

An Analysis of the Economic Value of Residential On-site Solar Power and Electric Vehicle Chargers

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Overview

Research Goal

To analyze the market value of on-site solar power and electric vehicle chargers in the residential market

Expected Benefits of Results

- Provide helpful information to homeowners considering installing on-site solar power and electric vehicle chargers
- Encourage future incentives for the installation of on-site solar power and electric vehicle chargers
- Catalyze the adoption of on-site solar power and electric vehicle incentives in the residential market

Research Questions

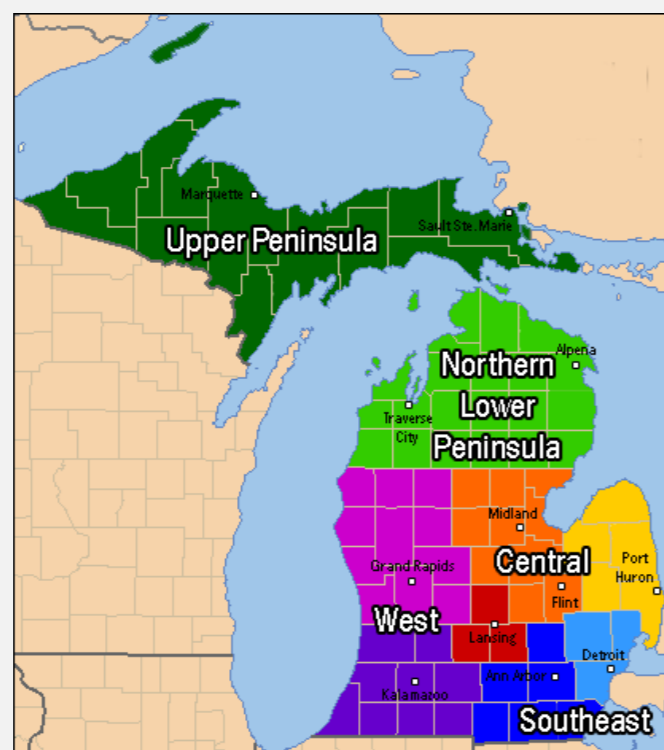
Question 1: Are real estate agents generally knowledgeable about on-site solar power and electric vehicle chargers?

Question 2: What perspective do real estate agents convey to their clients about the benefits or drawbacks of on-site solar power and electric vehicle chargers?

Question 3: What is the availability and demand of on-site solar power and electric vehicle chargers in the residential market in Michigan?

Question 4: How do(es) on-site solar power and electric vehicle chargers affect the market value of homes in Michigan?

Market: Michigan residential real estate



Methodology

Method

Survey: Real Estate agents throughout the state of Michigan were surveyed to glean their knowledge, trends, and perspective toward on-site solar power and electric vehicle chargers in the residential market.

Process

1. Assessed availability of information for consumers considering investing in on-site solar power and electric vehicle chargers on the value of these features in the residential market
2. Developed survey to distribute to real estate sales agents to gauge the market perception from front-line professionals
3. Collected email addresses of real estate agents in Michigan and sent emails with a link to the survey
4. Analyzed results



Qualitative Information

Semantics
Opinion
Perception
Knowledge
Trends
Challenges

Quantitative Information

Experience
Sales
Dollar value
Demand
Availability
Demographics

Result

The market value – perspective of real estate agents

Demographically, the random population of respondents was primarily 55 or older (60%), educated with a Bachelor, Graduate, or Professional degree (81%), and earned \$100,000 or more annually (83%).

KNOWLEDGE

- 75% believe solar power increases the market value of a home
- 83% believe solar irradiance in the US is average to good
- 14% do not believe solar PV decreases greenhouse gases
- No one disagreed that majority of electric vehicle owners do most charging at home
- No one disagreed that ability to charge overnight requires upgrading to Level II charger
- No one indicated any idea of cost to install Level II charger

VISION

- 66% believe solar power with the battery backup is a reliable source of electricity
- 24% were neutral toward whether solar power should be properly analyzed during appraisal
- Only 27% feel confident in ability to market a home with solar power
- 48% see electric vehicles as the way of the future or promising but with too many issues still
- 32% disagreed that EV chargers lead to increased home value
- 26% disagreed that installing an electric vehicle charger is beneficial in the long run

