Renewables Case Study: Greece

Legal Framework, Experiences, Challenges

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RES Department

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Agenda – Thematic Areas

1. Introduction, RES Targets and legal framework
2. Role of the Regulator in renewables area & licensing
3. Remuneration of renewables & market deficit
4. Connection issues & integration of renewables
5. Self-generation, self-consumption & “energy communities”
Apostolos G. Gkizas

Dipl. Electrical Engineer, Technical University of Patras
MSc. in Energy Production and Management, Technical University of Athens

Current Post (since 2013): RES Department, Greek Regulatory Authority for Energy (RAE)

- Production license applications’ evaluation for Wind farms focusing on technical issues (mainland and on non-interconnected islands). Monitoring of their development, granting of production licenses’ amendments and revocations
- Participation in RAE’s Working Group regarding the Reformation of Greek RES Market in accordance with the “EU State Aid Guidelines for Environment & Energy 2014-2020”
- Participation in the Ministry of Energy & Environment Working Group for the setting out the legal framework concerning the development of small Wind Turbine applications
- Participation in projects regarding the penetration of RES projects in the Hellenic Electricity System. Cooperation with TSO (ADMIE), DSO (HEDNO) and the Market Operator (LAGIE). Saturation issues in mainland and non-interconnected Grids concerning the large scale implementation of RES projects.

Previous Working Experience (2004 - 2013): Private sector

- Development of Greenfield RES Projects (W/F and PVs), Techno-economical analysis of RES Projects
1. Introduction – National RES targets

- Adoption of EU Directive 2009/28/EC regarding the European Union Member States RES targets (20-20-20) and RES treatment (connection issues, dispatch, financing)
- This trend based on recent Commission announcements will be extended to 2030: 27% RES penetration at Community Level
- In Greece based on the above EC Directive the target set for 2020 is 18% of RES penetration in the energy mix
- Nevertheless, the Greek State has set even more ambitious targets (Law 3851/2010) up to 2020:
  - 20% in total in the Gross Energy Consumption of which
    - 40% RES Penetration in the Gross Electricity Consumption
    - 20% RES Penetration in the heating sector
    - 10% in the transport sector
1. Introduction – National RES targets

- Ministerial Decree 19598/2010 lays down individual targets for installed capacity per technology for the years 2014 and 2020. Below are presented in comparison to the installed capacity:

<table>
<thead>
<tr>
<th>Technology</th>
<th>Installed capacity target in MW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2014</td>
</tr>
<tr>
<td>Wind</td>
<td>4000</td>
</tr>
<tr>
<td>SHPP (P&lt;15MW)</td>
<td>300</td>
</tr>
<tr>
<td>PV</td>
<td>1500</td>
</tr>
<tr>
<td>CSP</td>
<td>120</td>
</tr>
<tr>
<td>Biomass</td>
<td>200</td>
</tr>
</tbody>
</table>

- The target of PVs for 2020 (2200MW) is already met as there are 2604MW in operation (huge increase in the years 2012 and 2013). In all other technologies, the realization of the projects is below the targeted values.
1. Introduction – National RES targets

- The RES development in Greece: a) Installed capacity & b) Produced electricity

  - PVs hold the first position regarding installed capacity (48.7%) and WFs come second (45.8%).
  - On the other hand, wind farms produce the biggest part of RES-Energy (48%) and PVs come second (42%).

  - Average CFs: WFs 25.5%, SHPS 37%, PVs 17.2%, Bio 53.5%

Sources: Eurostat, Lagie
1. Introduction – Legal Framework

- In order to meet the binding national targets, RES units by virtue of Directive 2009/28/EC enjoy favorable treatment in the electricity market:
  - Dispatching priority for RES-e
  - Priority for issuing the interconnection terms by the DSO and TSO
  - Main support mechanism is guaranteed by means of long term Power Purchase Agreements (PPAs) (20yrs - 25yrs for CSP and small PVs) with predefined FiT
  - Possibility to account for investment grants or tax reductions
    - Subject to technology maturity-penetration
    - PV since 2010 and wind installations after 2013 are excluded

