**SUMMARY of SOLAR 101 presented on DEC 19**(drafted by ZOOM AI; re-org by Steve Miller)

Michael Winka presented a detailed overview of solar energy systems, discussed the process of installing solar panels on a single-family home, and explained the concept of the "duck curve" in relation to solar energy generation.

The team discussed the feasibility and cost-effectiveness of installing solar panels on a 27-year-old roof, the evolution of solar panel technology, and the potential of solar energy in the United States. They also explored the financial benefits of installing a solar system, the availability of solar installation data, and the use of solar panels to charge electric vehicles. Lastly, they introduced the New Jersey Electrification Coaching Network.

**RESPONSIBILITIES OF HOMEOWNER INSTALLING SOLAR**

Research and possibly reach out to installers listed on the BPU's solar installation data spreadsheet for their area. An alternative is the excellent source EnergySage: <https://www.energysage.com/local-data/solar-rebates-incentives/nj/> or <https://www.energysage.com/home2/>

Consider the cost and payback period of different financing options (cash upfront, loan, solar lease, power purchase agreement) for their solar installation.

Homeowner/installer obtain solar permits from multiple agencies (starting with local community building enforcement), line drawing submissions/ approvals, and subsequent inspections and sign off by licensed electricians, even if the homeowner is self-installing.

 **SUMMARIES - CHAPTER BY CHAPTER**:

**RECORDING PART 1**

**Solar Panel Installation Process Discussed**Michael discussed the process of installing solar panels on a single-family home, emphasizing the importance of checking with local authorities and the utility company for approval. He explained that solar panels can only offset energy costs, not demand charges, and that the size of the solar system should match the homeowner's energy usage. Michael also highlighted the need for a warranty, a licensed electrician, and a home improvement contractor for installation. He mentioned the interconnection process with the utility system and the importance of a building permit. Lastly, he touched on the potential for energy efficiency improvements before installing solar panels and the need to consider the age and condition of the roof.

**Solar Energy Generation and Grid Integration**Michael discussed the process of solar energy generation, from solar panels to inverters and back to the grid. He explained the concept of net metering and the use of a production meter to calculate the incentive for solar energy production. He also touched on the need for grid modernization, particularly with the integration of more inverter-based systems, and the potential for smart grid forming inverters. Michael highlighted the challenges posed by the 'Duck Curve' and the need for integrated distribution planning to manage the increased electricity demand from electrifying buildings and transportation. He concluded by explaining the process of solar panel connection, including the use of a combiner box and the conversion of DC power to AC power.

**Exploring Solar Energy Generation Patterns**Michael discussed the concept of the "duck curve" in relation to solar energy generation. He explained that solar power starts to generate when the sun rises, peaks during the day, and declines towards sunset. He also introduced the term "peak sun hours," which refers to the number of hours during the day that the sun provides a thousand watts per meter squared to hit the panels. Michael further discussed how the amount of solar energy generated varies throughout the year, with more energy generated during the summer months and less during the winter months. He also mentioned the importance of considering the load curve when building a solar system, as the load is higher in the winter months

**RECORDING PART 2**

**Solar Panels Installation and Battery Storage.** **(slide 34- 1st QUESTIONS)** During Q&A, Michael discussed the feasibility of installing solar panels on a 27-year-old roof, suggesting that the roof might need to be re-shingled before installing panels. He also explained the process of calculating the size of solar panels that can fit on a roof, considering factors such as the roof's direction, area, and slope. Michael also addressed the issue of battery storage for excess energy, stating that while there are no current state incentive programs for batteries, there is a federal tax credit for investment in batteries. He further explained the connection between solar panels and electric vehicles, stating that the panels are designed to generate enough electricity to meet the vehicle's needs, along with the household's. Anshul asked about the use of micro-inverters for individual panel inputs, which Michael confirmed as a viable option. Jeffrey raised a question about the condition of his roof, to which Michael responded that a 27-year-old roof likely needs re-shingling before installing solar panels. Pat confirmed that the presentation slides would be shared with all registrants.

**Solar Panel Evolution and Inverters (Slide 35)**Michael discussed the evolution of solar panel technology, highlighting the increase in panel efficiencies from 6-8% in the late 90s to over 20% today. He explained that panel efficiencies affect the size and cost of solar installations, with higher efficiency panels being more expensive but allowing for smaller installations. Michael also compared different types of inverters, such as string inverters, microinverters, and power optimizers, noting that microinverters and power optimizers are more expensive but offer better performance in shaded conditions. He concluded by mentioning the impact of supply and demand on panel costs, with more efficient panels becoming less expensive due to increased production.

