Solar at the Social Scale: Maintaining community when energy production and consumption is decentralized

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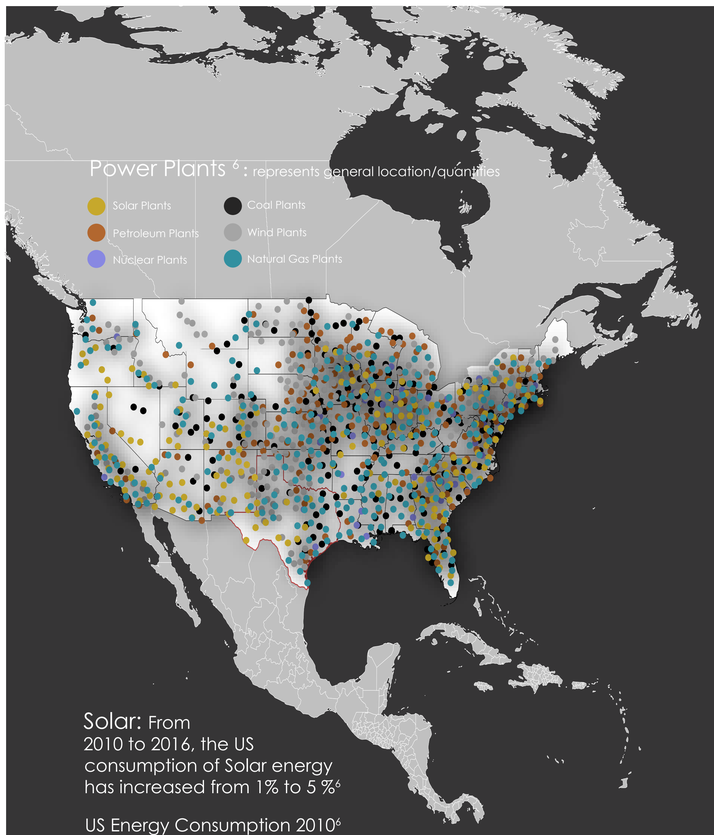
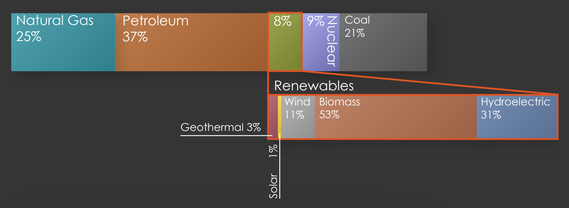
Research Statement:

The degradation of our environment as a consequence of human pollution has created a need for cleaner alternative energy sources. Where large scale companies and infrastructures fail to meet demands for renewables, there is a growing interest in individual scale solutions such as residential solar energy. As growth of these scenarios continues, the increasingly decentralized consumption of energy poses a challenge to the social connections and interdependencies of people in communities. Passive House consultant Bronwyn Barry, and many others, offer the critique that solar largely favors homes that are more remote and have more space to devote to solar technologies. Considering this, one possible solar future is a more sprawled out and disconnected community. What is the future of previously tight knit communities when our interdependencies have changed due to the decentralization of energy? This research serves to ultimately inform design solutions involving the hybridization of communal and private spaces in order to create more efficient and connected micro-communities.

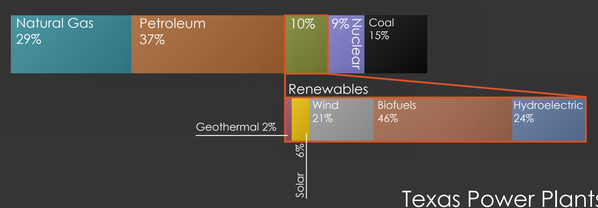


Solar: From 2010 to 2016, the US consumption of Solar energy has increased from 1% to 5 %[6]

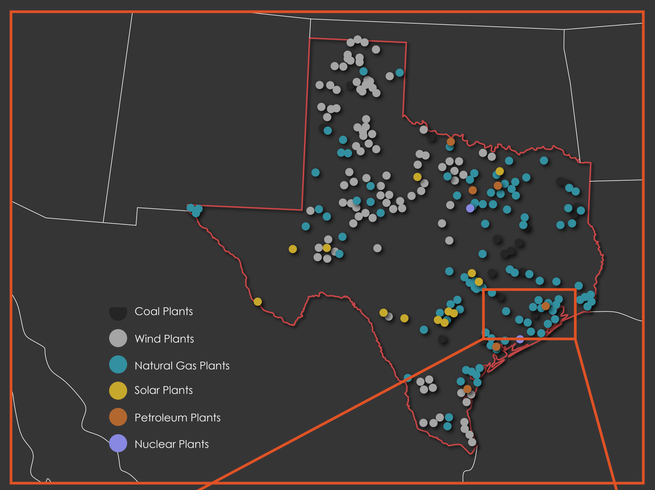
US Energy Consumption 2010[6]



