Renewable Energy Feed-in Tariffs: Lessons Learned from the U.S. and Abroad

U.S. Department of Energy (DOE) Technical Assistance Project (TAP) Webinar

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Presentation Overview

• Feed-in Tariff (FIT) Policy Overview
• FIT Policy Implementation in the U.S.
• Policy Design Comparison with Europe
• FIT Policy Clarifications (differences with PURPA)
• Policy Interactions (RES, climate legislation)
• Policy Design and Implementation Challenges
Feed-In-Tariff Definition

Feed-in Tariff* (FIT)**: A renewable energy policy that typically offers a guarantee of:

1. **Payments** to project owners for total kWh of renewable electricity produced;
2. **Access to the grid**; and
3. **Stable, long-term contracts** (15-20 years)

* A tariff is an electricity rate paid for generation.

** Also called fixed-price policies, minimum price policies, standard offer contracts, feed laws, renewable energy payments, renewable energy dividends and advanced renewable tariffs.
Fundamental FIT Policy Design Options

(1) Price method: Estimated cost + targeted return (e.g. VT, HI) Avoided cost (e.g. CA)

(2) Payment structure: Fixed-payment Premium-payment Constant (over spot market) Sliding

(3) Differentiation: technology, project size, location of project, and sometimes resource quality

(4) Bonus payments: target “smartgrid” principles – peak periods; optimal use of transmission system; specific technologies (e.g. advanced grid integration, emerging tech); certain ownership structures (e.g. community owned); deployment in locations with high loads (e.g. urban centers), etc.
FIT Payment Choice - 1

(1) Fixed Price FIT Payment
(can include escalation)

Most countries use fixed-price FIT payments

(2a) Premium FIT Payment
(above spot market)

EX: Vermont

EX: Spain (before 2007)
(2b) Premium FIT Payment *with Caps and Floors*

**EX: Spain** (2007 and beyond)

Refinements to FIT payment methodologies

(3) Spot Market Gap Model (above spot market)
EX: Switzerland (Germany starting in 2010)

If the retail price rises high enough, the FIT payment goes to zero.
Note: Gainesville Regional Utilities, has approved the first U.S. cost-based FIT for solar PV. In May 2009, Vermont enacted the first statewide FIT policy based on the RE project cost.

Source: NREL - adapted from Gipe www.wind-works.org, Sept 2009
Sectors: Commercial, Industrial, Residential
Length: 10-, 15- or 20-year contracts
Payment: Based on avoided costs
  – CPUC market price referent (MPR)
  – Adjusted by time-of-use factors
  – Higher solar energy rates (8 a.m. – 6 p.m.)
Caps: State-wide Program: 750 MW
    Project size: 3 MW
Vermont Energy Act (Act 45 – HB 446)

**Sectors:** Commercial, Industrial, Agricultural, Owners of Qualified SPEED Resources

**Length:** 25 year contracts (solar)

15-20 years (other technologies)

**Payment:** Based on project cost + profit

- Landfill methane: $0.12/kWh
- Agricultural methane: $0.16/kWh
- Wind (<15 kW): $0.20/kWh
- Wind (>15 kW), Hydro or Biomass: $0.125/kWh
- Solar: $0.30/kWh

**Caps:** State-wide Program: 50 MW

Project size: 2.2 MW

**Technologies:** Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Municipal Solid Waste, Anaerobic Digestion, Small Hydroelectric
## FIT policy: Flexible Design

<table>
<thead>
<tr>
<th></th>
<th>Germany</th>
<th>Spain</th>
<th>The Netherlands</th>
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<tbody>
<tr>
<td><strong>Payment level basis</strong></td>
<td>RE project cost (declines over time)</td>
<td>‘08: premium + spot ‘09: RE project cost</td>
<td>RE project cost (declines over time)</td>
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<tr>
<td><strong>Payment level structure (for a contract)</strong></td>
<td>Fixed payment level, 20 years, no inflation adj.</td>
<td>‘09: Fixed or premium w/cap and floor (PV: fixed only), 15-25 years, w/inflation adj.</td>
<td>Spot market gap</td>
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<tr>
<td><strong>Differentiation</strong></td>
<td>Tech., project size, resource quality, and vintage</td>
<td>Tech., and project size</td>
<td>Tech., project size, and resource quality</td>
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<td><strong>Caps</strong></td>
<td>a/ biomass: 20 MW a/ (none for wind or solar)</td>
<td>a/ ‘08 PV: 50 MW a/ ‘09 PV: 10 MW</td>
<td>a/ PV: 3.5 kW</td>
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<td>b/ program</td>
<td>b/ ‘08 PV: 5 year target (National Energy Plan)</td>
<td>b/ 4-year budgets:</td>
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<td>b/ ‘09 solar: 400 MW</td>
<td>- Wind: ~2,000 MW</td>
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<td>b/ ‘10 wind: 20,155 MW</td>
<td>- Offshore: ~400 MW</td>
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<td>- Biomass: ~250MW</td>
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<td></td>
<td></td>
<td>- Biogas: ~15 MW</td>
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<td></td>
<td></td>
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<td>- PV: ~70-90MW</td>
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<td><strong>Payment level adjustments</strong></td>
<td>Analyzed every 4 years with annual increments</td>
<td>Analyzed annually, re-set (and retroactive)</td>
<td>Subject to government review at any time</td>
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**Sources:** EEG 2008, RD 661/2007, RD 1578/2008, and van Erck 2008
EU Thoughts on FIT Policy Success

European analysts attribute RE sector success to the following FIT policy elements:

