



Energy Fintech - 21st C Funding for Energy Storage

The Economics of Energy Storage Projects

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Resource Resilience – the example of Denmark

In 1973 the oil price increased 400% from \$3 to \$12 per barrel

Oil & products fuelled > 90% of Danish heat, power & transport

Denmark applied 'least carbon fuel cost' organising principle of resource resilience

“Minimise oil input for any given output of energy as a service”,



National Grid

Denmark

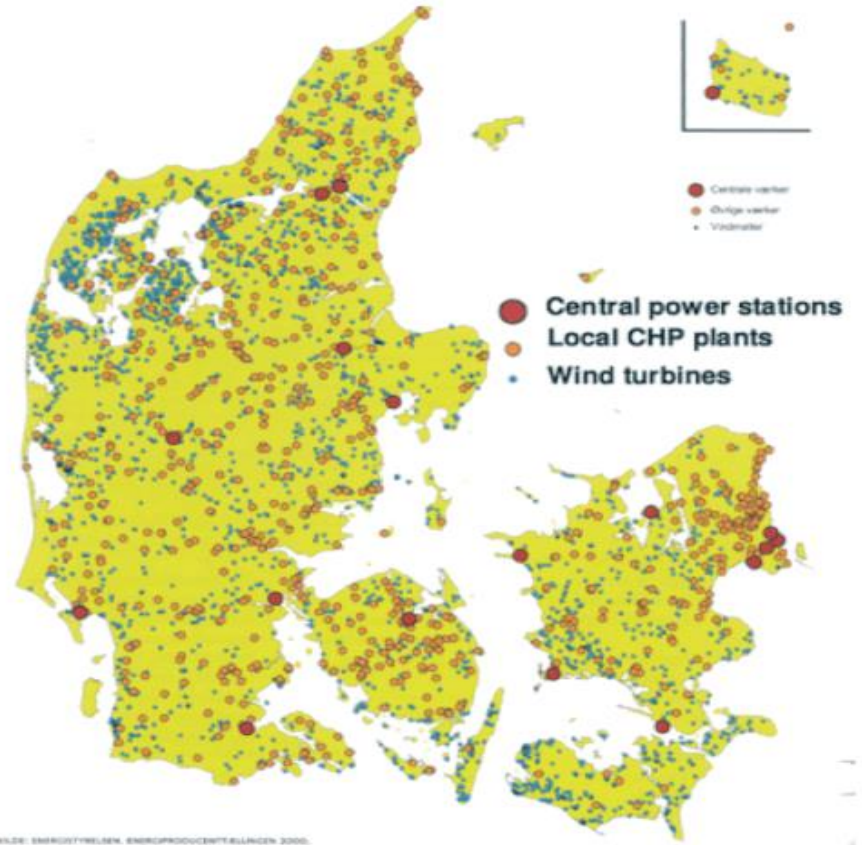
Natural

Grid

1990



2014



Transition to Services - Energy Intensity

“Stone Age did not end for lack of stones & Oil Age will not end for lack of oil” - Zaki Yamani

Peak *Affordable* Oil – secular increase in energy intensity of production & fall in Energy Return on Energy Invested

Oil/gas intermediaries between Immovable Object of capped prices & Irresistible Force of declining oil/gas EROEI

Smart strategy is transition to services

Smart Energy – higher the \$ oil/gas price more \$ profit in smart energy efficiency (Fifth Fuel) & renewables



Transition to Services - Capital Intensity

Commodity markets are capital intensive

- infrastructure funding
- market/credit risk

Services are *Capital Lite*

Intellectual capital is displacing physical & finance capital



Energy as a Service

We don't use raw energy as a commodity: oil, oil products, natural gas, electricity.

We use energy as a service: heat/cooling, power, mobility, light, communications

Energy as a commodity must be converted to energy as a service delivered to end users

Complementary institutions and instruments are needed for smart energy services markets – **Energy Fintech**



Prepaid Credit Obligations

Prepaid
Taxation



Prepaid
Energy

Pre-paid SIM Cards
Unlimited Talk & Text!



BUY SIM CARD NOW! - SIM Card plans as low as \$25!

Prepaid
Talk Time

Fintech 1.0 - Blockchain & Coins

Blockchain as Agreement

- **collective** machine protocol for encrypted transaction database
- authenticates electronic transactions – no 'double spend'
- **But** entire database is encrypted & replicated for every new transaction

Coins as Instruments

- Proof of **past** value creation (eg Proof of Work/Stake)
- Subjective exchange value but no objective utility



Energy Fintech Case Study - Venezuela and El Petro

Petro is based on oil

- acceptability of currency is based on utility
- many different types & qualities of oil
- consumers use gas, oil products, energy services *not* oil

Petro is a *Proof* not a Promise

- Proof of payment 'backed' by oil reserves
- No obligation to deliver either oil or money
- Petro cannot be used instead of Dollar to pay for Venezuelan oil



Energy Fintech – Swaps & Credits

Instruments

- Energy Swap – exchange of energy flows
- Energy Credit Obligation (ECO) – prepaid energy use

Institutions (Agreements)

- Energy Partnerships – production/cost sharing
- Clearing Union – risk sharing/mutual assurance



Energy Credit Obligation (ECO)

ECO is

- Segment of new credit obligation asset class
- Returnable in payment for supply
- Promise exchanged by energy producer vs value received