- Simplified Environmental Licensing Procedures

- Creation of One Stop Shop for the support of RES Strategic Investments

- Transmission System Reinforcement Projects have been undertaken by the TSO aiming at the increase of penetration of RES units in saturated areas. These projects are considered of high national importance and are being repaid by the RES producers.
2. Role of the Regulator in renewables area & licensing

- RAE’s responsibility is concentrated primarily on the electricity sector
- Three Stages’ licensing Procedure (not in smaller projects that are exempted from Production License, PL)

**RAE’s Licensing Responsibility**

- Production License
  - Issued by RAE
  - Approval of Preliminary Scope of Work Analysis
  - 25 years duration
  - Monitoring, renewal, amendment / modification, transfer are controlled by RAE

- Installation License
  - Issued by Ministry of Energy or Regional Authority
  - Green light to commence installation works
  - Once issued for 2 years with 2 times extension of total 3.5 years
  - Prerequisites: Environmental Terms Approval & Binding Interconnection Terms

- Operation License
  - Issued by the same Body as the Installation License
  - Project becomes operational
  - Duration 20 or 25 years
  - Prerequisites: Interconnection Contract & PPA
2. Role of the Regulator in renewables area & licensing

- RAE’s responsibilities regarding the handling of Production Licenses include:
  - Evaluation of applications for issue of Production License (PL)
    - The procedure is governed by the “Regulation on RES Production License”. To that end, also an Evaluation Instructions’ Manual issued by RAE is applicable.
    - 4 application windows (1-10 March, June, September, December). -> Better control and overview of the procedure, Overlapping issues
    - Applications only by legally constituted and operated companies / legal bodies or physical bodies are acceptable
    - Applications are published on RAE’s webpage so that everybody that has legal interests to be aware of and to be able to submit his objections to the issuance of the specific modification.
    - The applications are also communicated to the Municipalities.
2. Role of the Regulator in renewables area & licensing

RAE’s responsibilities regarding the handling of Production Licenses include:

- Evaluation carried out by RAE is based on 8 Techno-economic Criteria stipulated in the RES law (L. 3468/2006) and the accompanied RES Regulation for PL.

- Most Significant Techno-economic Criteria / Parameters:
  
  a. Calculated energy production on the basis of Wind Potential measurements carried out by accredited according to EN ISO/IEC 17025/2000 or similar (IEC 61400-12-1) measuring laboratories.

  Minimum Requirements for W/F: CF 20% or/and average Wind Farm Speed 6 m/sec

  b. Financial and technical capability of Project Company to realize the project

  c. Limitations arising from the Special Spatial Planning for RES (Restricted areas, wind farms density per municipality)

- Issue of PL within 2 months following the completion of the application folder

- Obligation of SPV to secure the Construction License within 30 months period following the issue PL
2. Role of the Regulator in renewables area & licensing

- RAE holds a registry with all the PL issued, amended and revoked published in its webpage and updated constantly.

- For the representation of the RES projects and their most up-to-date significant elements (capacity, wind turbines, SPV, location, licensing stage etc.) a very helpful Geo-informatics map is being used (www.rae.gr/geo/)
2. Role of the Regulator in renewables area & licensing

- Information published per project in the Geo-informatics map
- The user can download and print a Certificate of his project and use it in the next steps/stages of the licensing procedure
2. Role of the Regulator in renewables area & licensing

- Wind potential map of the Country at heights of 80, 100 and 120m based on measurements from 123 wind masts located all over Greece.
2. Role of the Regulator in renewables area & licensing

– For the monitoring of the projects’ progress each developer must submit to RAE every six months Progress Reports, where the investor presents the progress that it was carried out during the last six months.

– In these reports, the investor must make clear to RAE with tangible data, that he has undertaken all necessary actions in line with the legal framework for the timely development of the project.

– Intention of RAE is to develop a system so that the Progress Reports are submitted electronically for easier and swifter control.

