



OWNERSHIP MODELS FOR 100% RENEWABLE ENERGY SYSTEMS

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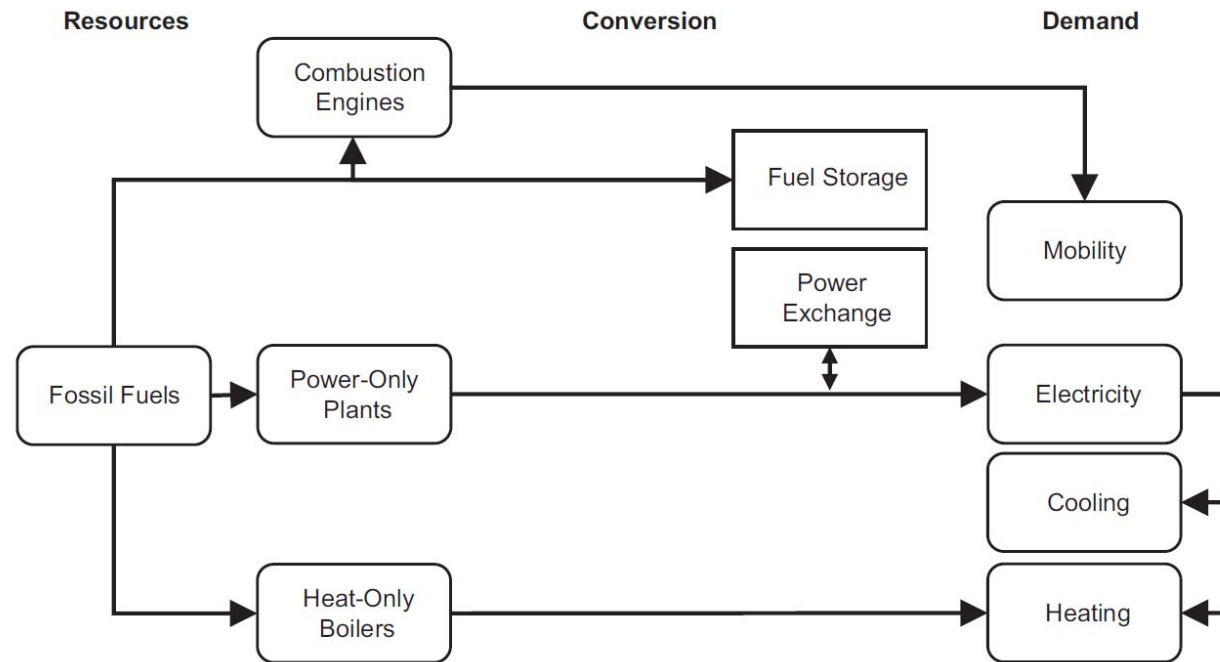


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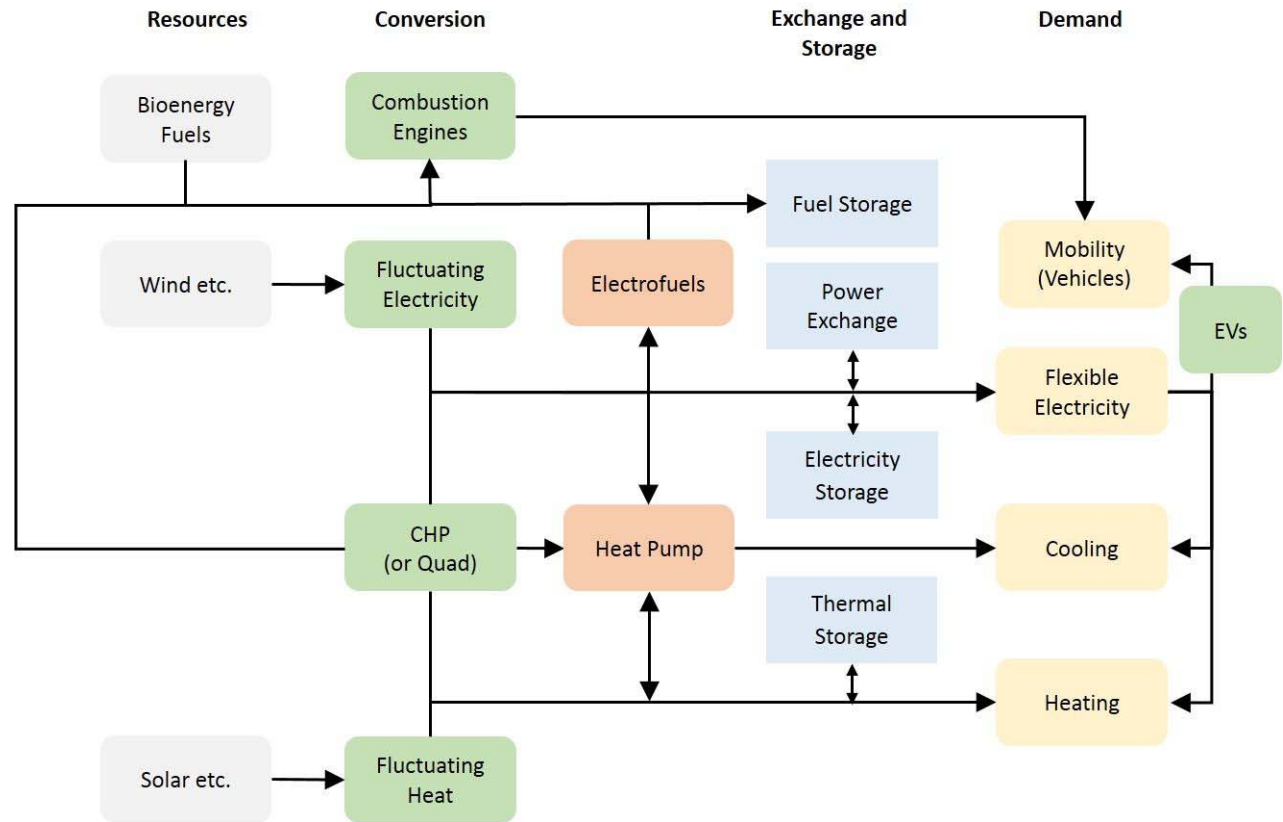


