From a promise to a problem
Making photovoltaic markets happen

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Introduction

• Photovoltaic (PV)
  ▫ early 2000s: promising but utopian
  ▫ late 2000s: booming, next big thing
  ▫ ... and today: problematic, chaotic, uncertain

• What can explain the brutal and to an extent dramatic changes in the status of PV markets?
  ▫ PV markets, especially in Europe, have been driven by policy support.

If the fate of PV is tied to that of support instruments, what can the study of feed-in tariffs teach us about PV?
What is a Feed-in tariff?

**Emerging technology**

**Grid connexion**

**Purchase agreement**
Electric utilities *have* to buy power generated from PV installations

**Fixed price**

**Fixed period of time**
15 to 20 years

**Paid for by electricity users**
“The difficulty was that we thought of it as an extremely simple problem of economic theory with an extremely limited number of solutions, and then we kept on refining it by turning a few screws so as to get something that combined too many objectives. [...]"

It took place in a great mess because we were in the thick of problems that were, on the one hand, that in some countries it was too expensive, and on the other hand, that we had trouble developing several sectors in a regular manner, as many governments wanted to.

– Interview, utility, 2012.
A history of FITs

Emergence (1978-1999)

- **1978**: PURPA – US
- **1980s**: Denmark and Germany
  - voluntary agreements for wind electricity
  - Wind power purchased at a percentage of retail price
- **1990**: German Feed-in Law
  - FITs as regulatory instruments
- **1996**: Internal Market Directive and Green Paper on Renewable Energy Sources
A history of FITs (2)

Generalisation and stabilisation (2000-2008)

- **2000**: German EEG (Eneuerbare Energien Gesetz)
- **2001**: *PreussenElektra v. Schleswag*
  - European Court rules that FITs do not constitute State Aid
- Development of EU renewable energy policy
  - DIR 2001/77/CE
  - EU Energy-Climate Package (2008)
  - DIR 2009/28/CE
- The ‘Feed-in tariff v. Tradable Green Certificate’ debate
A history of FITs (3)

Sophistication (2008 onwards)

- EEG evolutions to channel growth in PV installations
  - Dynamic degression of FITs depending on the rate of development, growth corridor
- Reforms of FITs throughout Europe
  - Spain (2008), Czech Republic (2010), France (2010-11), UK (2011)...
- Sophistication and hybridisation of instruments
FITs as market devices and political instruments

- FITs as marketisation instruments (Caliskan & Callon, 2010)

- FITs rely on:
  - *institutional arrangements*: administrative procedures, purchase obligations, mechanisms to compensate for cost, RE targets...
  - *theories of the economy*: innovation studies, learning-by-doing, experience curves, effectiveness, static and dynamic efficiency, (investment) risk evaluation and perception, modelling...
  - *things valued*: renewable electricity and its characteristics, grid connection, RE technologies, RE resources and potentials...
# French PV policy