– In case that the investor does not show the progress it is needed and stipulated by the Law, RAE sets out a relevant decision where asks for justifications regarding the delay in the progress of the project

– Lack of reasonable justification drives to revocation of the license by virtue of specific RAE decision.

– On top of that, RES investor is charged with a fee (1.000€/MW) per year for the delay in the development of the projects (3 years following the issue of PL for W/Fs, 1 year for PVs)
2. Role of the Regulator in renewables area & licensing

– The production licenses can be amended/modified followed a specific application by the project owner submitted to RAE. The application is accompanied with all the relevant data modified (for instance project lay out, financing, transfer etc.). The same Regulation is applied.

– Current RES situation in Greece as regards projects with and without PL

<table>
<thead>
<tr>
<th>RES Technology</th>
<th>RES Plants with PL</th>
<th>RES Plants in Operation With PL</th>
<th>RES Plants in Operation With &amp; Without PL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Power (MW)</td>
<td>Number</td>
</tr>
<tr>
<td>W/F</td>
<td>1132</td>
<td>23,911.8</td>
<td>207</td>
</tr>
<tr>
<td>PVs</td>
<td>922</td>
<td>4,284.9</td>
<td>249</td>
</tr>
<tr>
<td>Small Hydro</td>
<td>433</td>
<td>976.3</td>
<td>105</td>
</tr>
<tr>
<td>Geothermie</td>
<td>1</td>
<td>8.0</td>
<td>0</td>
</tr>
<tr>
<td>Biomass</td>
<td>88</td>
<td>388.8</td>
<td>0</td>
</tr>
<tr>
<td>SCP</td>
<td>82</td>
<td>442.2</td>
<td>0</td>
</tr>
<tr>
<td>Hybrid</td>
<td>20</td>
<td>463.6</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>2,678</td>
<td>30,475.60</td>
<td>568</td>
</tr>
</tbody>
</table>
2. Role of the Regulator in renewables area & licensing

Apart from the aforementioned licensing and monitoring role, RAE has also to carry out among others the following tasks:

- Approval of all Transmission System, Distribution and Market Codes where the participation of the RES units in the market is clearly defined.
- Calculation of the RES levy for the remuneration of RES production.
- Setting of terms and conditions regarding the interconnection of RES units to the grid (unit costs, procedure, monitoring)
- Carrying out the auctions for the remuneration of new RES units
- Setting the framework for the repayment of Transmission System Reinforcement Projects for the connection of RES projects
- Advise and support the Ministry of Energy regarding the:
  a. Review of the RES units remuneration (Reference Tariffs)
  b. Setting of the new framework concerning RES applications (net metering, operation of hybrid projects, operation of aggregators, small Wind Turbines)
  c. Revision of the existing PPAs
  d. Submission of the new RES support scheme to Commission for approval

Basic Principles: Non discrimination and equal treatment of all participants, public consultation in all the changes of the existing framework, publicity and frequently update of all information
2. Role of the Regulator in renewables area & licensing

- In general, RAE has taken over the majority of the tasks of the European Regulators.

<table>
<thead>
<tr>
<th>NRA's role</th>
<th>Example of Member States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overseeing/ managing the FIT scheme and/or setting the level of FITs</td>
<td>AT, GR, FI, HR, HU, LT, MT</td>
</tr>
<tr>
<td>Overseeing financial flows linked to the funding of the RES scheme</td>
<td>DE, FR, SI, ES, HU and GR)</td>
</tr>
<tr>
<td>Setting the level of the RES levy/contribution</td>
<td>FR, GR, LU</td>
</tr>
<tr>
<td>Overseeing the levy determination process</td>
<td>DE, AT, GR</td>
</tr>
<tr>
<td>Running registries of RES installations</td>
<td>AT, DE, GB, SE, SI, LU, GR</td>
</tr>
<tr>
<td>Checking the eligibility for exemptions of the funding scheme</td>
<td>FR, HU, LU, NO</td>
</tr>
<tr>
<td>Managing the system for the guarantees of origin and disclosure of electricity</td>
<td>AT, ES, HU, LU</td>
</tr>
</tbody>
</table>

