

Circular Economy Seminar

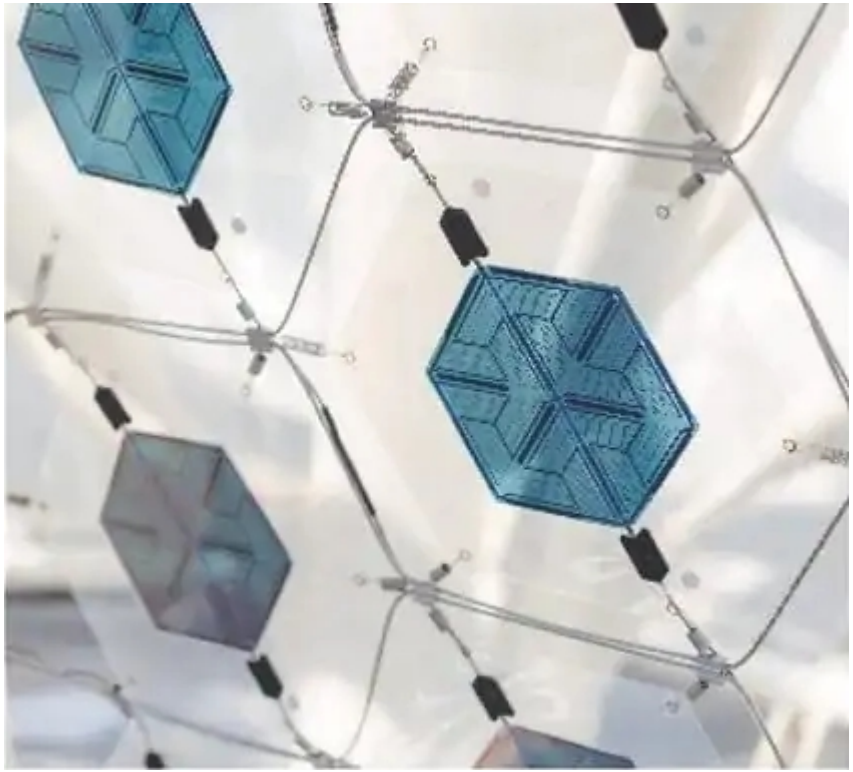
Solar Energy and the Environmental Impact of the Built Environment

