Continuous Rooftop Solar Panels with Tilting Systems

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Introduction: Rowhomes and Why

A rowhome is one of a group of residential buildings that shares one or both side walls and a roofline with the structures next door.

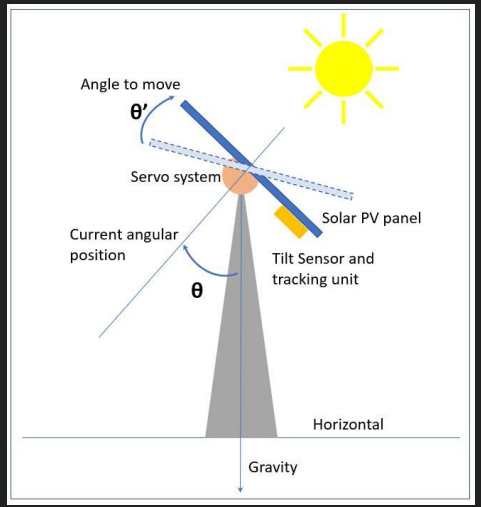
Philly has the highest number of families living in rowhomes in the U.S.

These types of homes have connected rooftops, meaning that having continuous solar panels across them could potentially save a significant amount of money as compared to regular, separated houses.

Concept: Contiguous solar panels for rowhomes with solar tilting systems

- Having interconnected, continuous panels across rowhomes would be much more cost-effective than having independent panel installations.

- Having solar panels with tilt sensors can potentially increase their efficiency by receiving the maximum intensity of sunlight.
- These systems achieve this by angling the solar panel to be perpendicular to the direction of sunlight.
- The system includes tilt sensor, a servo system, and a controller that jointly tilt the solar panel based on the sun's orientation throughout the day.

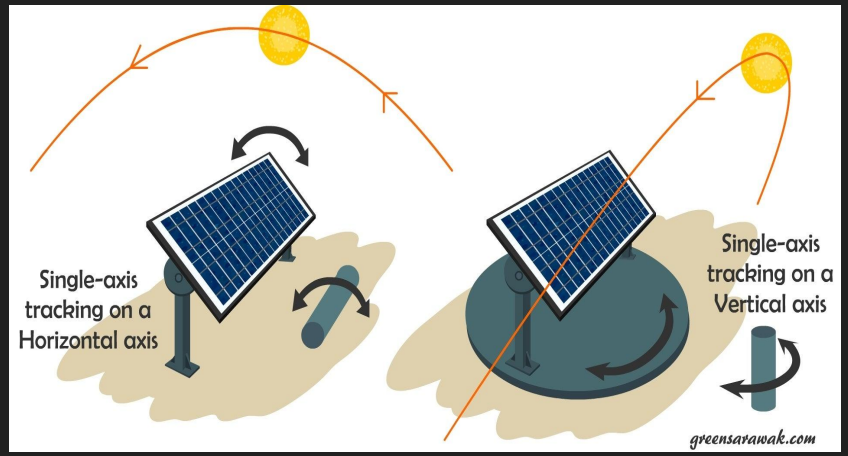


Geographical considerations

- Philadelphia’s grid-style, linear row home areas would make large-scale solar panel installation a very easy and effective way to increase energy efficiency across the entire area. There are also typically no taller buildings or many trees to obstruct sunlight from reaching the panels.

Expenses (Zip: 19135)

- Horizontal Single Axis Tracking
- Labor Cost ~$600 to $1680 per roof
- Row home roof size ≈ 400 sq ft (Zip: 19135)
- Solar panel 5.4 ft x 3.25 ft ≈ 17.5 sq ft
- 15 tracking solar panels cost about $22,125



