Social Acceptance of New Energy Technology in Japan: CCUS and Hydrogen Energy

Kenshi Itaoka
International Institute for Carbon-Neutral Energy Research
Kyushu University

November 24, 2020

Energy Infrastructure:
Public Acceptance

Webinar organized under the auspices of the
IEA Experts’ Group on R&D Priority-setting and Evaluation (EGRD)
Contents

- The three aspects of social acceptance of new technologies
- Status of awareness and deployment:
  - Hydrogen energy technology and carbon dioxide capture, utilization and storage (CCUS)
- Socio-political acceptance
- Community acceptance
- Market acceptance
- Conclusion
The three aspects of social acceptance of new technologies

**Socio political acceptance**
- Of technologies and policies
- By the public
- By key stake holders
- By policy makers

**Community acceptance**
- Procedural justice
- Distributional justice
- Perceived risk (cost) and benefit
- Trust

**Market acceptance**
- Consumers
- Investors
- Intra-firm

Note) This figure is developed based on Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Energy policy, 35(5), 2683-2691.
Status of awareness and deployment
Awareness about H₂ and fuel cell technology and CCS

Q: Do you know about the technologies below?

- **1 Energy saving device**
  - Know it very well: 6.6%
  - Know it to some extent: 27.9%
  - Heard it before: 48.1%
  - Never heard of it: 17.4%

- **2 Fuel efficient vehicle**
  - Know it very well: 14.2%
  - Know it to some extent: 47.9%
  - Heard it before: 33.5%
  - Never heard of it: 4.4%

- **3 Fuel Cell Vehicle (FCV)**
  - Know it very well: 10.9%
  - Know it to some extent: 39.9%
  - Heard it before: 39.8%
  - Never heard of it: 9.4%

- **4 Nuclear energy**
  - Know it very well: 11.7%
  - Know it to some extent: 46.6%
  - Heard it before: 35.8%
  - Never heard of it: 5.8%

- **5 Biomass energy (Energy utilizing residue)**
  - Know it very well: 6.4%
  - Know it to some extent: 33.1%
  - Heard it before: 44.6%
  - Never heard of it: 15.8%

- **6 Absorbing/fixing CO₂ by planting trees**
  - Know it very well: 7.1%
  - Know it to some extent: 31.3%
  - Heard it before: 41.0%
  - Never heard of it: 20.6%

- **7 Solar energy**
  - Know it very well: 16.4%
  - Know it to some extent: 48.6%
  - Heard it before: 30.8%
  - Never heard of it: 4.2%

- **8 Carbon dioxide Capture & Storage: CCS**
  - Know it very well: 13.5%
  - Know it to some extent: 39.0%
  - Heard it before: 44.7%
  - Never heard of it: 5.4%

- **9 Wind energy**
  - Know it very well: 12.0%
  - Know it to some extent: 47.7%
  - Heard it before: 34.9%
  - Never heard of it: 5.4%

- **10 Hydrogen station**
  - Know it very well: 8.0%
  - Know it to some extent: 33.2%
  - Heard it before: 43.8%
  - Never heard of it: 15.0%

- **11 Fuel Cell for household**
  - Know it very well: 7.9%
  - Know it to some extent: 33.7%
  - Heard it before: 43.4%
  - Never heard of it: 15.0%

(N=5000) 0% 20% 40% 60% 80% 100%

1 Know it very well 2 Know it to some extent 3 Heard it before 4 Never heard of it

Source: Public survey conducted by Kyushu University in 2019

- **H₂ stations and FCVs are relatively well known to the public**
- **Almost half of the public have never heard of CCS**
Deployment status of hydrogen and fuel cell technology:

- The deployment of FCVs and H2 stations has a chicken and egg relationship.

- The spread of fuel cell vehicles (FCV) is delayed.
- The spread of H2 stations has grown as planned but is still not enough.

Source) Next Generation Vehicle Promotion Center

Source) Japan H2 Mobility
https://www.jhym.co.jp/post-2138/
Deployment status of Carbon dioxide capture and storage (CCS)

- CCS projects in Japan
  - Nagaoka CCS experiment: 2003-2005, CO2 injected 10,400t
  - Tomakomai CCS Demonstration Project: 2016-2019, CO2 injected 300,110t
  - For CCU, several experimental or demonstration projects have been conducted
    (for production of methane, methanol, polymer and cement*.)
    *commercialized

- Only a relatively small-medium CCS demonstration project (Tomakomai) has been implemented
- No large CCS projects are planned in spite of the need for a large amount of CCS toward the long term goal of a carbon neutral society

Source) METI

Socio-political acceptance
Public support for climate technologies

Q: If you were in charge of planning global warming measures of the Japanese government, which technologies would you use......?

1. Energy saving device
2. Fuel efficient vehicle
3. Biomass energy
4. Solar energy
5. Wind energy
6. Using fuel that emits less CO2
7. Nuclear energy
8. Absorbing CO2 by planting trees
9. CCS
10. Ocean fertilization by iron spraying
11. CCU

N=4247

Source: Public survey conducted by Kyushu University in 2019

- Fuel efficient vehicles are popular as a climate change mitigation measures
- The public are neutral toward CCS and CCU as climate change mitigation measures
- A neutral public attitude reflects a shortage of knowledge or indifference
Public support of CCS implementation: Potential pros and cons for CCS in general public

Q: What is your opinion on implementing CO2 capture and storage in Japan as a part of the climate policy portfolio?

Q: What is your opinion on implementing onshore (offshore seabed) CO2 capture and geological storage in Japan?

