TELOS

Energy (part 1)

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LE:NOTRE Institute
Linking Landscape Education, Research and Innovative Practice
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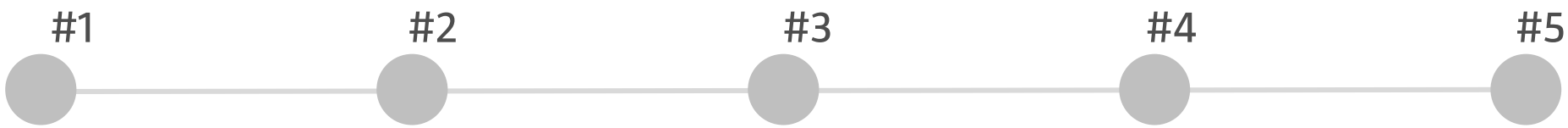


Context

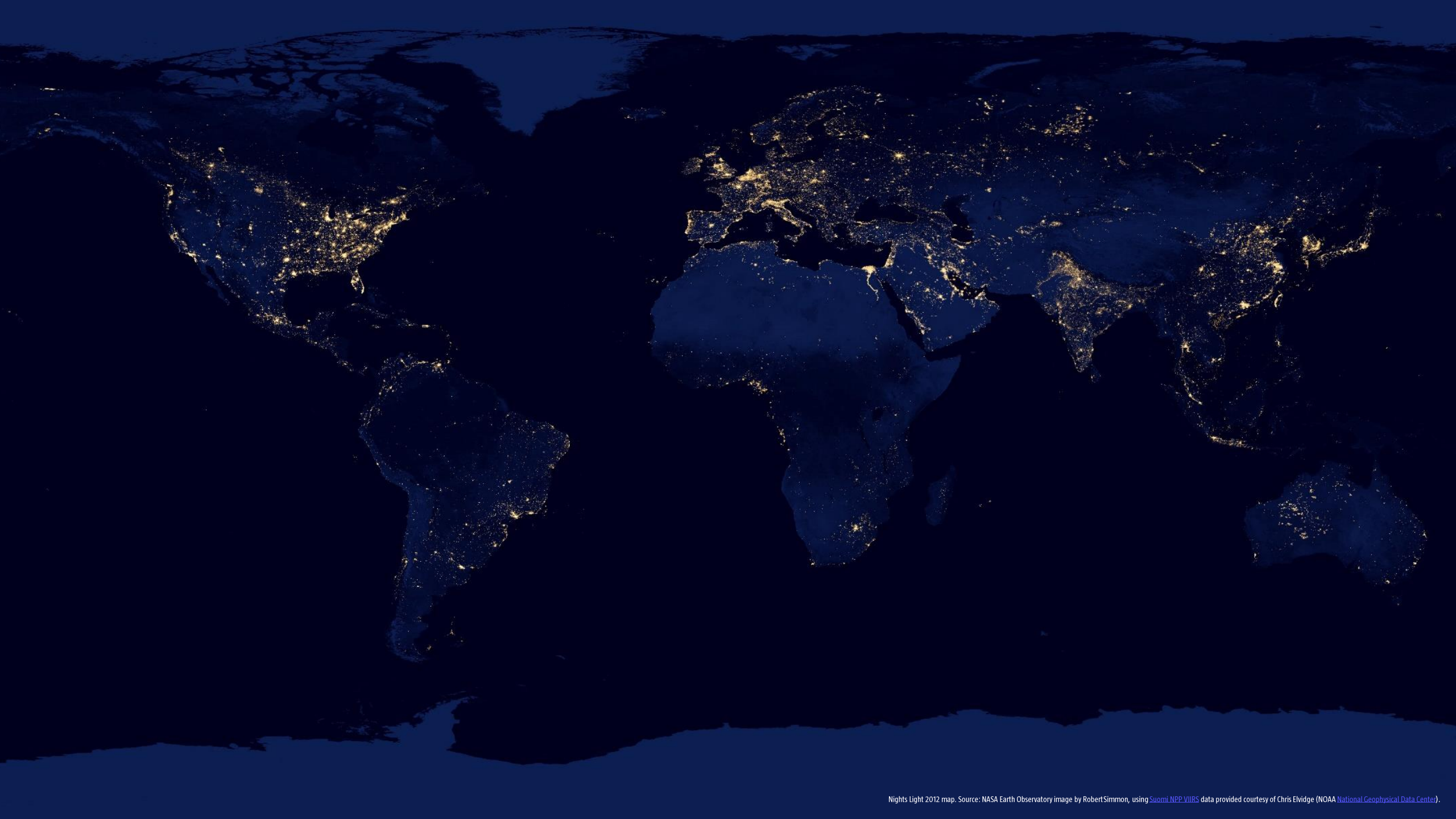
Energy Landscapes

Energy Policy: Renewables

Impacts of Renewables

Interim Summary

#1 Energy a cross-cutting topic



Nights Light 2012 map. Source: NASA Earth Observatory image by Robert Simmon, using Suomi NPP VIIRS data provided courtesy of Chris Elvidge (NOAA National Geophysical Data Center).

Interactions btw. SDG 7 "Energy" and the non energy SDGs

Sustainable Development Goals

1 – No Poverty
2 – Zero Hunger
3 – Good Health and Well-being
4 – Quality Education
5 – Gender Equality
6 – Clean Water and Sanitation
7 – Affordable and Clean Energy
8 – Decent Work and Economic Growth
9 – Industry, Innovation and Infrastructure
10 – Reduced Inequalities
11 – Sustainable Cities and Communities
12 – Responsible Consumption and Production
13 – Climate Action
14 – Life below Water
15 – Life on Land
16 – Peace, Justice and Strong Institutions
17 – Partnerships for the Goals

#2 Energy Landscapes – a relevant topic!

Energy landscapes … yesterday