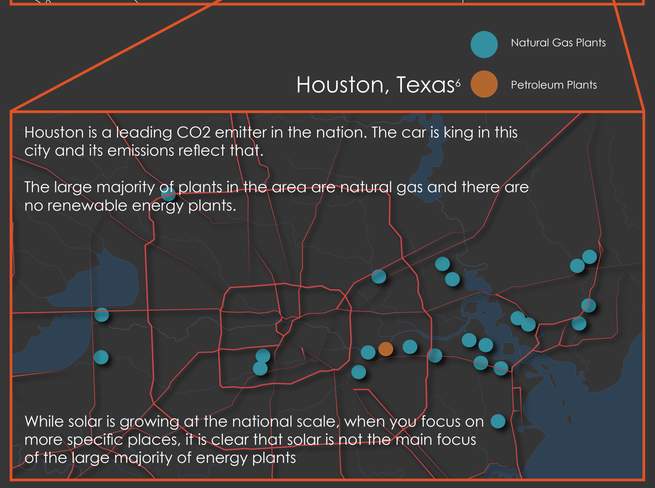
US Energy Consumption 2016[6]



Texas Power Plants[6]



Houston, Texas[6]



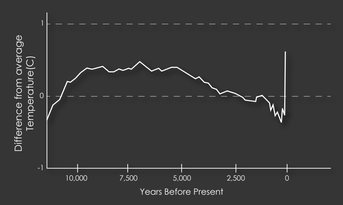
Houston is a leading CO2 emitter in the nation. The car is king in this city and its emissions reflect that.

The large majority of plants in the area are natural gas and there are no renewable energy plants.

While solar is growing at the national scale, when you focus on more specific places, it is clear that solar is not the main focus of the large majority of energy plants

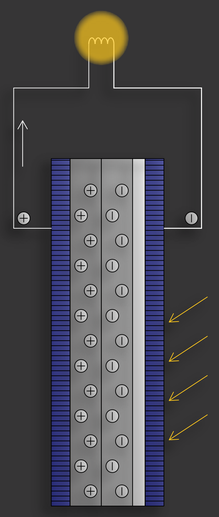
Climate Change

The spike in global temperature correlates with when humans began burning fossil fuels[7]



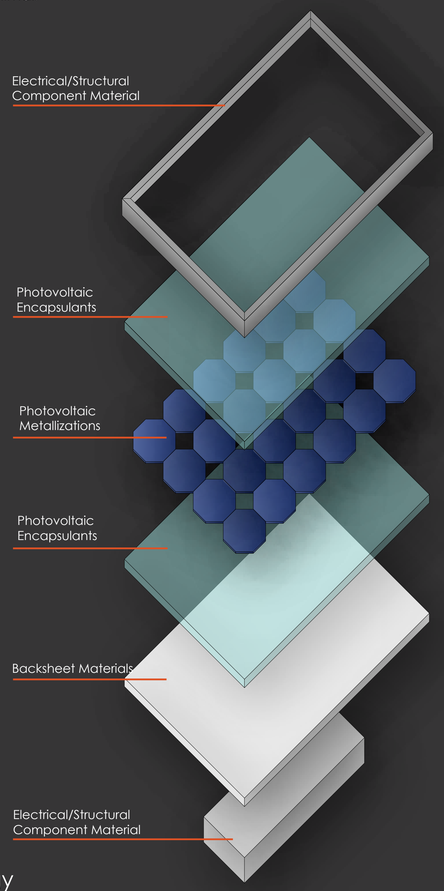
Earth's warming had led to the melting of ice caps and as a result, a rise in the level of the ocean and could potentially threaten the oceans circulation system causing adverse climate consequences

The planet has been shedding sea ice at an average annual rate of 13,500 square miles(about the size of Maryland) since 1979[8]



When photons from the sun hit the silicon of a photovoltaic cell, electrons are released to then flow through a circuit, creating a flow of current and producing electricity

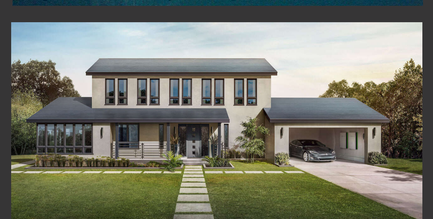
Germany serves as an interesting example of an economy transitioning from conventional energy sources towards renewables. One of people's fears in moving towards renewables is a major loss of jobs. In Germany there has been a decrease in jobs in conventional energy but a significant increase in the amount of jobs in renewables. The net jobs has ultimately been minimal.[10]