- The public is neutral or favorable toward implementing CCS in general.
- When more concrete CCS project such as onshore and offshore projects is available, the public become more concerned about their implementation.

Source: Public survey conducted by Kyushu University in 2014

(N=1448)
For the acceptance of the public and industry for a particular new technology, sending clear policy signals on development and deployment of the technology by governmental communication (national plan, white paper, roadmap etc.) is considered as a key measure.

**Hydrogen energy**

- The 5th Strategic Energy Plan (2018) refer to various role of hydrogen energy and expectation of realizing Hydrogen Society.

**CCUS**

- No comprehensive national roadmap of CCUS.
- Long-term Low Carbon Vision recognize (2017) fossil fuel fired power generation equipped with CCS as one of low carbon power sources in 2050.

- Clear policy signals on the promotion of H2 energy technologies has been sent.
- Clear policy signal has not been sent for CCS deployment but for CO2 use.
Community acceptance
Community acceptability of H2 technology (H2 station and buses) is relatively high. People feel that it is beneficial to the community.

Only H2 pipelines have a potential difficulty for deployment.
CCS implementation near his/her house
Potential pros and cons for CCS in community

Q: What do you think of the plan CCS implementation offshore in the seabed?

<table>
<thead>
<tr>
<th>Options</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. At a tens of kilometers away from the sea near Japan (n=547)</td>
<td>6.4%</td>
</tr>
<tr>
<td></td>
<td>19.7%</td>
</tr>
<tr>
<td></td>
<td>54.3%</td>
</tr>
<tr>
<td></td>
<td>15.7%</td>
</tr>
<tr>
<td></td>
<td>3.8%</td>
</tr>
<tr>
<td>2. At a few kilometers away from the closest seashore to your house (n=546)</td>
<td>10.3%</td>
</tr>
<tr>
<td></td>
<td>27.7%</td>
</tr>
<tr>
<td></td>
<td>49.3%</td>
</tr>
<tr>
<td></td>
<td>10.6%</td>
</tr>
<tr>
<td></td>
<td>2.2%</td>
</tr>
</tbody>
</table>

1 Strongly oppose  2 Somewhat oppose  3 Neither support nor oppose  4 Somewhat support  5 Strongly support


- The public is neutral or rather negative toward implementing CCS near his/her house
- Compared to general opinion of promotion of CCS as a part of climate mitigation portfolio, NIMBY (not in my backyard) thought is observed
Influence of the factors on public acceptance of CCS

Factor 1: Pro renewable and anti-climate change (respondents’ preference of renewables and energy saving technologies)

Factor 2: Environmental responsibility (respondents’ understanding of responsibility for climate change and tendency not to take risk by using new technologies)

Factor 3: Perceptions of risk (respondents’ perception of risk on technology including concern about environmental impacts and risks caused by injection of CO₂ and possibility of leakage and negative attitude to use nuclear) is this about perceptions of risks more generally not just CCS?

Factor 4: Source trustworthiness (respondent tendency to trust information sources and optimistic attitude toward new technologies to solve energy problems)

For CCS implementation as a part of climate policy portfolio, “Source trustworthiness” is the most influential factor

For CCS implementation offshore near your house, “Perceptions of risk” is the most influential factor

Community acceptability of CCS implementation may depend on local characteristics
Market acceptance
Q: Would you consider to purchase the types of vehicle below for (a) current vehicle performance and refueling infrastructure, and (b) in 2030, following improvements in vehicle performance and refueling infrastructure

Future market acceptability of FCV can be improved depending on following improvements in vehicle performance and refueling infrastructure
**Q:** Considering the location of your house, work place and other places you often visit, if a H2 station was to be located within X minutes of those places, would you consider purchasing an FCV?

<table>
<thead>
<tr>
<th>Duration</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>About 5 min</td>
<td>26.4%</td>
</tr>
<tr>
<td>About 10 min</td>
<td>43.7%</td>
</tr>
<tr>
<td>About 15 min</td>
<td>18.1%</td>
</tr>
<tr>
<td>About 20 min</td>
<td>9.0%</td>
</tr>
<tr>
<td>Further</td>
<td>2.8%</td>
</tr>
</tbody>
</table>

Source: Public survey conducted by Kyushu University in 2019

- The spread of refueling infrastructure (H2 stations) is key for market acceptance of FCVs. A higher level of deployment of H2 stations is necessary.
Consumer activeness tiers in the new energy market and action in the energy transition

- **Active**: Voluntary participation in the energy market
- **Intermediate**: Seeking economic and environmental benefits through new market products & services (~14.6%)
- **Passive**: Act depending on opportunity & information about benefits (~41%)
- **Not voluntarily participating**: Avoid hassle, remaining indifferent to new market products & services (~44.4%)

- Although a large portion of consumers are indifferent to new market products & services, the rest can seek economic and environmental benefits through new market products & services

Conclusion

- Awareness and perception
  - Most of the Japanese public is still not aware of CCUS while H2 technologies, especially FCVs are getting popular
  - The public do not have a bad image toward either H2 or CCUS
  - A portion of the public is indifferent to energy environment issues

- Social acceptance
  - The Japanese public are rather positive toward promoting CCS in general as a part of climate portfolio but neutral or negative toward implementation
  - “Source trustworthiness” and “Perception of risk (leakage)” would influence public opinion on CCS
  - The spread of H2 stations is the key for FCV spread
  - A record of safe operation of CCS and H2 stations is probably helping to sustain the good perception of these technologies

- Implications
  - Clear policy signals are necessary for large scale CCS deployment
  - Stronger incentives for FCVs are necessary to overcome the disadvantages of refueling infrastructure sparseness