<table>
<thead>
<tr>
<th>Event</th>
<th>Year</th>
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<tbody>
<tr>
<td><strong>Loi du 10 février 2000 sur la modernisation du service public de l’électricité</strong></td>
<td>2000</td>
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<tr>
<td>Establishement of the first feed-in tariffs for PV</td>
<td>2002</td>
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<tr>
<td>Modification of feed-in tariffs; introduction of a BIPV premium</td>
<td>2006</td>
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<tr>
<td><strong>Energy-Climate Package</strong> – Binding RE targets for EU member states</td>
<td>2008</td>
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<td>French PV capacity objective: 5.4 GW by 2020</td>
<td></td>
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<td>PV module prices divided by 2</td>
<td></td>
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<tr>
<td><strong>PPI 2009-2015</strong> – Confirmation of the 5.4 GW PV by 2020 (about 500 MW/year)</td>
<td>2009</td>
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<td><strong>Rapport Poignant</strong> – Warnings from the Spanish experience</td>
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<td><strong>January</strong> – Revision of FIT categories and decrease of FIT levels</td>
<td>2010</td>
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<td><strong>July</strong> – Creation of the Comité d’Evaluation de l’Intégré au Bâti (CEIAB)</td>
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<td><strong>August</strong> – Rapport Charpin; second revision and decrease of FITs</td>
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<td><strong>November</strong> – Auditions on PV held at the Assemblée Nationale</td>
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<td><strong>December</strong> – Moratorium on FITs for PV installations (except on individual households)</td>
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<td><strong>January-March</strong> – Consultation of PV</td>
<td>2011</td>
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<td><strong>04 March</strong> – New support system: yearly cap, self-adjusting FIT, calls for tenders</td>
<td></td>
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<tr>
<td>Etats Généraux du Solaire Photovoltaïque organised by PV representatives</td>
<td></td>
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<tr>
<td><strong>Fall</strong> – Emergency measures for PV announced</td>
<td>2012</td>
</tr>
<tr>
<td><strong>January</strong> – Punctual revision and increase of tariffs, premium for systems produced in the EU</td>
<td>2013</td>
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2002 v. 2006 designs

### 2002

- Maximum level: 15.25 eurocents/kWh (~ 1 FF)
- Categories:
  - mainland/overseas
  - installation capacity and type of ownership
- Stepped: -5% each year

### 2006

- 30 eurocents/kWh + BIPV Premium (25 c/kWh)
- One-size-fits-all
- Indexed to inflation

### Effects

**2002**

- Does not guarantee profitability
- No real increase in installed capacity

**2006**

- Discrepancy between FITs levels and installation costs
- Rapid increase in projects
- Difficult control over “BIPV”
- PV investors and developers are a very heterogeneous group
## 2006-2010 FITs

### 2006-2009

<table>
<thead>
<tr>
<th>Standard</th>
<th>30</th>
<th>30.520</th>
<th>31.193</th>
<th>31.502</th>
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</thead>
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### BIPV ≤ 250 kWc

<table>
<thead>
<tr>
<th>Residential</th>
<th>58</th>
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<tbody>
<tr>
<td>Educational and Medical</td>
<td>58</td>
</tr>
<tr>
<td>Other buildings</td>
<td>50</td>
</tr>
<tr>
<td>Simplified</td>
<td>42</td>
</tr>
</tbody>
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### BIPV premium (25c€/kWh)

| ≤ 250 kWc | 31.4 |
| ≥ 250 kWc | 31.4 x C |

### 2010

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<tr>
<th>12 January 2010 Arrêté, 16 March 2010 Arrêtés</th>
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<th>31 August 2010 Arrêté</th>
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<tr>
<td>&lt; 3 kWc</td>
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<td>&gt;3 kWc</td>
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The post-moratorium scheme

"Self-adjusting" FITs

Calls for tenders

- "Simplified" for PV installations between 100 and 250 kWc
- Classic for PV projects larger than 250 kWc, with 7 distinct lots aiming at promoting emerging technologies

Commission de Régulation de l’Énergie (2011)
Re-framing strategies

• Categorisations and refinements to channel innovation and shape technologies
  ▫ Support is increasingly differentiated by installation types and size
• Sophistication of mechanisms to enable FITs to take into account more and more information
  ▫ Regional coefficients
  ▫ Automatic decrease
  ▫ Bonus for EU-manufactured PV systems...
• Political management
  ▫ Consultation in 2010-2011
  ▫ “Emergency measures” in January 2013
Conclusions

- FITs were elaborated, stabilised and then transformed through the **interactions** of energy policies and policy process, economic theories, and technology developments.

- PV markets **depend** on FITs, but they also **disrupt** FITs.

- Various **re-framing** strategies have been used to deal with PV markets overflowings. Most have relied on modifications of support instruments design, also affecting the theories they relied upon.
Thank you for your attention!