GREEN ENERGY BUSINESS: THE SOLAR CHALLENGE

Alternativas de Financiamiento para Sistemas Fotovoltaicos

Agustín Irizarry Rivera, PhD, PE  
Catedrático  
Universidad de Puerto Rico - Mayagüez  

Centro de Capacitación para Bio Desarrollos  
Mayagüez, Puerto Rico  

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Outline

- Work based on current project
- Photovoltaic Tech and Puerto Rico’s Solar Resource
- Brief Economic Analysis of PV in Puerto Rico
- Financing Mechanisms
- A Summary of Reactions from Financing Sector
Rooftop Solar Challenge – reduce PV energy cost to fossil fuel costs

- Partnerships among relevant stakeholders to improve market conditions for rooftop PV in major regions of the USA.
- Focus on grid-connected rooftop PV in the residential and commercial sectors
- Emphasis on streamlined and standardized permitting and interconnection processes + financing.
- Encourage participation to ensure meaningful, measurable results.

Source: Funding Opportunity Announcement DE-FOA-0000549
Rooftop Solar Challenge - Market Transformation in PR
(Authors: Dr. José Colluci and Agustín Irizarry)

<table>
<thead>
<tr>
<th>Load, kW</th>
<th>Payment, $</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>800 x 0.27</td>
</tr>
<tr>
<td></td>
<td>= $216</td>
</tr>
<tr>
<td>8,000</td>
<td>8000 x 0.30</td>
</tr>
<tr>
<td></td>
<td>= $2,400</td>
</tr>
<tr>
<td>80,000</td>
<td>80,000 x 0.30</td>
</tr>
<tr>
<td></td>
<td>= $24,000</td>
</tr>
<tr>
<td>800,000</td>
<td>800,000 x 0.30</td>
</tr>
<tr>
<td></td>
<td>= $240,000</td>
</tr>
</tbody>
</table>

Average Monthly Electric Bill

- Residential
- Commercial, Mid End; BK, MacDonald, El Mesón
- Commercial, High End; Gatsby, KMart
- Walmart Super Center
Ejemplo de factura residencial, ¿Qué me están cobrando?

Le cobraron $116.27 por la electricidad 440 kWh x 0.26425 $/kWh = $116.27

Del 17 de enero al 17 de febrero 2012 consumió 440 kWh.

En el mes de febrero 2012 los kWh costaron a ₋26.425 (26.42 ₋/kWh)

Fuentes: Oficina de Prensa de la Autoridad de Energía Eléctrica
Rooftop Solar Challenge to Induce Market Transformation in Puerto Rico
Medida Neta Actual en Puerto Rico

27 ¢/kWh
7.5 a 27 ¢/kWh

contador

Autores: Dr. Gerson Beauchamp, Agustín Irizarry
Costo estimado sistema PV, 1 kW

<table>
<thead>
<tr>
<th>Elemento del sistema/trabajo</th>
<th>($) /W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paneles</td>
<td>1.70</td>
</tr>
<tr>
<td>Invertidor</td>
<td>0.70</td>
</tr>
<tr>
<td>Materiales eléctricos, cajas, herrajes</td>
<td>0.70</td>
</tr>
<tr>
<td>Instalación</td>
<td>0.50</td>
</tr>
<tr>
<td>Diseño, certificación, permisos</td>
<td>0.50</td>
</tr>
<tr>
<td>Total estimado</td>
<td>4.10</td>
</tr>
</tbody>
</table>

Costo estimado sistema PV >35 kW?, 3 $/W
Estimated average insolation in Puerto Rico, kWh/m² per year

1495
1343
1191
1952
1800
1648
2408
2256
2104
Rooftop Solar Challenge to Induce Market Transformation in Puerto Rico

**Levelized Cost of Energy, $/kWh**
(net metering, 20 years, 1% annual degradation)

- **El Yunque**: $0.27
- **Adjuntas Canovanas Mayagüez Norte**: $0.17
- **Cabo Rojo Sur Guánica**: $0.08

**Peak sun hours**

- **2.5**: $0.22
- **3**: $0.19
- **3.5**: $0.18
- **4**: $0.16
- **4.5**: $0.15
- **5**: $0.13
- **5.5**: $0.12

**LCOE 4$/W** (orange diamonds)
**LCOE 3$/W** (red squares)

**Notes**: The graph illustrates the levelized cost of energy (LCOE) for different locations in Puerto Rico, considering various peak sun hours and the costs associated with net metering over a 20-year period with 1% annual degradation. The costs are provided in $/kWh, with a focus on rooftop solar installations.
Rooftop Solar Challenge to Induce Market Transformation in Puerto Rico

Y si es tan barata esa energía ¿Por qué no hay sistemas PV en todos los techos? **Costo inicial**

- 500 kWh/mes con 4 horas sol pico (Mayagüez)
  - 500/30 = 16.7 kWh/dia
  - 16.7 (kWh/dia)/(4 h/dia) = 4.2 kW, digamos 4 kW
- 4 kW = 4,000 W, 4,000 W x $4/W = $16,000

Toyota Yaris
$16,200 a $19,400 (julio 2012)
Costo inicial – ¿cómo financiar un sistema PV, residencial?

