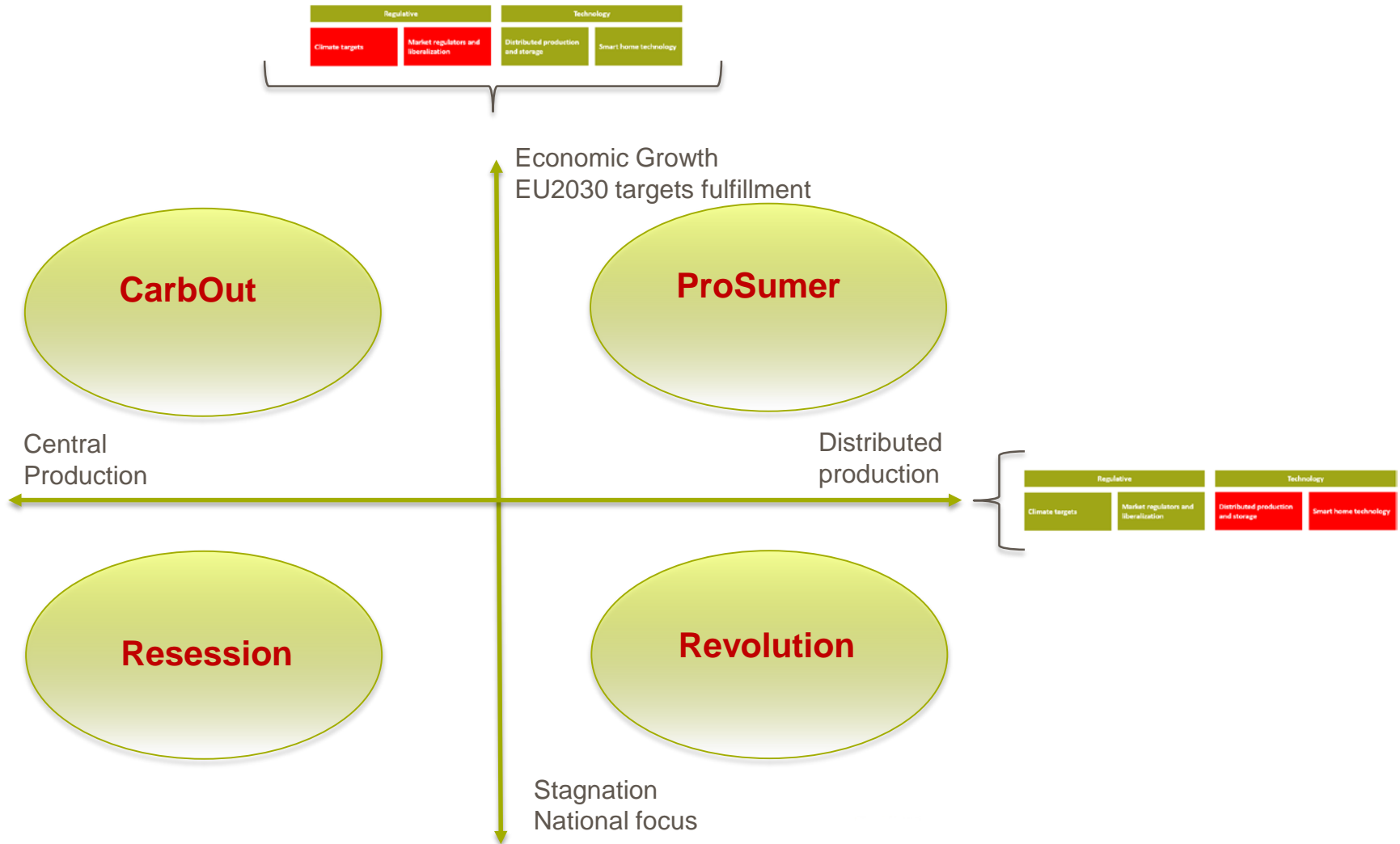
Apple etablerer energiselskap

Publisert 21-06-2016



Apple, her representert ved selskapets nye hovedkvarter som er under bygging, har levert inn søknad til amerikansk energimyndigheter om å startet et energiselskap. Illustrasjon: Apple

Future Scenarios



What do we believe in?