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15th March, 2021

Thesis Topic

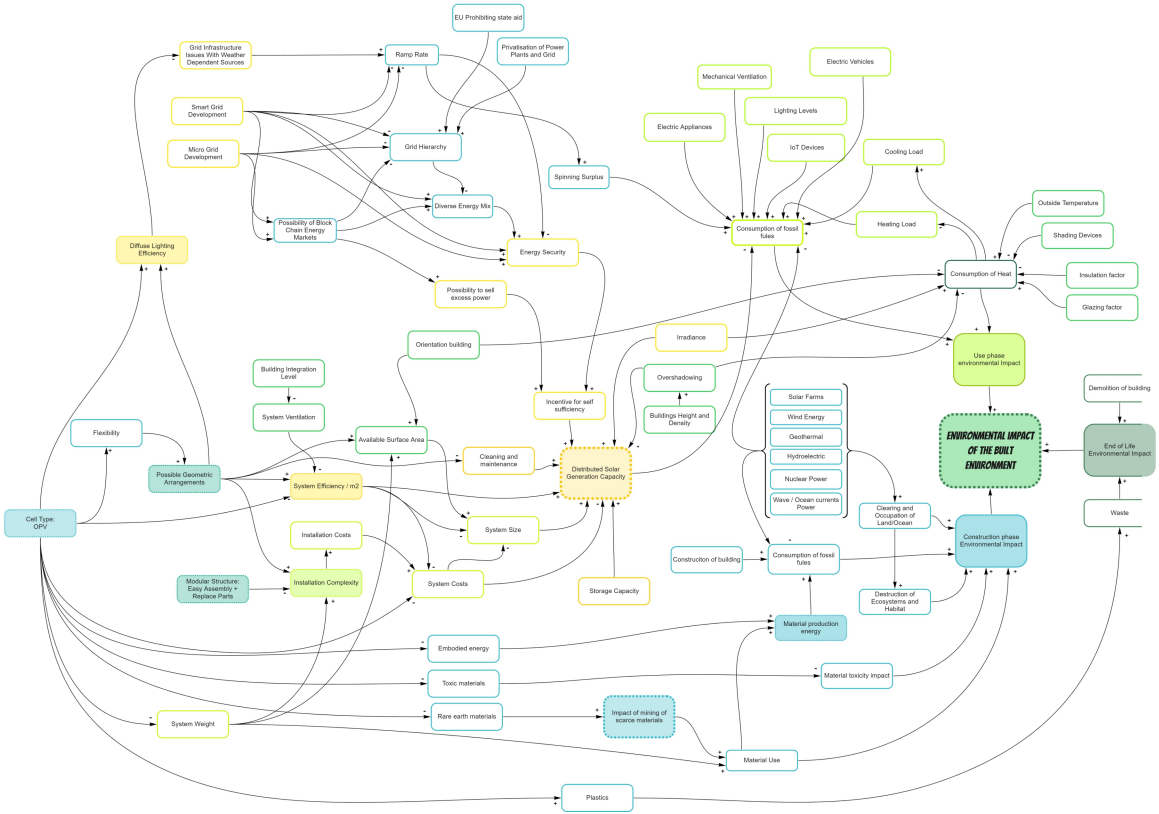
Solar Energy



Solar Energy and Architecture

- Organic solar cells
- Modular Systems
- Easy Assembly and Replacement of Parts
- Geometrical Arrangements

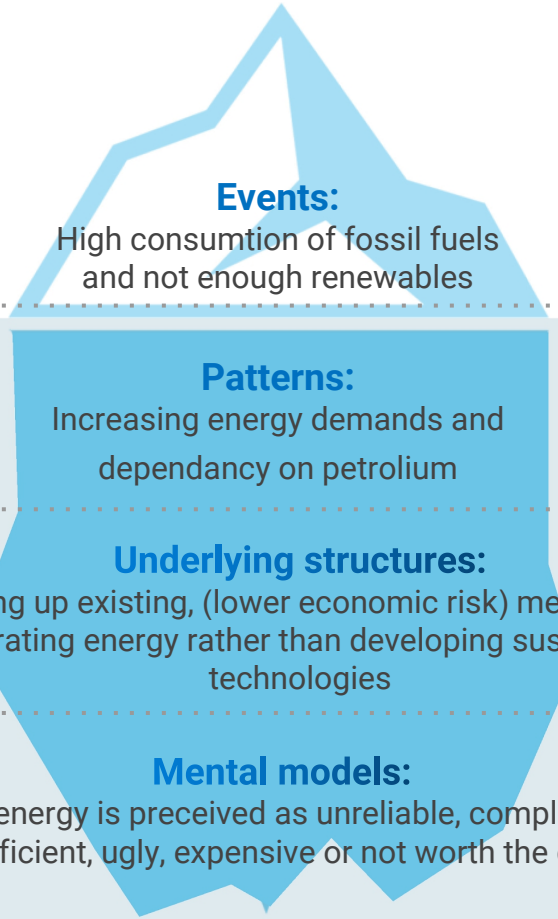
Systems map



- **Building Energy Flows**
  - Where in the system you are intervening?
    - Diffuse lighting and geometry
    - Efficiency / m2
    - Weather fluctuations - ramp rate
    - Embodied energy
    - Use of toxic / rare materials
  - Unforeseen consequences?
    - Higher installation cost and complexity
    - Less direct lighting efficiency
    - Difficulties to keep the system clean
    - Instabilities in the current grid infrastructure
    - More plastic waste

Solar Energy

Iceberg



Events:
High consumtion of fossil fuels and not enough renewables

Patterns:
Increasing energy demands and dependancy on petrolium

Underlying structures:
Scaling up existing, (lower economic risk) methods to generating energy rather than developing sustainable technologies

Mental models:
Solar energy is preceived as unreliable, complicated, inefficient, ugly, expensive or not worth the cost

Where on the iceberg can you place your intervention/thesis topic:

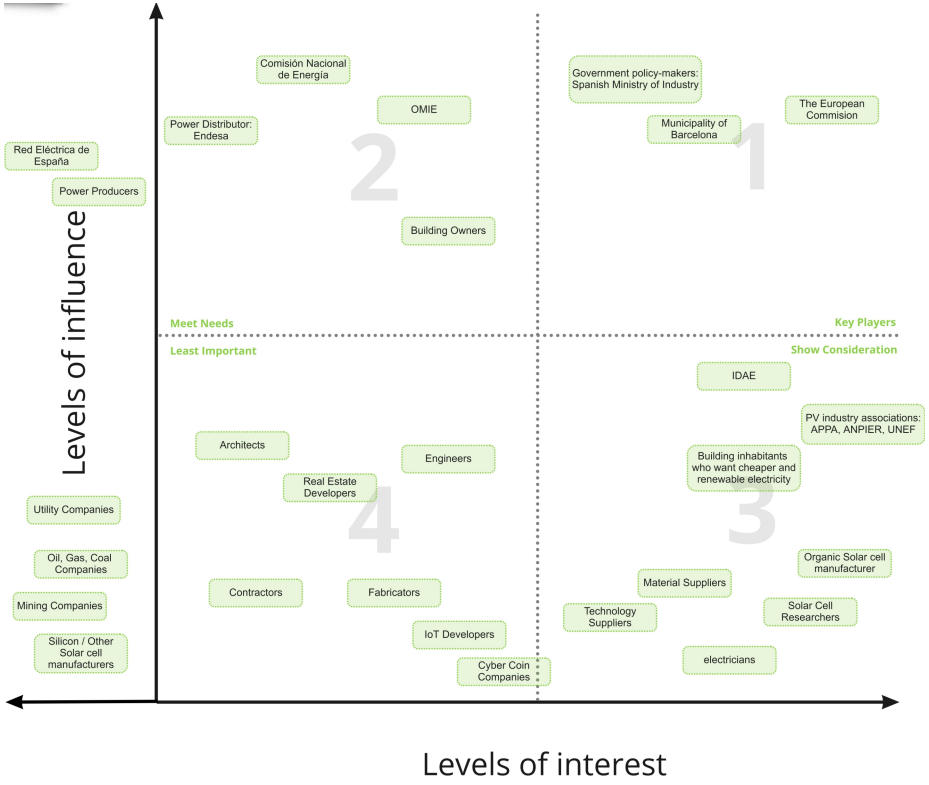
- Underlying Structures

How might you go down one level further.

- Design a simple system
- Energy efficient in relation to cost efficiency
- Nondisruptive integration into the built environment
- Test reliability of the proposed design

Solar Micro Grid Communities

Stakeholders Assessment



GOAL

Build a neighbourhood micro-grid with the solar design in Barcelona

Main hurdles:

Permission to build
Funding
Permission to connect to existing infrastructure

Longlist of stakeholders

Public Utilities Commissions	Building Stakeholders	Suppliers	Other Stakeholders
Spanish Ministry of Industry	Building Owners	Organic Solar Cell manufacturer	Solar Cell Researchers
Municipality of Barcelona	Building Inhabitants	Polymer material suppliers	Power Producers
Government policy-makers	Contractors	Wood Suppliers	Utility Companies
European Union	Real Estate Developers	Prefab Manufacturers	Oil, Gas, Coal Companies
Red Eléctrica de España (TSO)	Architects	Transistor supplier	Cyber Coin Companies
OMIE (Market operator)	Engineers	Battery supplier	Mining Companies
Endesa (Power Distributor)	Electricians	Smart Grid Technology supplier	IoT Developers
MIBEL			PV industry associations: APPA, ANPIER, UNEF
Comisión Nacional de Energía			
IDAE (Instituto para la Diversificación y el Ahorro de la Energía)			

Solar Micro Grid Communities

Influential Stakeholders

Stakeholder	Level of influence	Contribution	Physical	Socio-economic	Political
Spanish Ministry of Industry	2	Decides both the general goals and the design elements of the RES-E promotion policy	NA	Renewable sources of electricity promotion policies (RES-E)	Get agreement to implement solar micro grid, connected to the regular grid, in a neighbourhood in Barcelona
Municipality of Barcelona	1	Building Permits and funding check whether investment proposals meet technical requirements and solve disputes between promoters and the distribution companies	NA	Identify neighbourhoods that will benefit more from cheaper power	Solve dispute with energy producers, distributor and TSO Get permit to build experimental electricity structures
European Union	1	Establishes national targets for each member state on renewable energy generation Several Funding Programmes Available	NA	Find funding through the Horizon Programme	NA
Endesa (Power Distributor)	2	Distributor, Measures final consumption, applies distribution tariffs, control supply points	Connect microgrid to DSO Deal with weather dependency of solar power	Distribution tariff	Get agreement for supplying the microgrid with power when solar is deficient
Building Owners	2	Allow installation / facade retrofitting on buildings	Estimate size of system needed	Overcome competing business case between sustainable energy and fossil fuels	NA

Strategies:

Permission to build:

Make prototype and proof of concept

Make agreement with the city of Barcelona

Funding:

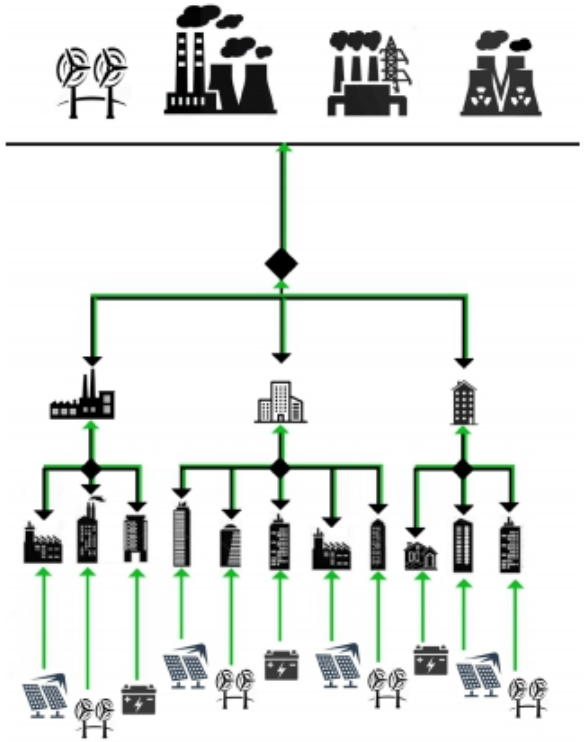
EU initiatives

Permission to connect to existing infrastructure:

Get Certificado de Instalación Eléctrica (CIE)

Install sensors at every level

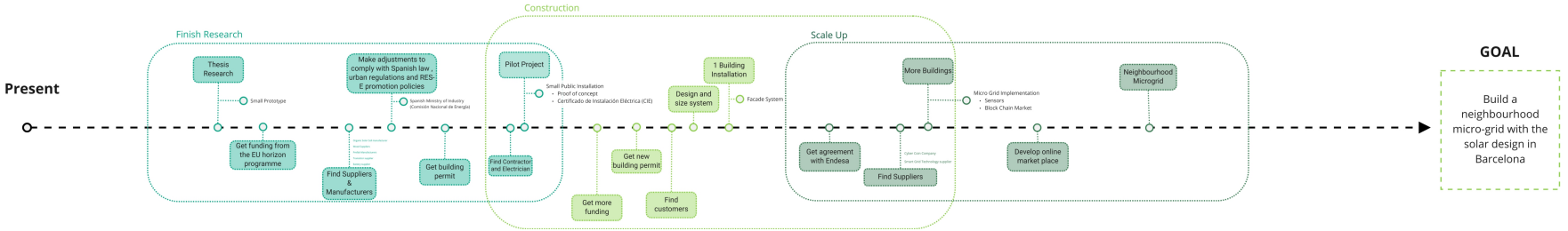
Transfer responsibilities for electricity reliability down the chain



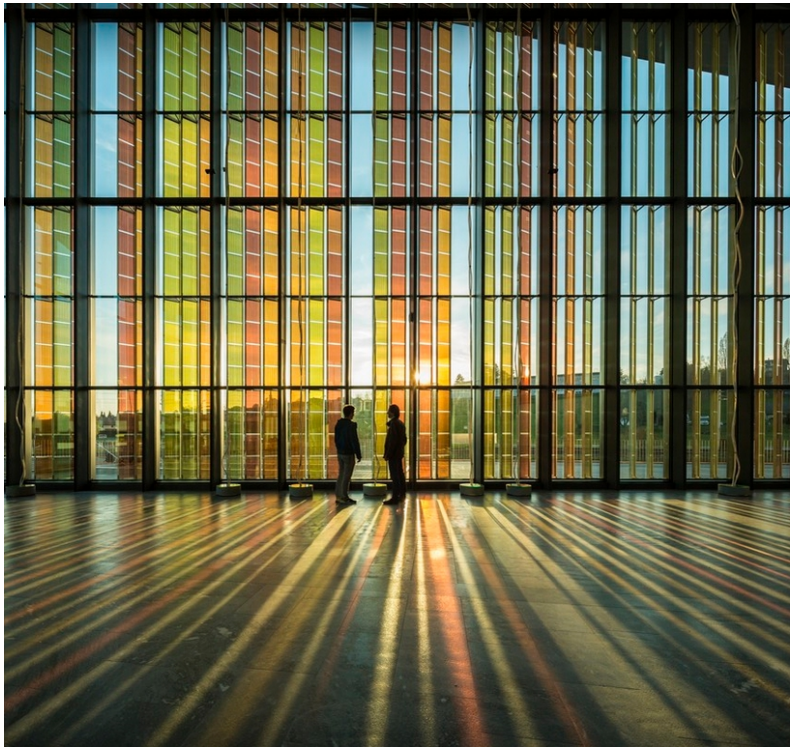
Layered Decentralized Optimization

Solar Micro Grid Communities

Goal



Conclusions



Take aways of the seminar:

- Keep assembly system simple
- Disassembly strategies and Maintenance
- Implications of using plastic materials, Possibilities for Recycling
- Look more into the grid infrastructure and micro / smart grid technologies
- Multitude of companies, commissions and organisations that don’t want to lose money or control
- Complexity within the energy sector makes it difficult to understand who decides/controls what