Method - considerations & subheaders

1) Initial exploratory research
   -determine best angle
   -is it realistic to consider costing it out (based on available info)? Will this yield useful data?
   -what examples exist
   -current research on:
      -types
      -construction
      -accessibility
      -barriers
      -environmental impact

2) Examining logistics and feasibility
   -concerns and realistic mitigation strategies

3) Examining cost
   -financial
   -global concerns
   -land use

4) Examining gain
   -energy save
   -resources saved
   -reduction in emissions
   -reduction in fossil fuel use

5) Specific example projection (?) and/or profiles of organizations

https://www.sciencedirect.com/science/article/pii/S0959378023001620
Stock, R. and Sovacool, B.K. (2024). Blinded by sunspots: Revealing the multidimensional and intersectional inequities of solar energy in India. Global environmental change, 84, pp.102796–102796. doi:https://doi.org/10.1016/j.gloenvcha.2023.102796.
https://www.sciencedirect.com/science/article/pii/S0301421522000933
Sovacool, B.K., Barnacle, M.L., Smith, A. and Brisbois, M.C. (2022). Towards improved solar energy justice: Exploring the complex inequities of household adoption of photovoltaic panels. Energy Policy, 164, p.112868. doi:https://doi.org/10.1016/j.enpol.2022.112868.

-solar energy justice

Spatial inequities unevenly distribute both positive and negative solar externalities.•
Interspecies inequities include pollution and toxic waste flows embodied in solar equipment.
•
Temporal inequities include the shifting of solar burdens to future generations.

Impacts of differences in access to solar panels in developing countries

Mostly coal still being used
Not everyone has energy
Carbon footprint will be huge - new solution needed
Easier to change energy now in preparation (instead of fossil fuels)
Cell phone example?

-biggest stumbling block:
-resource access
    -materials, construction
    -weatherproofing more expensive
    -foldout

-reduce cost
-reduce manufacturing costs
-biodegradable materials

Jan 7:
Main hook: impact of reduction
Then
Where do we go from there?
Options:
-what is the cost to do that?
    -challenge: possible issues finding information globally
-looking at small-scale/grassroots/startup options (maybe cool tech, accessibility, etc)
-profile of what is currently being done and how effective/expensive/realistic it is

-initiatives?

https://www.sciencedirect.com/science/article/pii/S2214629621004060
Akter, S. and Bagchi, K. (2021). Is off-grid residential solar power inclusive? Solar power adoption, energy poverty, and social inequality in India. Energy Research & Social Science, 82, p.102314. doi:https://doi.org/10.1016/j.erss.2021.102314.

https://www.sciencedirect.com/science/article/abs/pii/S1364032118301527
Shahsavari, A. and Akbari, M. (2018). Potential of solar energy in developing countries for reducing energy-related emissions. Renewable and Sustainable Energy Reviews, [online] 90(90), pp.275–291. doi:https://doi.org/10.1016/j.rser.2018.03.065.

Solar photovoltaic (PV) can be an appropriate technology for a source of renewable electricity in developing nations especially in remote rural areas where grid extensions are financially or technically not viable. PV can also be used to reduce demand for fossil fuels and associated emissions, including carbon dioxide (CO_2), nitrogen oxides (NO_x) and sulfur dioxide (SO_2). The use of PV systems can reduce 69–100 million tons of CO_2, 126,000–184,000 t of SO_2 (Sulphur Dioxide) and 68,000–99,000 t of $N0_x$ by 2030.

https://www.sciencedirect.com/science/article/abs/pii/S0038092X2200281X
Kumar Singh, A., Prasath Kumar, V.R. and Krishnaraj, L. (2022). Emerging technology trends in the C&I rooftop solar market in India: Case study on datacentre – Retrofit with BIPV by U-Solar. Solar Energy, 238, pp.203–215. doi:https://doi.org/10.1016/j.solener.2022.04.033.

https://www.statista.com/statistics/271748/the-largest-emitters-of-co2-in-the-world/
Tiseo, I. (2021). CO2 emissions by country. [online] Statista. Available at: https://www.statista.com/statistics/271748/the-largest-emitters-of-co2-in-the-world/.