CarbOut



Prosumer



Resession



Revolution



The Prosumer Contract

Kundene må imidlertid ha det enkelt



Hiding complexity from the end customer

FORBRUKER

Kunden har en enkel hverdag



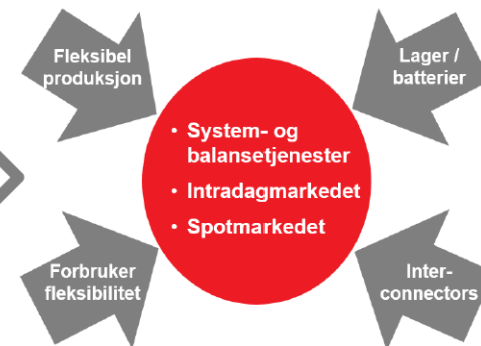
LEVERANDØR

Leverandøren optimerer kundens fleksibilitet og styrer deres posisjon i spot-, intradag- og balansemarkedene



MARKED

Effektiv konkurranse. Markedsmodellen fungerer!



Trenger ikke et nytt markedsgeslag !

- ✓ Ta dagens markedsløsninger i bruk – implementere!
- ✓ Samle likviditet i de markedene vi har og utvikler
- ✓ Forbedre de løsningene vi har

Understanding our options



Off grid Solutions



Piloting: Technology Feasibility



Solar



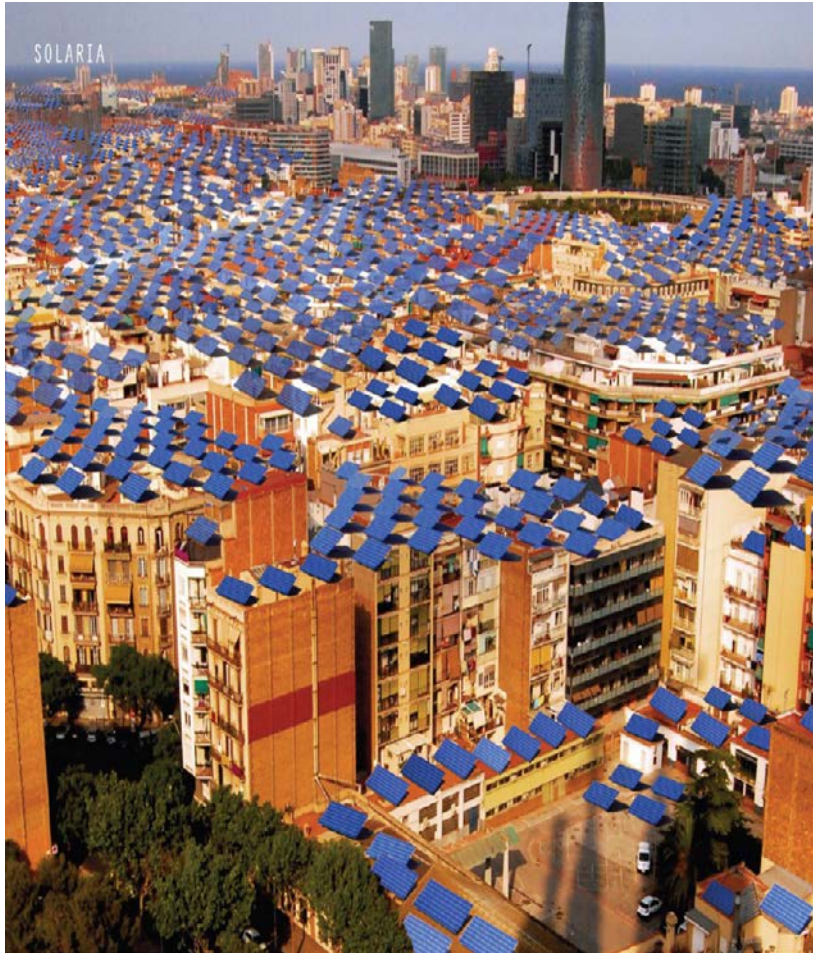
**VIL DU
PRODUSERE
DIN EGEN
SOLKRAFT?**

Vi søker testpiloter.
Påmelding og mer informasjon
www.tronderenergi.no/sol

**REN
TRØNDER
ENERGI**

TrønderEnergi 

Piloting: Customer preferences



We're facing some fundamental challenges



Innovation -> Ideas?

Commercialization?