The fossil-fuel energy system



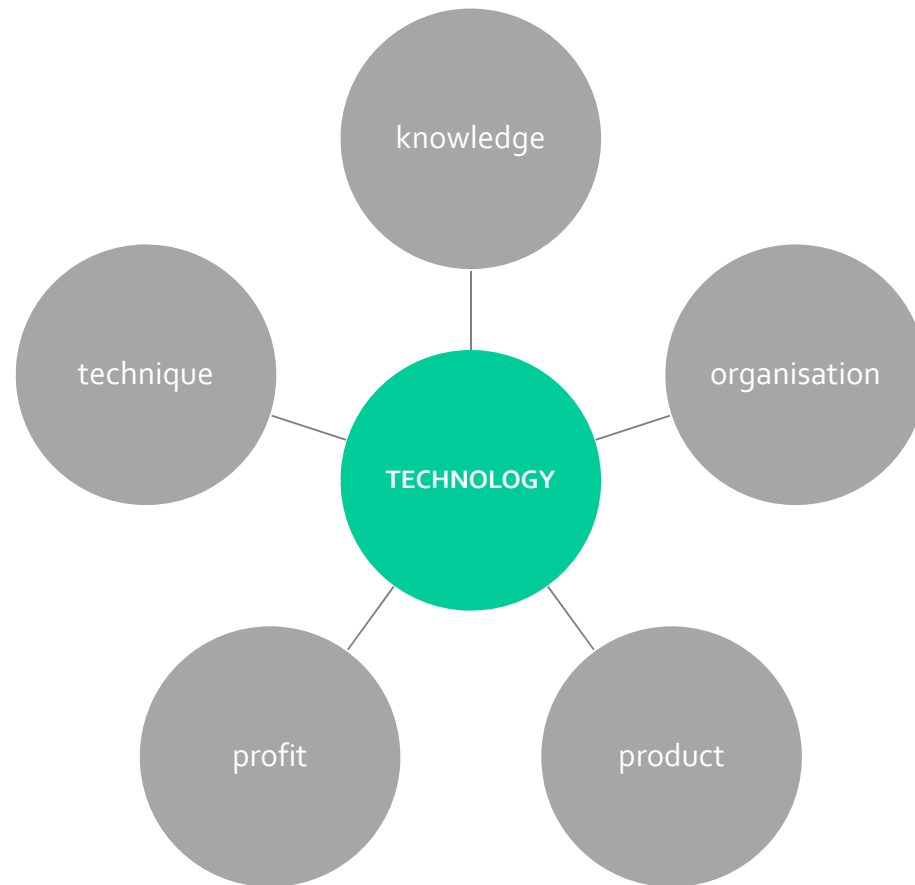
Source: Connolly D., Lund H. & Mathiesen B.V. (2016) 'Smart Energy Europe: The technical and economic impact of one potential 100% renewable energy scenario for the European Union', *Sustainable and Renewable Energy Reviews*, vol. 60, pp. 1634-1653.

The 100% renewable smart energy system



Source: www.energyplan.eu

**RADICAL
TECHNOLOGICAL
CHANGE**
with a system
perspective!



Reference: Hvelplund, F. (2011) 'Innovative Democracy and Renewable Energy Strategies: A Full-Scale Experiment in Denmark 1976–2010', in Järvelä, M. and Juhola, S. (eds) *Energy, Policy, and the Environment. Modeling Sustainable Development for the North*. London: Springer Science+Business Media, pp. 89–113.



Organisational Innovation

New actor interactions, ownership and business models are needed to facilitate the necessary **coordination** in smart energy systems

Owners of components of Smart Energy Systems in Denmark

Technologies that should be integrated	Present ownership
1. House insulation	Consumer
2. District heating systems	Consumer coops/municipalities
3. Heat pumps	Consumer coops/municipalities
4. Industrial heat	Local firms
5. Biomass use	Local producers
6. Wind power	Consumers or large companies
7. Electric cars	Consumers
8. Electricity distribution systems	Consumer coops/municipalities
9. Solar power	Consumers and/or consumer coops

Source: Hvelplund F. & Djørup S. (2019) 'Consumer ownership, natural monopolies and transition to 100% Renewable Energy Systems', *Energy*, In press.