A Grassroots response in Clean Energy

Kagoshima Nanatsujima mega Solar power plan[9]

Places of rocky terrain like Japan in which it is difficult to create solar farms have created ocean solar farms[9]



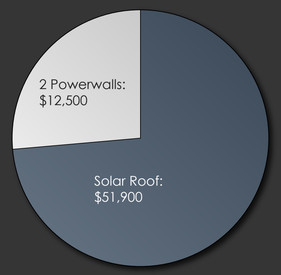
Earlier this year Tesla released their solar roof tiles which allow you to utilize solar energy in conjunction with the Tesla powerwall which has a usable capacity of 13.5 kWh.[1]

Solar panels on individual homes has become a more grassroots response to the issue of energy and emissions. People are able to take control and solve these issues as individuals. It bypasses government obstacles of mass distribution of energy and provides autonomy to the homeowner.

The Price of The Tesla Solar Roof

The average size a the US home is about 2500 square feet.

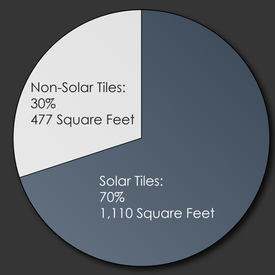
Price Breakdown A quote from Telsa of their solar roof on a 2 story 2500 square foot home with a 1,587 square foot roof[1]



- $17,700 Tax Credit

Total: $46,700

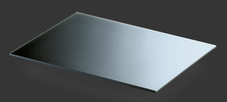
Amount of roof covered in Solar Tiles vs Non-Solar Tiles



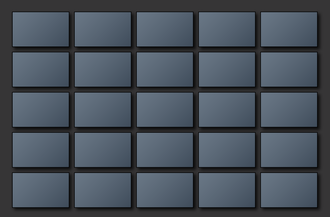
Solar Tiles: $42 per square foot[4]
1,110 square feet = $46,620

Non-Solar Tiles: $11 per square foot[4]
477 square feet = $5,274

Tesla Solar Tile:
1 Tile = 12 Watts[3].



25 tiles = 300 Watts[3]



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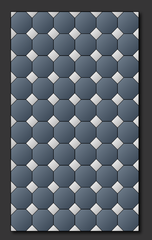
About 1 Solar Panel[2]



Assuming a household consumes under 1500 kWh[6] of electricity per month, a home would need about 50 regular solar panels or 1,250 Tesla tiles to produce all of the energy it consumes.[2]

If 70% of a 1.587 square foot roof is covered in solar tiles, it contains about 1321 Tesla Tiles(14" x 8.65" each[1]) which will create about 1585 kWh per month which should account for all the electricity consumed by the home

Pay Back time of Home: 30 years[1]

Average Household income in US

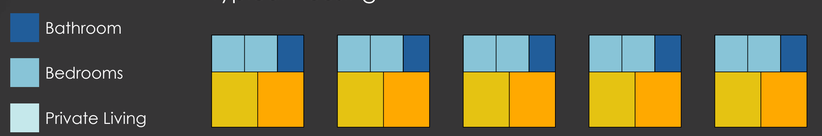
Married Couple: $117,000[5]

Single Person: $65,000[5]

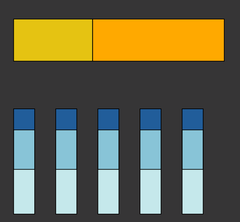
While Tesla has financing options, the large majority of homeowners cannot currently afford a solar system.

Every home has their own fridge, stove, living room, kitchen, and other things making it expensive to go solar.

Typical Housing



Micro Communities



However, if spaces with energy taxing appliances were consolidated into spaces shared amongst small communities while private areas were kept separate, the amount of energy needed for the total community would decrease substantially. The brunt of the cost would be largely diluted and easier to afford while creating a strong sense of community through increased human interaction.

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8. NASA. (2017). NASA Study Shows Global Sea Ice Diminishing, Despite Antarctic Gains. [online] Available at: https://www.nasa.gov/content/goddard/nasa-study-shows-global-sea-ice-diminishing-despite-antarctic-gains [Accessed 18 Sep. 2017].
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10. Clean Energy Wire. (2017). The energy transition's effect on jobs and business. [online] Available at: https://www.cleanenergywire.org/dossiers/energy-transitions-effect-jobs-and-business [Accessed 18 Sep. 2017].