Untapped regional innovation potential



Energy and Environmental Engineering
Industrial Economics
School of Entrepreneurship



Centre for Sustainable Energy Studies



Energy



Enabling the «renewable» innovation value chain

Activity Ramp up vs NTNU

- Research programs (Censes)
- MsC Thesis
- ES (School of Entrepreneurship projects)
- Climate Launch Pad
- Start NTNU
- “Green entrepreneurship”
- Take Off
- Renewable start up weekend



Commercialization through our “Energy Accelerator”

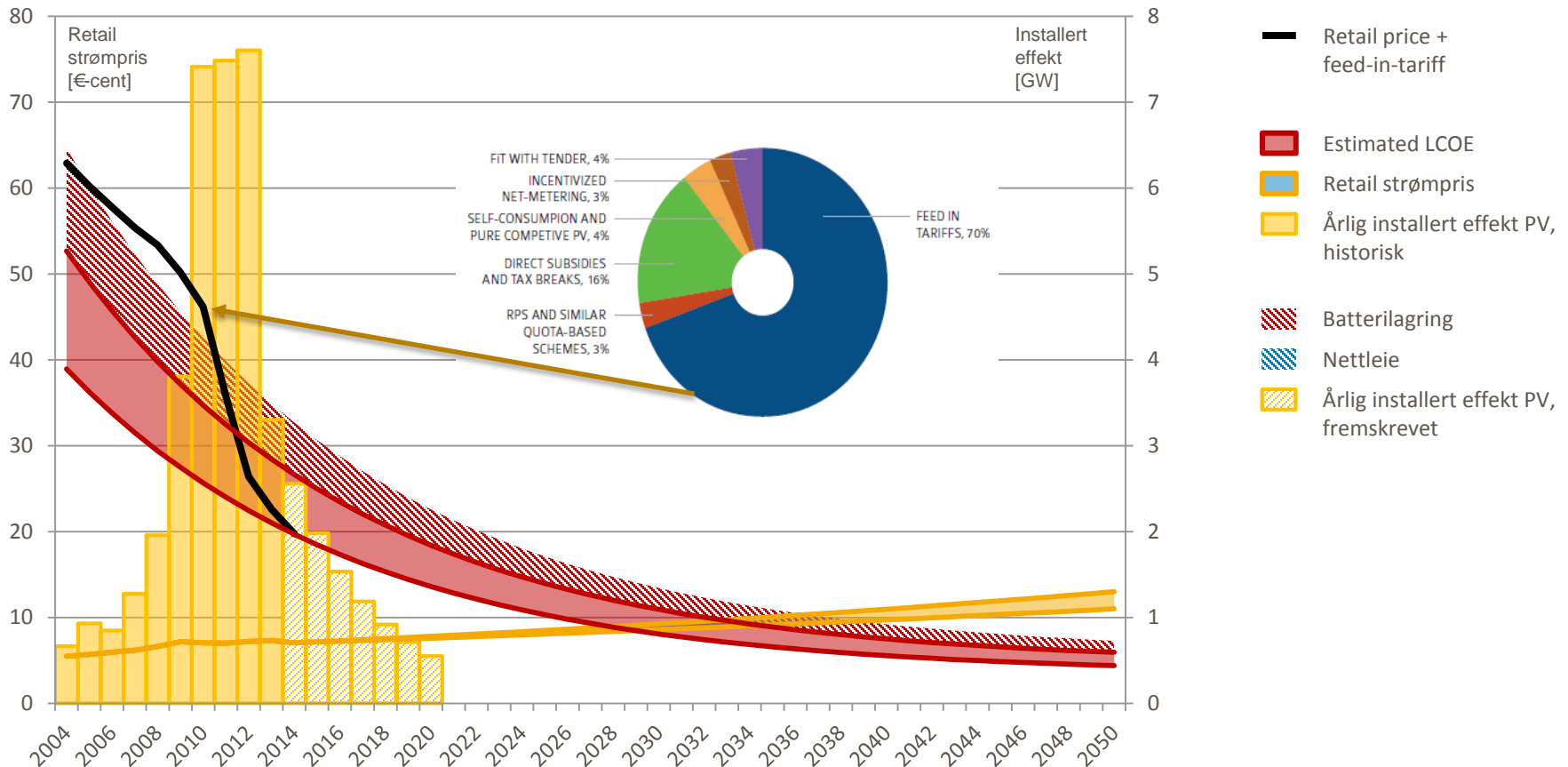


- Accelerator for energy specific innovations and start up's
- 15-20 companies + TE internal projects
- TE employees acts as coach
- TE demanding industrial customer
- NTNU, Sintef, Programmes
- Funding structures

- **Internationally leading center for “Energy Innovation”**

Feed in tariffs key driver for installed PV effect

Historical and projected energy price development and installed PV power, Germany



- Targeted 41 TWh PV production by 2020.
- 2014 production at 37 TWh equal to 30% of domestic demand