DECISION

- 75% do not know whether insurance covers solar panels
- 25% feel solar power is not a valuable investment
- 25% are apprehensive about complexities of solar feature
- 16% would deter clients from solar due to perceived maintenance
- 35% believe that market value of homes with EV chargers will increase
- 35% believe market value of EV chargers is limited to small percentage who drive EVs
- 61% believe installing EV charger would be burdensome

Evaluation of the Electric Vehicle-to-Grid Service in a Wholesale, Day-Ahead Electricity Market in Japan

Energy and Environmental Systems Laboratory, Kyushu University
with Dr. Hooman Farzaneh, Mohamed Suliman, and Nie Zifei



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Overview

Research Goals

To evaluate the potential for electric vehicle-to-grid service in Japan

Expected Benefits of an Electric Vehicle-to-Grid Service Model

- Reduce peak demand
- Use electric vehicle batteries as an asset
- Reduce payback period of residential solar photovoltaic arrays

Research Questions

Question 1: How does the availability of solar photovoltaic energy vary throughout the regions in Japan, the time of year, and the time of day?

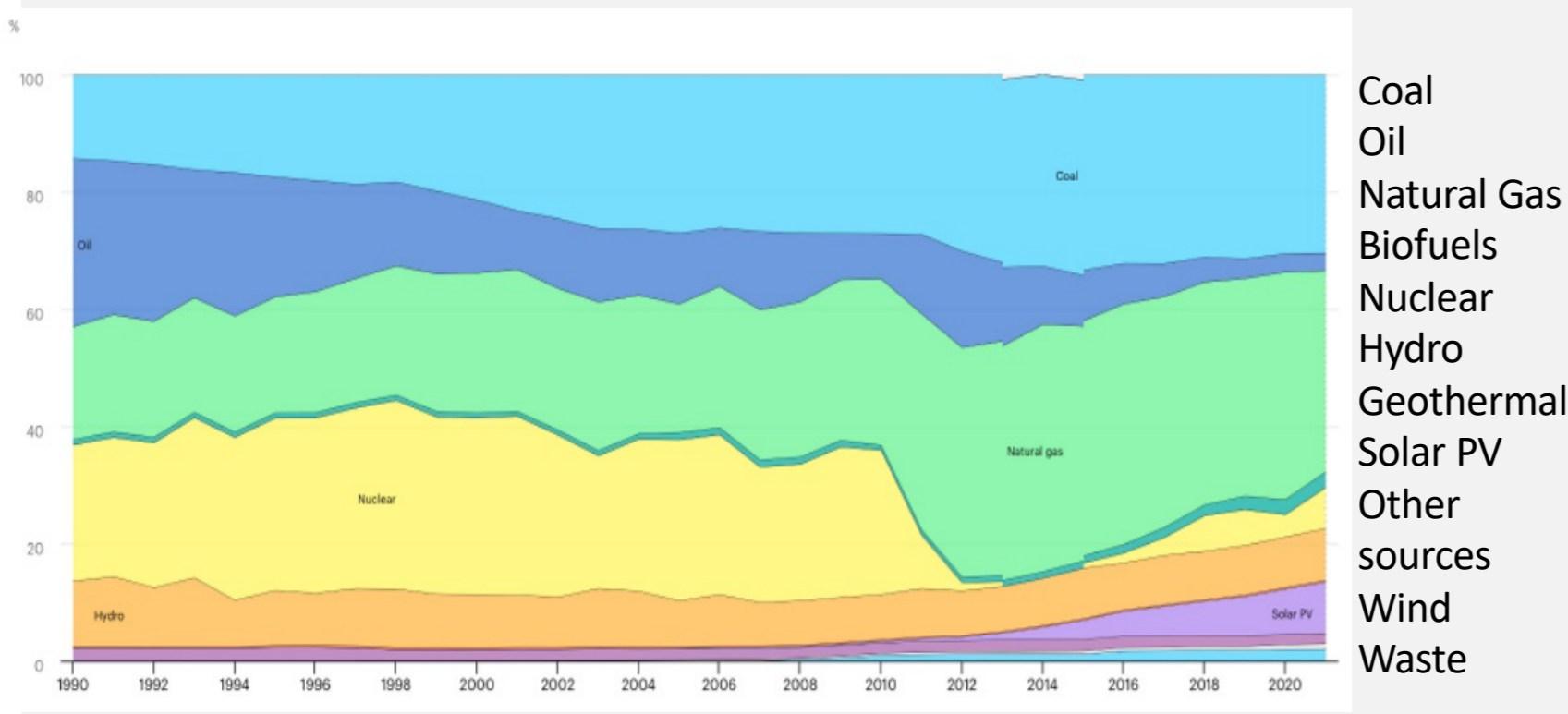
Question 2: What is the historical price of electricity in Japan?