ECO is not

- Debt - no right to demand money
- Derivative – no right to demand delivery
- Equity – no ownership right in respect of energy assets

ECO requires trust framework for issuers & investors



ECO Funding – Fossil Generation

Energy Loan

Investors/Consumers prepay & receive ECO returnable in payment for energy supply

Consumers pay for energy with ECO or £

Investors sell ECO to investors or consumers & receive energy denominated return

Generation as a Service

- fuel for energy swap
- technology for energy



ECO Funding – Renewable Generation

Energy Loan

Investors/Consumers prepay & receive ECO returnable in payment for energy supply

Consumers pay for energy with ECO or £

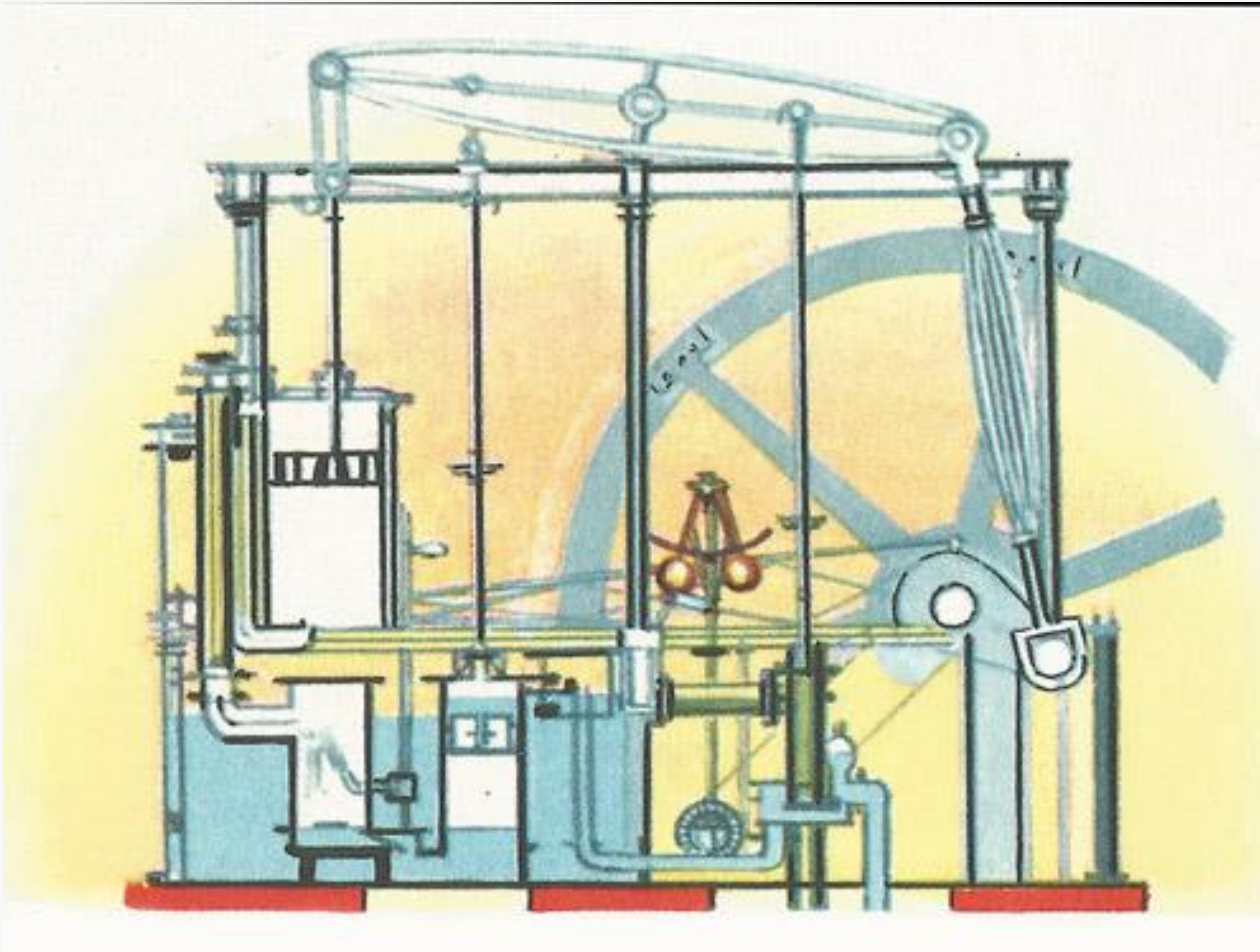
Investors sell ECO to investors or consumers & receive energy denominated return

Generation as a Service – smart swaps

- solar as a service
- wind as a service
- hydro/tidal as a service



James Watt's 'Fifth Fuel' 1778 - the first Smart Swap



ECO Funding – Energy Storage

Energy Loan

Investors via Energy Loans receive ECOs returnable in payment for energy savings

Consumers pay for energy as a service with ECO or £

Investors sell ECO to investors or consumers & receive energy denominated return

Storage as a Service

- Return on energy loan investment at £ *retail* price



ECO Funding – Outcomes

Energy Loan

ECO denominated in energy, not \$, € or £

ECO is independent of nation states

ECO has an energy return (no interest/discount rate)

Banks do not issue ECO, but provide banking-as-a-service
eg risk management & investment banking

Energy economics replaces dollar economics

Natural Grid replaces National Grids