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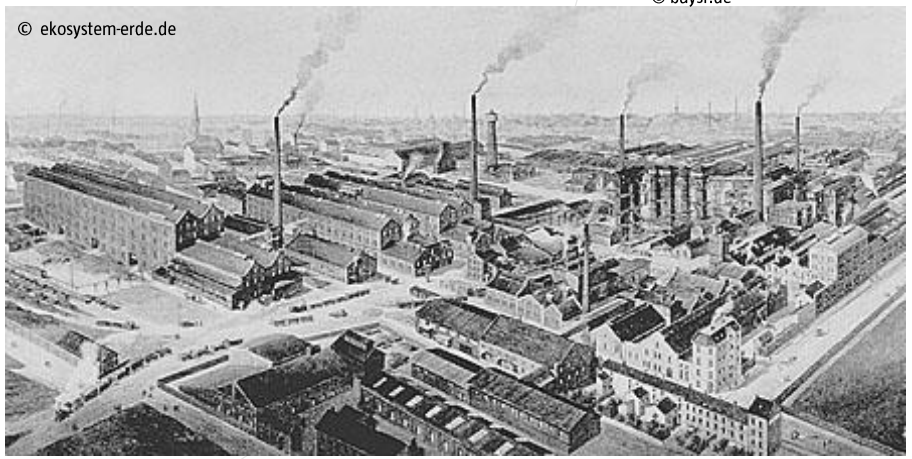

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Energy landscapes … yesterday (?)

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#3 Energy Policy

Landscape matters!

- EU energy targets and the economic crisis has affected the commitment to **energy transition based on renewable resources**

  → **2020:** 20% share for renewable energy
  → **2030:** 32% share for renewable energy
  → **2050:** first climate neutral continent

- Urbanization and vast energy consumption of cities challenge environmental designers to **envision urban landscapes** with sustainable energy systems.
- Historical chance to **re-invent urban-rural relationships** that enable **higher-density energy landscapes** while addressing **socio-economic challenges** in rural areas

Landscape matters!

- RE sources **change the land use** (decentralized energy system), which raises the question of an integrative spatial policy.
- The discourse on energy landscapes evolves around a triplex: **Ethical considerations, aesthetical challenges** and **planning/design questions.**
- The relationship between renewable energy and space needs an **energy-conscious organization of the physical environment**→ planning and design of sustainable energy landscapes.