Question 3: What is the daily electricity demand for a typical Japanese family?

Question 4: How do traffic conditions and the weather affect the energy efficiency of electric vehicles?

Market: Japan Electric Power Exchange (JEPX)

- Nine Regions – Tokyo, Kansai, Kyushu, Tohoku, Hokuriku, Shikoku, Hokkaido, Chubu, Chugoku
- Day-ahead market price



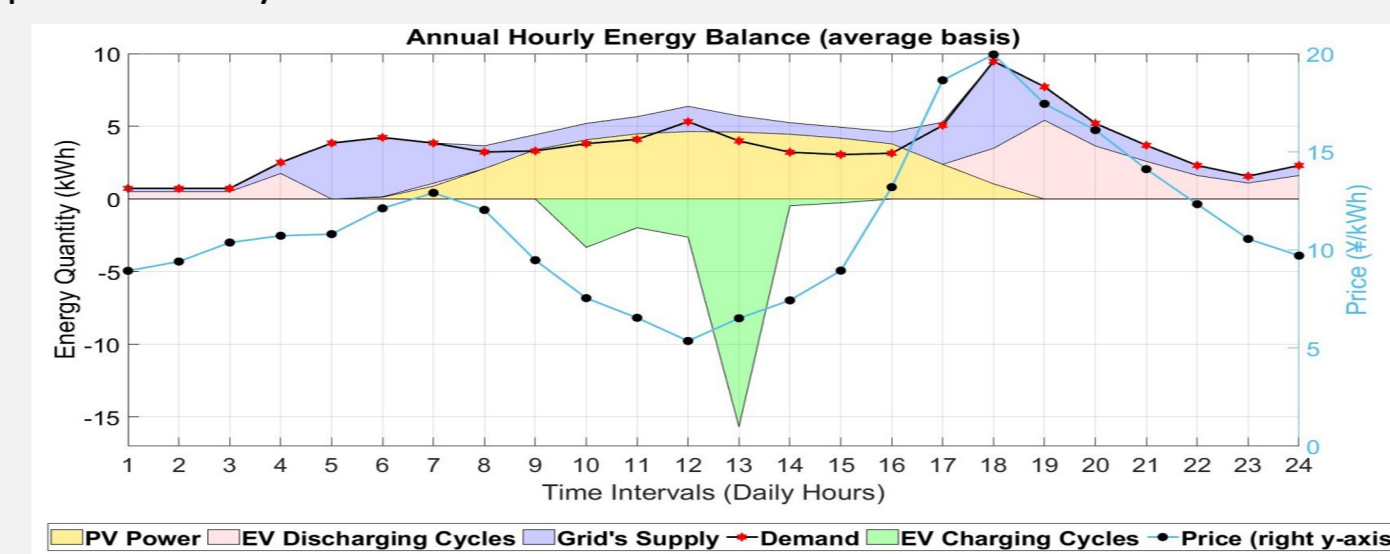
Methodology

Method

Residential cost-benefit assessment segmented by nine Japanese regions

Process

1. Gathered data on hourly solar availability for typical meteorological year (TMY)
2. Gathered data from JEPX for historical hourly day-ahead market price for one year for each of the nine regions
3. Analyzed expected hourly electricity use based on daily activities of the typical Japanese family