- 500 kWh/mes = $135 @ $0.27/kWh (AEE)
- 500 kWh/mes = $75 @ $0.15/kWh (PV 4 horas/dia)
- $3,000 de pronto, $13,000 a financiar, 5.25% a 15 años son $104.5/mes – Financiamiento propio

Toyota Yaris
$16,200 a $19,400 (julio 2012)
Costo inicial – ¿cómo financiar un sistema PV, comercial?

- 6,000 kWh/mes = $1,800 @ $0.30/kWh (AEE)
- 6,000 kWh/mes = $ 660 @ $0.11/kWh (PV 4 horas/día)
- 50 kW @ $3/W = $150,000
- $135,000 a financiar, (90%) 5.25% a 15 años son $1,085.23/mes – Financiamiento propio
Rooftop Solar Challenge
Questions from Financing Sector (Coops, Banks)

- Warranties? – Equipment and Installation
- Government or third party certification?
- Performance history?
- Insurance? – Installer insurance, owner insurance
- ¿Secondary market? - A business opportunity!
- How to mix the above to come up with the Terms and Conditions of a loan to finance PV systems?
Rooftop Solar Challenge
Other schemes: Third party financing

A Power Purchase Agreement (PPA) a contract between a solar electricity generator and a client seeking solar energy.

- a reduced rate of electricity for an extended period of time (10-20 years),
- no upfront installation cost, and
- the option to purchase the solar facility at the end of the contract.

PPA Provider designs, develops, operates, maintains, and owns the solar facility located on the client’s property. The client pays the PPA Provider for the electricity.
Rooftop Solar Challenge
Third – party financing

- **Tax Benefits** - Investment Tax Credit (ITC) returns over 30% of a solar project’s capital cost to investors in the form of a tax credit.

- **Accelerated Depreciation** - Commercial projects developers can realize additional tax benefits from depreciating cost of the solar facility. An entity “can depreciate the installed cost of the system minus 50% of the business Investment Tax Credit (ITC) over the first five years of ownership (SEIA 2008) using the modified accelerated cost recovery system (MACRS) (DSIRE 2008). Lawrence Berkley National Laboratory, says this tax benefit is equivalent to 26% of the installed cost of the system.
Rooftop Solar Challenge
Third – party financing

- **Long-Term Solar REC (Renewable Energy Credits) Contracts**- are helpful in financing proposed solar projects. Buyers and sellers enter into bilateral contracts to secure price, quantity, and term of the SREC contract. Counterparties agree to pay or delivery SRECs at a specified future date.

- If a residential customer needs to sell the house, there are three options:
  - Assign the PPA to the buyer of the home;
  - Prepay the PPA and add this prepaid electricity to the sales price of the home
  - Purchase the PV system outright from company and sell it with the house.
Rooftop Solar Challenge
Community solar: Another opportunity

- **Create a Solar Financing Community**
  - Identify possible clients (coop members, businesses)
  - Create Call for Proposals (CFP) for PV Installers ($/W, minimum technical requirements, minimum warranties, etc)
  - Negotiate Solar RECs sales (PREPA?, AES, ecoelectrica, …)
  - Use benefits from economies of scale and sales of RECs to produce an attractive financing option
Solar Photovoltaic Financing: Residential Sector Deployment, NREL
"The Resale Market Value of Residential Solar Photovoltaics: A summary of literature and insight into current value perceptions"
Technology Roadmap Solar photovoltaic energy, NREL
Solar PV Project Financing: Regulatory and Legislative Challenges for Third-Party PPA System Owners, NREL
Rooftop Solar Challenge to Induce Market Transformation in Puerto Rico

- Contact Info:
  - maviles@aae.gobierno.pr
    - Mariely Aviles, Esq.
  - PuertoRicoSolar2012@hotmail.com
    - Efrain O’Neill – Project’s Principal Investigator

- We invite you to visit the following websites for more info:
  - www.eere.energy.gov/solar/sunshot/rooftop_challenge.html
  - http://prsol.r.ece.upr.m.edu/