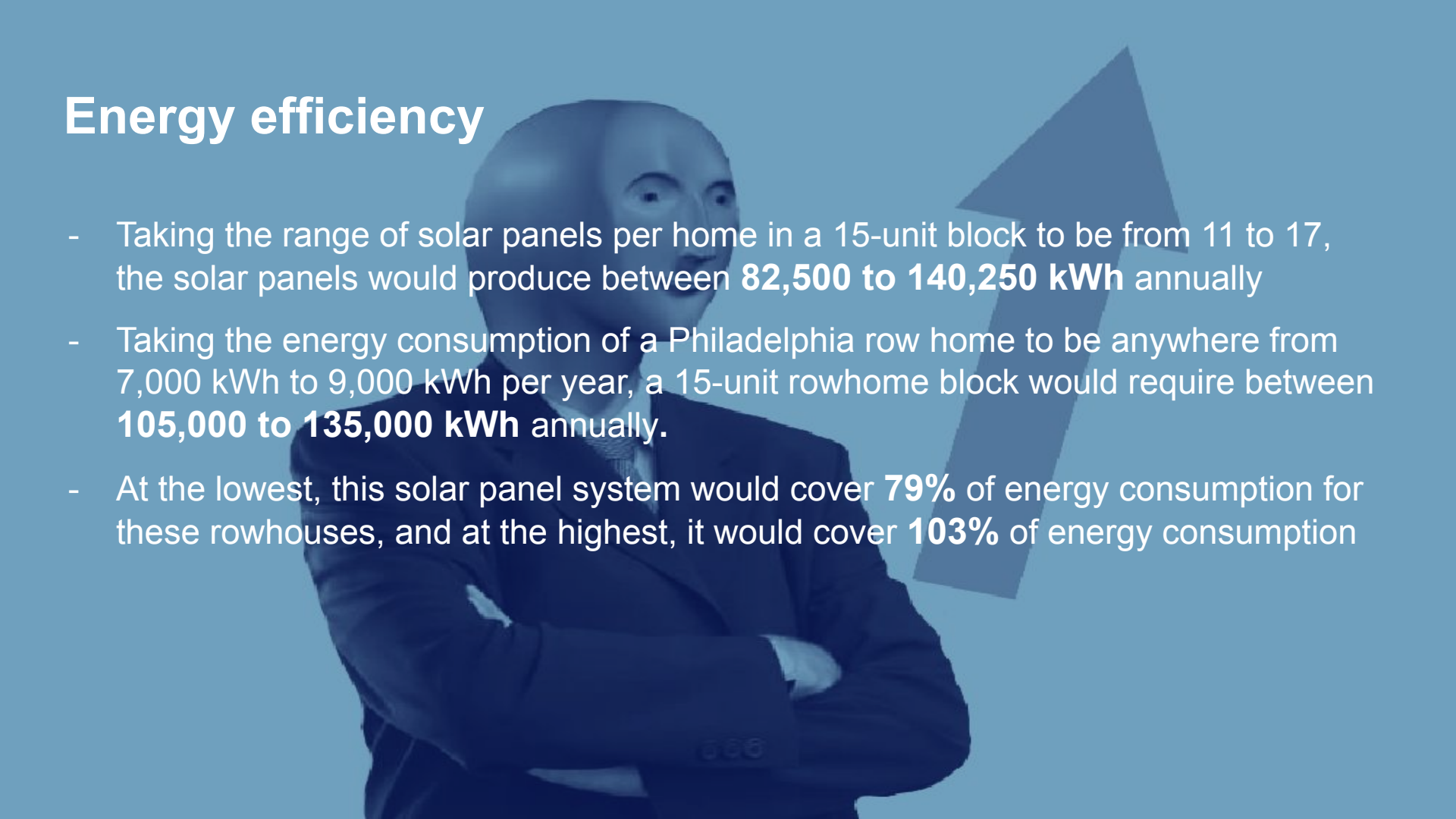
Expenses Calculation (Zip: 19135)

- 15 row home ≈ 6000 sq ft
- Solar panel 5.4 ft x 3.25 ft ≈ 17.5 sq ft
- 11-17 solar panels per row home (15 row homes: 165-255 solar panels)
- Total Cost: $252,375 - $401,325

Solar Panels After Installation

- Solar panels last 25-30 years
- Little maintenance required
- It rains almost ⅓ of the days

Energy efficiency



- Taking the range of solar panels per home in a 15-unit block to be from 11 to 17, the solar panels would produce between **82,500 to 140,250 kWh** annually
- Taking the energy consumption of a Philadelphia row home to be anywhere from 7,000 kWh to 9,000 kWh per year, a 15-unit rowhome block would require between **105,000 to 135,000 kWh** annually**.**
- At the lowest, this solar panel system would cover **79%** of energy consumption for these rowhouses, and at the highest, it would cover **103%** of energy consumption

Carbon Reduction

- Average U.S household emits 48 metric tons of CO_2 per year
  - 15 Rowhomes → 720 metric tons per year
- Over 25 years, 15 households would produce 18000 metric tons of CO2
- Solar PV == 50g of CO_2 per kWh Vs. Coal == 975g of CO_2 per kWh
  - 20x cleaner
- Production and Installation
  - 8.2 metric tons of CO_2 for 15 row homes
- Decrease of 77 metric tons of CO_2 emissions per year

Government Incentives

- **Solar Rebate**
  - Commercial: $ 0.1 per watt
  - Residential: $ 0.2 per watt
  - 100,000 threshold and Scalability
- **Pennsylvania net metering policy**
  - Sell excess solar electricity back to the grid
- **Solar Renewable Energy Certificates (SRECs)**
  - Credits hold value of $30
  - A credit is created for every 1000 kWH produced
- **Investment Tax Credit (ITC)**
  - Reduce Cost of PV solar system by 26 percent
- **Solar Savings Grant Program**
  - Targeted at low and moderate income homes

Unexplored Problems

- Row home historic issue with roof damage
  - $6000-$7000 to re-roof per home
- Having a whole block agree on this
- How to distribute energy from system equitably to each home
  - Would their bills all look the same?
- Blinding reflection

QUESTIONS?