- China: 31.49%
- U.S: 13%
- India: 8.1%
- Russia: 4.81%
- Japan: 2.62%

https://www.ecohedge.com/blog/carbon-measurement-understanding-scope-1-3/
Carbon emissions are measured in tonnes, tCO_2e (tonnes carbon dioxide equivalent)
https://www.c2es.org/content/international-emissions/

World's largest solar farms

https://www.theecoexperts.co.uk/solar-panels/biggest-solar-farms
A single GW could power one million homes in the UK for an hour.

1. Xinjiang solar farm — China

- 5GW capacity
- roughly the same area as New York City

2. Golmud Solar Park — China

- 2.8 GW capacity

3. Bhadla Solar Park — India

- 2.7 GW capacity
- The site covers 14,000 acres, or 56 km2—equivalent to 3% of the entire surface area of London or just under the size of Manhattan (59.1 km2).

Bhadla solar park in India as seen from space – credit Sentinel Hub

4. Mohammed bin Rashid Al Maktoum Solar Park — UAE

- **52,881 acres**
- **2.62GW capacity**

5. Pavagada Solar Park — India

- **13,000 acres**
- **2.05GW capacity**

6. Benban Solar Park — Egypt

- **1.8GW capacity**

7. The Tengger Desert Solar Park — China

- **10,626 acres**
- **1.5GW capacity**

- Can power 600,000 homes

8. Noor Abu Dhabi Solar Power Project — Abu Dhabi

- 1,977 acres and
- 1.2 GW capacity
- Powers 90,000 homes

9. Datong Solar Power Top Runner Base — China

- Once finished it will have a capacity of over 3GW capacity
- Panda Green Energy used dark monocrystalline silicon and lighter thin film cells

10. Jinchuan Solar Park — China

- 1.03 GW capacity

11. Kurnool Ultra Mega Solar Park — India

- 1 GW capacity

12. Yanchi Ningxia Solar Park — China

- 2.5 million solar panels.
- 1GW capacity

13. Villanueva Plant — Mexico

- 754 MW capacity
- Powers 1.2 million homes

14. Kamuthi Solar Power Station — India

- Powers 265,000 homes.
- 648 MW capacity

15. Francisco Pizarro — Spain

- 590 MW capacity
- Powers around 334,400 homes.

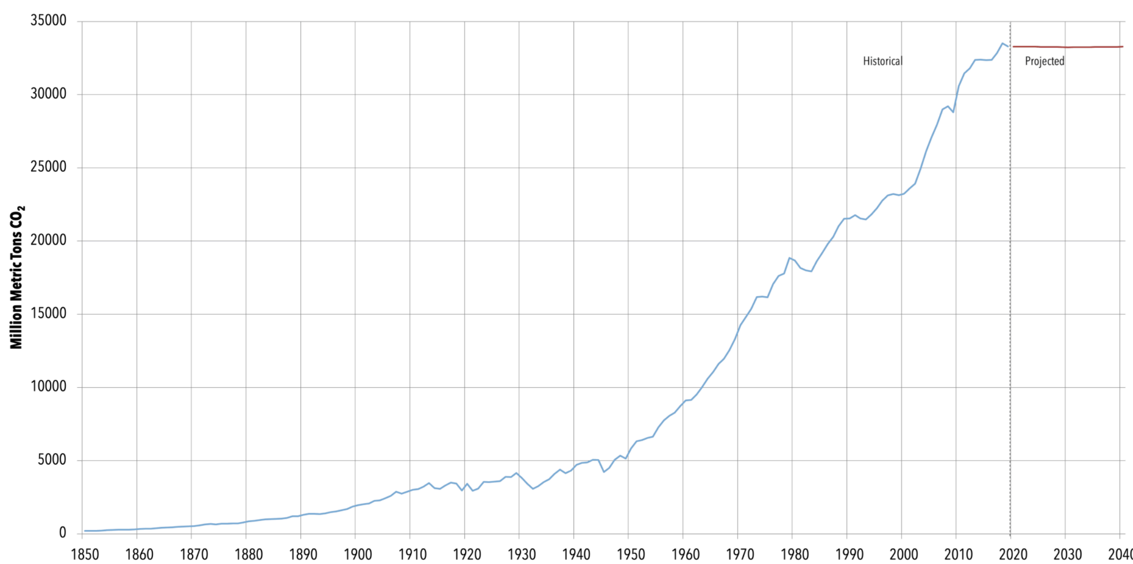
https://www.cbc.ca/player/play/video/9.6685258#:~:text=Scientists%20set%20out%20to%20explore,up%20to%200.13%C2%B0C.