#4 Impacts of Renewables

Bioenergy

Roth et al. 2018

Direct landscape impacts:

- Visual impacts on landscape and land use change (monocultures)
- Pre-existing agricultural activity is converted into new, often more intensive forms of agriculture
- Scale-dependent impact of processing facilities
- Trend to large industrial scale

Indirect landscape impacts:

- Effects on soil, gaseous emissions, water contamination, unfamiliar smells
- Changes in the ecosystem, altering flora and fauna, loss of biodiversity
- Intervisibility: from low-height crops to above-eye-height crops
- Increased traffic of biomass transport

Bioenergy

Roth et al. 2018

Mitigation strategies:

- Close-loop biorefineries limit land-use impacts
- Usage of wider range of substrates, e.g. domestic, economic and forest waste, residues
- Production of energy crops on marginal or abandoned land

Potential positive impacts:

- Use of waste → circular economy
- Local fertilizers (fermentation residues)

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Geothermal Energy

Roth et al. 2018

Direct landscape impacts:

- Geothermal infrastructure development (drilling of wells, spread with km distances, access roads, pipelines)
- Industrial looking generation stations (steam operators, cooling towers, pipes, generator buildings)

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Indirect landscape impacts:

- Hillside stability and landslides (thermal changes in the soil)
- Subsidence of land (extraction of fluids)
- Earthquakes (reinjection)
- Change/disappearance of hot springs, fumaroles

Geothermal Energy

Roth et al. 2018

Mitigation strategies:

- Reclamation of destroyed vegetation (with local species)
- Smart drilling, underground pipelines, colors that harmonise well with the landscape, design of inconspicuous buildings

Potential positive impacts:

... Hard to envisage

- Blue Lagoon Spa, Iceland
  → attraction in spill water of geothermal power station

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Hydro Energy

Roth et al. 2018

Direct landscape impacts:

- Large facilities (power stations, damming rivers, artificial reservoirs, pipes, transmission lines) → presence of structures constitutes substantial change in landscape features
- Small facilities: run-of-the river (canal or pipe which spins turbines) → less impact, still infrastructure above surface
- Underground impacts by pipes, turbines, pumps
- Flooding of villages

Indirect landscape impacts:

- Building of reservoirs might dry up large watercourses
- Damming of lakes and rivers: erosion of the shoreline
- Riverbank erosion downstream of power plants
- Rapid flow: drastic changes in water-related ecosystems (physical and chemical qualities)

Hydro Energy

Roth et al. 2018

Mitigation strategies:

- Use of existing infrastructure
- Use of existing lake reservoirs
- Depending on the original state of the landscape and cultural value: artificial lakes are often perceived as attractive
- Power stations and power lines are considered disturbing: underground solutions
- Simple solutions like fish-ladders

Potential positive impacts:

- Major regional attractions → boost for tourism and local income

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Wind Energy

Roth et al. 2018

Direct landscape impacts:

- Great height → prominent visual impact
- Varying scale of windfarms: single pylons to 20-30
- Development of infrastructure: roads, transmission lines, buildings, night lights, shadow flicker etc.
- Appearance depends on position of wind turbines, landscape type, wind turbine size, proximity to wind turbines
- Change of landscape character esp. in coastal zones and mountain ridges

Indirect landscape impacts:

- Hazards to birds and bats, noise pollution and destruction and degradation of habitats
- Underground and surface waters
- Coastal erosion

Wind Energy

Roth et al. 2018

Mitigation strategies:

- Landscapes with technical installations can assimilate easier → existing association with industrial structures or infrastructure
- Avoid visibility from sensitive viewpoints
- Location and design aligned to surrounding landscape
- No single-color

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Potential positive impacts:

- Contrary to emotional conflicts about wind farms, they can facilitate local identities (technological efficiency, progress, climate friendly, utility)
- Coastal zones: new source of income generation, new habitat development (reduced pressure from shipping)
- Symbol of energy transition

Solar Energy

Roth et al. 2018

Direct landscape impacts:

- Large-scale PV on ground: land use, biodiversity, water-related aspects, visual-aesthetic, glare
- Concentrated solar thermal: glare effect from mirrors, visual impact of tall cooling towers, water management

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Solar Energy

Roth et al. 2018

Mitigation strategies:

- Appropriate sitting (former mines, industrial areas, sites with low visibility)
- Integration into buildings
- Dual use of land
- Appropriate design

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Potential positive impacts:

- Co-existence with agriculture and grazing (increase of crop production)
- Structures of PV as land stabilisation
- PV as spatial definition of certain areas (public area, bike lane, etc.)
- PV panels for shade

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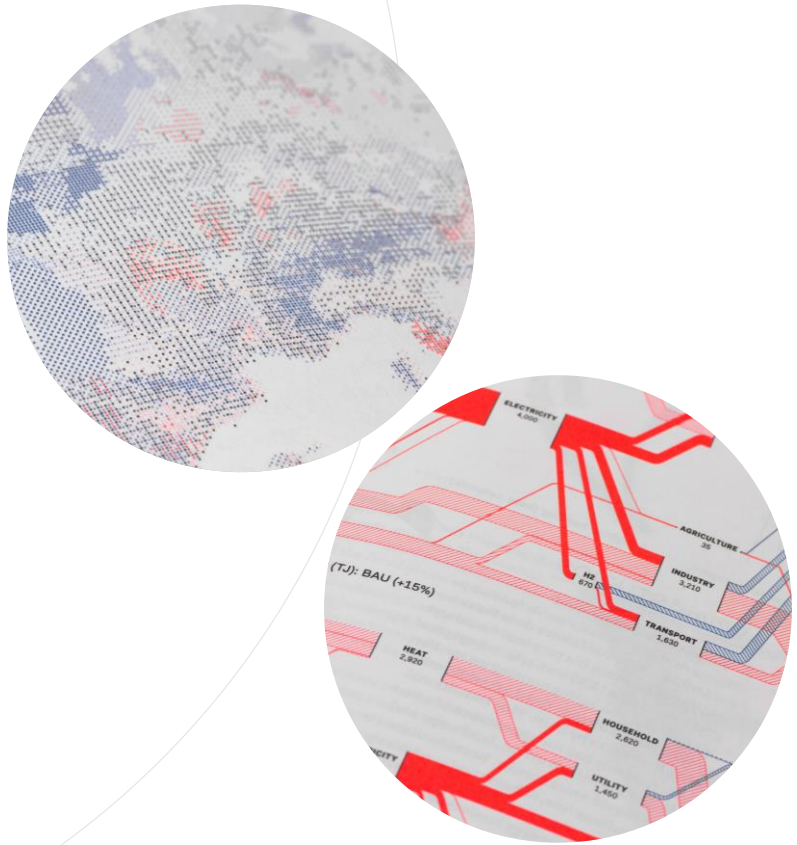
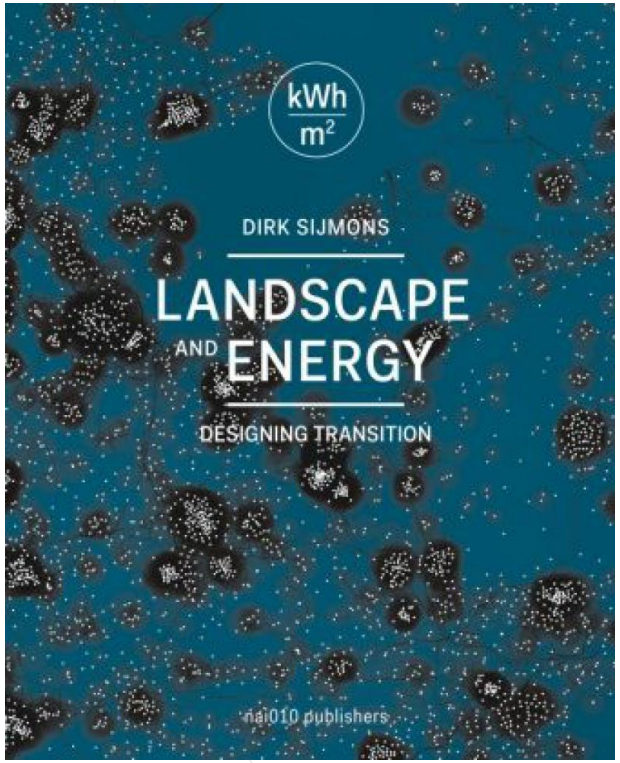
#5 Interim Summary

Planning matters!