1. are methodologically based on RE project costs (+ return)
2. are in place over a long period of time to provide policy stability and reduce uncertainty
3. Payments are differentiated by technology type, project size, and resource quality.
4. involve long-term contracts (15-25 years)
5. include built-in decreased payments to drive innovation and cost-reduction over time
6. are generally available to all end-users & project investors
7. minimize the use of program and project caps (target their use for high-cost or emerging technologies)
Key differences: U.S. & EU

1. Methodology used to set payment level
   - U.S.: Utility avoided generation costs, typically
   - EU: Estimated RE project costs (plus a reasonable profit)

2. Ability to encourage diversity
   - U.S.: Often target one tech., at DG level
   - EU: Differentiate payments based on technology, size of project, quality of resource, number of install., and other locational factors

3. Investor certainty provided
   - EU: guaranteed 15-25 year contracts to meet long-term goals
   - U.S.: often use shorter contracts and program/project caps

4. Breadth of eligible participants
   - U.S.: Com. & Ind. customers (sometimes residential)
   - EU: above PLUS fed/state/local govt., NGOs and utilities
Tariff Degression

<table>
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<tr>
<th>Time Periods or Capacity Levels</th>
<th>Electricity Price (c/kWh)</th>
<th>FIT Payment levels (t1, t2, etc.)</th>
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The graph illustrates the relationship between time periods or capacity levels and the corresponding electricity prices and FIT payment levels.
FIT Policy Clarifications

- FITs are not a “foreign” policy
  - **Genesis**: California “standard offer contract” (PURPA)
  - U.S. utilities get **cost-recovery + profit** for conventional generation

- FITs are not the same as PURPA
- FIT policies can be used to meet renewable electricity (and climate change) goals
- FITs can provide investor certainty
FIT payments are distinctly different from PURPA

→ PURPA payments were anchored on erroneous projections (e.g. oil)
→ In reality, actual electricity prices diverged greatly from forecasts (NG-fired power on the margin; lower fuel prices);
  → PURPA payments remained high and continued to grow
→ In contrast, FITs are not usually tied to fossil fuel/electricity prices (mostly tied to est. project costs), and payments are levelized (perhaps small, fixed escalator of 2-3%).

CA SOC No. 4: contracts based on utility projections of long-run fossil fuel prices

% of retail electricity price FIT policies
Avoided cost-based FIT policies
Undifferentiated FIT policies

Modern FITs, fully differentiated, most often based on RE project cost estimates
FITs and RPS: complimentary policies

- Utilities either own power generation, or they purchase power through competitive solicitations (i.e. request for proposal/RFP)
- FITs replace/compliment RFPs, NOT RPS policies (e.g. EU countries use FITs to achieve goals)
- Options for implementation
  1. FITs can be designed to target distributed generation only
     - RFPs left to target utility-scale systems
  2. FITs can be used for utility-scale projects
     - Used *between* competitive solicitations
     - Can *replace* utility RFPs.
FITs in the Financial Crisis

- U.S. tax equity market consolidation
- FITs facilitate project financing through guaranteed, long-term contract for system output
  - Help attract capital to RE market
  - Ratepayer backing attractive to debt lenders
- FIT policy can stimulate new industries, create jobs, if designed well
  - Long-term policy commitment
  - Differentiation for diversity
  - Large targets/caps (e.g. Ontario)
- FITs can provide the opportunity for low-risk, moderate returns on local energy investments
FIT Policy Challenges

**Up-front capital need:** Does not directly offset the need for substantial capital to pay for up-front project costs
  – But L-T contracts ↑ investor confidence

**Setting FIT payment level is challenging:**
if set too low, little new RE development;
if too high, surplus profits to developers

**Policy design challenge:** Tracking technological improvement and cost reduction accurately over time

**Complexity:** Usually many levels of differentiation

**Cost:** supporting emerging and higher-cost technologies can lead to upward pressure on electricity costs (and rates)
  – Can be designed to limit support for such technologies

**Policy crutch:** concern that RE industries could develop a reliance on FITs for project deployment; no incentive for innovation
  – Payment can ramp down over time, to encourage innovation
FIT Policies: Key Takeaways

1. Europe credits rapid and stable expansion of diverse RE projects on key FIT policy elements:
   - Long-term policy stability (to attract investors)
   - Long-term contracts (and thus lower c/kWh payments)
   - Target estimated RE project costs across technologies, project sizes, and vintage through differentiation
   - Most end-users able to participate

2. FIT policies are for supply procurement and they can be used to compliment RES and climate policy goals.

3. If designed well, can limit ratepayer costs and also provide investor certainty.

4. Long-term targets can drive new RE investment.
Overview of NREL FIT Tasks

**Analysts**
- Exeter Associates, Inc.
- Sustainable Energy Advantage
- Meister Consultants Group
- National Regulatory Research Institute (Scott Hempling)
- Law Offices of Carolyn Elefant

**Tasks**
1. FIT Model and FIT Rate Setting
2. Interconnection Policy Best Practices
3. FIT Legal Analysis
4. Technical and policy assistance to specific states

Karlynn Cory and Claire Kreycik, NREL
http://www.nrel.gov/docs/fy09osti/45549.pdf

http://www.nrel.gov/docs/fy09osti/45551.pdf

COMING SOON
http://www.nrel.gov/docs/fy09osti/44849.pdf
Thank you for your attention!

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FIT Policy: Application in Europe

Feed-in tariff
Tradable RECs
Feed-in/RECs
Other policy
Recent/pending feed-ins

Source: Wilson Rickerson, Meister Consultants Group