**Solar Energy Potential and Efficiency (slide 54)**

Michael discussed the solar energy potential in the United States, emphasizing that solar panels can be installed on rooftops without occupying large farmland areas. He explained how the efficiency of solar panels affects the amount of energy produced, with higher efficiency panels requiring less space to generate the same amount of energy. Michael also mentioned the role of PJM, a transmission system that can distribute electricity across the United States. Jon raised a question about the cost-effectiveness of replacing old solar panels with new, more efficient ones, and Michael suggested that with the 30% investment tax credit and net metering, it could be cost-effective.

**Solar Panel Installation and Management 25:21 (Slide 61 Questions; Recording Part 2)**
Michael, Jon, Pat, Jeffrey, Anshul, and Stephen discussed various aspects of solar panel installation and energy management. Michael explained that utilities may rush through applications and that timing plays a crucial role in decisions like adding more solar panels or an electric vehicle. He also clarified that during a blackout, solar panels cannot directly power a home, requiring a transfer switch and batteries. Jeffrey inquired about Tesla's solar tiles, and Michael advised doing research on their efficiency and cost. Stephen, a DIY enthusiast, asked about installing solar panels in his yard, and Michael advised consulting the zoning board and a contractor for a suitable system. The team also discussed the challenges of retrofitting solar systems and the importance of inspections and permits.

**Conducting Energy Analysis for Solar Panels (slide 62)**Michael discussed the importance of conducting an energy analysis to determine the amount of energy needed for a home. He suggested using free estimates from utilities and their calculators to gather information about energy usage and costs. He also explained how to use these tools to calculate the required solar panel size and energy generation. Michael emphasized the need to consider factors such as the angle and direction of the solar panels, the type of heating and cooling systems, and the overall energy efficiency of the home. He concluded by suggesting that efficiency measures, such as using more efficient air conditioners, could help reduce the need for solar panels.

**Solar System Financial Benefits Discussed (slide 74)**Michael discussed the financial benefits of installing a 7 kW solar system. He explained that the total cost of the system, including installation and incentives, is approximately $14,700. The system generates around $11,475 in incentives over 15 years, significantly reducing the initial cost. The simple payback period is less than 6 years, and the return on investment is 17%. Michael also mentioned the availability of financing options such as solar leases, power purchase agreements, and home equity loans. He emphasized the importance of hiring a reliable solar installer.

**Solar Installation Data and Costs 50:30 (Recording Part 2)**Michael discussed the availability of solar installation data for every municipality in New Jersey, including residential customers, on the BPU website. He suggested that this data could be used to identify solar installers and their satisfaction levels. Michael also mentioned several websites, such as Energy Sage and Solar Review, that provide information on solar installers in a specific area. He emphasized the importance of getting quotes from multiple installers to understand costs, using the example of a range of $2 to $7 per watt. Lastly, he mentioned that he had more slides on storage, but planned to hold a separate webinar on the topic.

**Solar Panels for Electric Vehicles 54:30 Questions on Slide 93 (part 2)**Jeffrey and Michael discussed the use of solar panels to charge electric vehicles (EVs). Michael clarified that no special equipment is needed, but a charging point is required. The amount of solar panels needed depends on the energy used, including EV charging. He also explained that net metering allows for the storage of electrons on the grid during the day, which can be used at night. Steve added that a significant portion of the grid is supplied at night by nuclear power, which is GHG-free. Kimi pointed out a disconnect between the theoretical and practical aspects of grid energy handling. The team agreed to further discuss the practical implications of these concepts.

**New Jersey Electrification Coaching Network 1:00:59** **(part 2)**In the meeting, Pat Miller introduced the New Jersey Electrification Coaching Network, which officially launched in November. The network has grown to 18 coaches, with Pat being a new coach. Pat encouraged attendees to apply for a coach at <https://njecn.substack.com/> if they were considering electrification projects for their homes. (See [QandA-CHAT](https://climate.smiller.org/50x30/building-electrification/2024-12-19-solar-training/Q%26A-CHAT.docx) for details) Steve thanked Mike Winka for his thorough presentation on solar, and Michael agreed to share his presentation slides.

NEXT STEPS

1. Steve to share the AI-generated summary and action items

2. Homeowners use BPU solar installation data on recent local installations, to seek installer reviews, and contact installers listed on the BPU's solar installation data spreadsheet for their area. An alternative is the excellent source EnergySage: <https://www.energysage.com/local-data/solar-rebates-incentives/nj/> or <https://www.energysage.com/home2/>

3. Homeowners consider the cost and payback period of different financing options (cash upfront, loan, solar lease, power purchase agreement) for their solar installation.

4. Homeowners (installers) require a solar permit from multiple agencies (starting with local community building enforcement), line drawing submissions/ approvals, and subsequent inspections and sign off by licensed electricians. Homeowners must obtain these, even if they are self-installing.