- Energy production and consumption are closely liked with landscape
- Renewables also have impacts on landscapes
- Landscapes are spaces of impact and action at the same time
- Landscape planning on all levels can contribute to
  - minimization and mitigation of landscape impacts
  - transparency and accountability in all decisions
  - achieving social acceptance
- Landscape planning and design have influence, but cannot achieve energy transition without stakeholder collaboration
- Interdisciplinary understanding and cooperation is necessary
- Thinking in multifunctional synergies when developing and accompanying energy projects



References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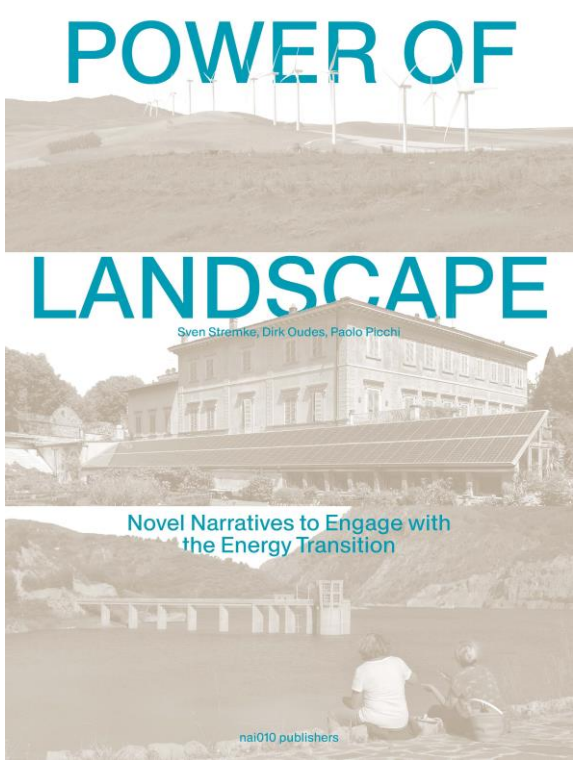
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Sven Stremke, Dirk Oudes, Paolo Picchi
Novel Narratives to Engage with
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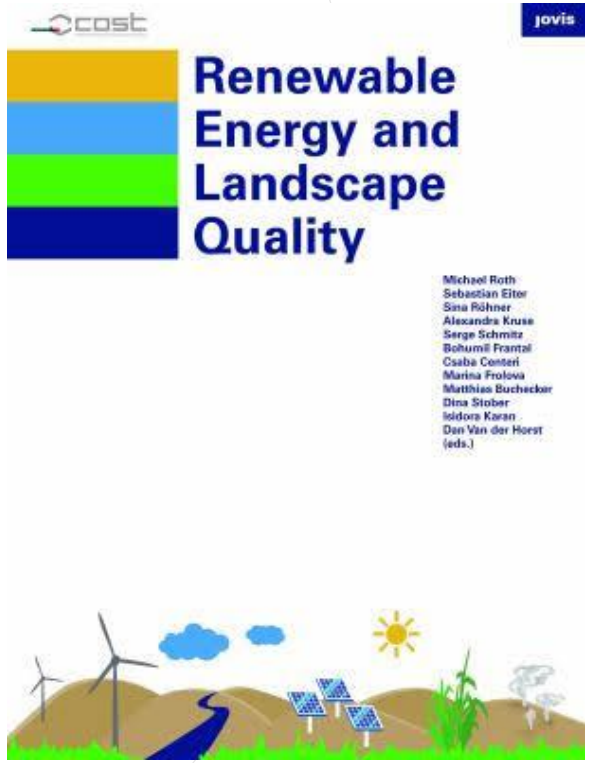
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THANK YOU

→Prof. Andreucci continuous with Positive Energy Districts

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Politechnika Gdańska

Hochschule für Wirtschaft und Umwelt Nürtingen-Geislingen

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kWh/m^2

Electricity for 1 million households, spatial footprint

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Heat for 1 million households, spatial footprint

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