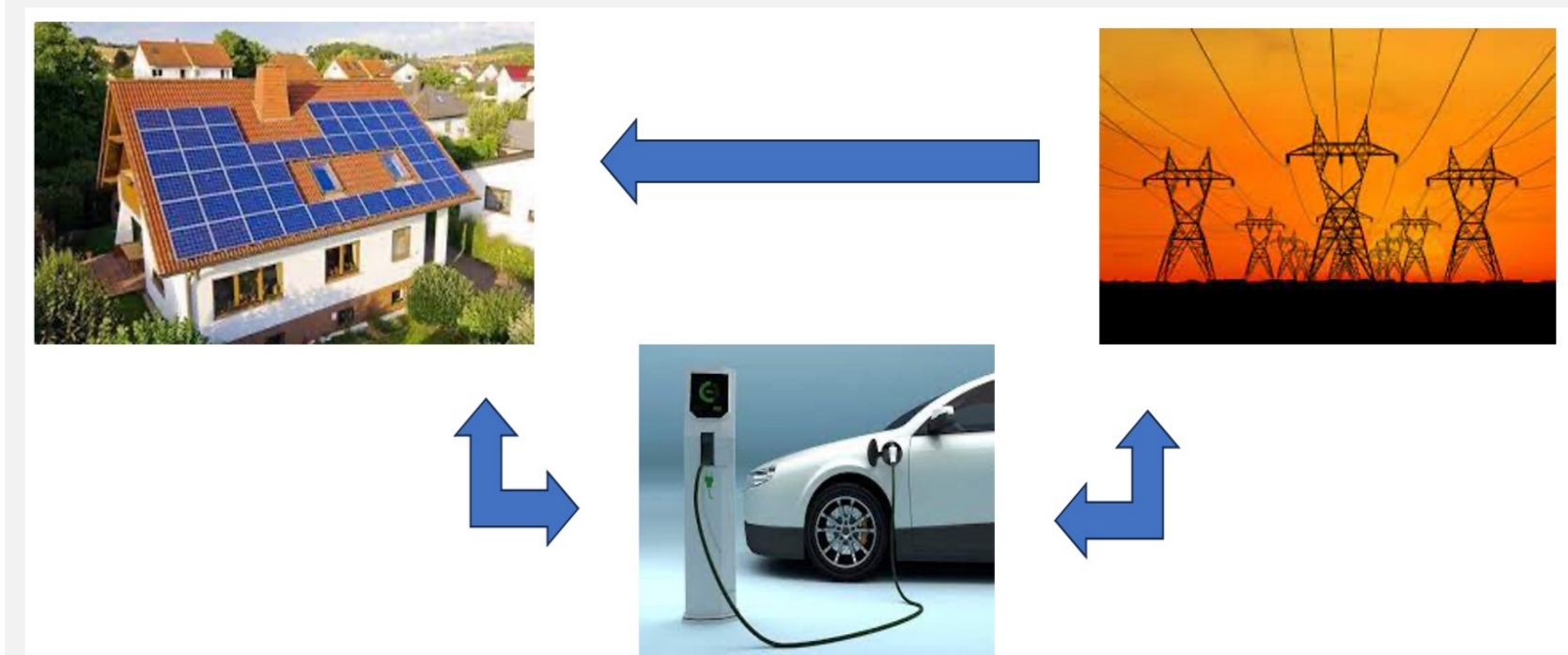
4. Demonstrated various driving conditions in laboratory simulation
 1. Heavy traffic, sunny sunrise
 2. Moderate to heavy traffic, light rain
 3. Light to moderate traffic, sunny night
 4. Light and smooth traffic, sunny sunset
 5. Moderate traffic, sunny
 6. Smooth traffic, heavy rain night
5. Created Excel model integrating hourly data on solar availability, price, and demand



Result

Electric vehicle-to-grid service has economic potential

- Co-benefits to employing sustainable energy
- Helps to manage peak demand
- Revenue source for electric vehicle owners with on-site solar power



Capital costs are RECOVERED

- Net present value becomes positive after 15 years

Investments become PROFITABLE ASSETS well before efficiency degrades

- Investment value surpasses \$1 MILLION after 19 years

Payback period is REDUCED to a timeframe well within the productive life of the investment

- Bidirectional charging reduced the payback period of investing in a 10kW rooftop solar system and the bidirectional charger necessary to make it possible from 32 years to 13 years

Production limitations, along with zero-price energy, are offset by VALUE-ADDED battery storage

FINANCIAL FEASIBILITY OF SOLAR POWER AND ELECTRIC VEHICLE CHARGERS IN THE RESIDENTIAL MARKET

Center of Leadership Development in Built Environment Sustainability

Eliza Searles, Third Student Cohort

Facilitated by Louisiana State University, Supported by the National Science Foundation



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