Scientists set out to explore the impact of covering every rooftop on Earth with solar panels.They found that swapping traditional energy sources for rooftop solar could actually cool the planet — lowering global temperatures by up to 0.13°C.

IN the past 3 decades solar panels have seen growth. They now supply 6% of total energy in the world.

They trained AI to find rooftops on satellite imagery. 286,393 km^2 in the world is covered by rooftops. That's about the size of the Philippines. The drop in temperature in the world could be between 0.05 and 0.13 degrees Celsius.

https://www.statista.com/statistics/217265/largest-solar-pv-power-plants-in-operation-worldwide/



https://www.greenmatch.co.uk/blog/countries-with-the-highest-carbon-footprint

1	China	12,667	32.88%
2	U.S	5,057	12.6%
3	India	2,830	6.99%
4	Russia	2,032	4.96%
5	Japan	1,083	2.81%

*Measured in $MtCO^2$
https://www.wri.org/insights/interactive-chart-shows-changes-worlds-top-10-emitters

https://www.worldometers.info/co2-emissions/co2-emissions-by-country/#google_vignette

https://climatetrade.com/which-countries-are-the-worlds-biggest-carbon-polluters/

https://www.investopedia.com/articles/investing/092915/5-countries-produce-most-carbon-dioxide-co2.asp#:~:text=As%20of%202022%2C%20the%20five,India%2C%20Russia%2C%20and%20Japan.

https://www.carbonbrief.org/analysis-no-growth-for-chinas-emissions-in-q3-2024-despite-coal-power-rebound/#:~:text=Defying%20predictions%20of%20slowing%20growth,up%20of%20growth%20changed%2C%20however.

https://www.reuters.com/business/energy/china-power-demand-growing-faster-than-expected-2024-industry-association-says-2024-10-29/
9.9 trillion kilowatt-hours (kWh) consumed in China 2024

Project Structure

Question: Finding out the amount of carbon emissions (tCO2e) we could reduce if the nations with the most emissions cut straight to solar energy. —> And the cost, time for installation and (insert other thing here)

Goal:

We could reduce 591725000 Kilograms of Carbon Dioxide Equivalent if the top 5 emitters stayed with there emissions that they are doing today

$249 dollars for 2 100 -watt monocrystalline IP68 (This may not be the best one)
269.99 dollars for a 550W output 144 cells 21.3% efficiency

591725 Metric Tonnes of Carbon Dioxide

During summer in Beijing there is on average 13h 35m of light in the summer.

Watts x hours divided by 1000 (W to kWh)

If we were to use the LONGi Hi-MO5 solar panel per day on average in beijing we would generate 7.4708315 kWh

We'd need 132 515 369 942 solar panels though if we wanted to generate that in a day. But we don't.

To do that in a year we need 363 055 808 solar panels
Which would cost 98 021 437 618 dollars and 50 cents

That is ninety-eight billion twenty-one million four hundred thirty-seven thousand six hundred eighteen dollars and 50 cents.

542.7 million metric tons of coal was purchased.

121.36 dollars per short tonne
Around 598224348.439 short tonnes
72 600 506 926 dollars and 60 cents in coal without the cost of importing
That's seventy-two billion six hundred million five hundred six thousand nine hundred twenty-six dollars and 60 cents.
That means that we are 25 420 930 692 dollars and 10 cents.*

**This is a purely hypothetical situation. This used the average hours of daylight in summer of Beijing, if the supply of solar panels and prices stayed the same, without the cost of importing/installing and the average price of coal.*

WHAT IS BEING DONE:

https://energysmartcanada.com/solar-grants-incentives-rebates-in-alberta-for-2025/#:~:text=The%20Clean%20Energy%20Improvement%20Program,the%20property%2C%20not%20the%20owner.

This is a Canadian initiative to encourage solar energy and other renewables

https://www.ucsusa.org/resources/environmental-impacts-solar-power

2 tradeoffs of solar implementation are the land use and water use. For utility-scale solar facilities per 1 megawatt they use about 3.5 to 10 acres

https://www.sciencedirect.com/science/article/abs/pii/S1364032111001675

Turney, D., & Fthenakis, V. (2011). Environmental impacts from the installation and operation of large-scale solar power plants. Renewable and Sustainable Energy Reviews, 15(6), 3261–3270. https://doi.org/10.1016/j.rser.2011.04.023

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