Source: CEER
3. Remuneration of renewables & market deficit

- Before 2006 a uniform price for all RES linked with MV electricity tariffs was set (~68€/MWh)

- Law 3468/2006 introduced technology dependent FiTs and special RES licensing procedure, which were inflated

<table>
<thead>
<tr>
<th>Technology</th>
<th>Inteconnection</th>
<th>Non-Inteconnection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind onshore</td>
<td>73</td>
<td>84.6</td>
</tr>
<tr>
<td>Wind offshore</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>SHPP P&lt;15MW</td>
<td>73</td>
<td>84.6</td>
</tr>
<tr>
<td>PV P&lt;100kW</td>
<td>450</td>
<td>500</td>
</tr>
<tr>
<td>PV P&gt;100kW</td>
<td>400</td>
<td>450</td>
</tr>
<tr>
<td>CSP P&lt;5MW</td>
<td>250</td>
<td>270</td>
</tr>
<tr>
<td>CSP P&gt;5MW</td>
<td>230</td>
<td>250</td>
</tr>
<tr>
<td>Other</td>
<td>73</td>
<td>84.6</td>
</tr>
</tbody>
</table>

- L.3734/2009 introduced gradual FiT reduction for PVs due to the CapEx decrease of this technology. Nevertheless, the potential decrease was underestimated.

- 18-36 months from PPA to electrification otherwise FiT at date of electrification
3. Remuneration of renewables & market deficit

- The main target was at the end to set the PV values as a function of the System Marginal Price (market oriented approach)

<table>
<thead>
<tr>
<th>Date of PPA</th>
<th>I.S. P&lt;100kW</th>
<th>I.S. P&gt;100kW</th>
<th>N.I.I. P&lt;100kW</th>
<th>N.I.I. P&gt;100kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb-09</td>
<td>400,00</td>
<td>450,00</td>
<td>500,00</td>
<td>450,00</td>
</tr>
<tr>
<td>Aug-09</td>
<td>400,00</td>
<td>450,00</td>
<td>500,00</td>
<td>450,00</td>
</tr>
<tr>
<td>Feb-10</td>
<td>400,00</td>
<td>450,00</td>
<td>500,00</td>
<td>450,00</td>
</tr>
<tr>
<td>Aug-10</td>
<td>392,04</td>
<td>441,05</td>
<td>490,05</td>
<td>441,05</td>
</tr>
<tr>
<td>Feb-11</td>
<td>372,83</td>
<td>419,43</td>
<td>466,03</td>
<td>419,43</td>
</tr>
<tr>
<td>Aug-11</td>
<td>351,01</td>
<td>394,89</td>
<td>438,76</td>
<td>394,89</td>
</tr>
<tr>
<td>Feb-12</td>
<td>333,81</td>
<td>375,54</td>
<td>427,26</td>
<td>375,54</td>
</tr>
<tr>
<td>Aug-12</td>
<td>314,27</td>
<td>353,55</td>
<td>392,84</td>
<td>353,55</td>
</tr>
<tr>
<td>Feb-13</td>
<td>298,87</td>
<td>336,23</td>
<td>373,59</td>
<td>336,23</td>
</tr>
<tr>
<td>Aug-13</td>
<td>281,38</td>
<td>316,55</td>
<td>351,72</td>
<td>316,55</td>
</tr>
<tr>
<td>Feb-14</td>
<td>268,94</td>
<td>302,56</td>
<td>336,18</td>
<td>302,56</td>
</tr>
<tr>
<td>Aug-14</td>
<td>260,97</td>
<td>293,59</td>
<td>326,22</td>
<td>293,59</td>
</tr>
<tr>
<td>2015 onwards</td>
<td>1,3 x SMP_{t-1}</td>
<td>1,4 x SMP_{t-1}</td>
<td>1,5 x SMP_{t-1}</td>
<td>1,4 x SMP_{t-1}</td>
</tr>
</tbody>
</table>
3. Remuneration of renewables & market deficit

- L. 3851/2010 readjusted the FiT scheme for all other RES and abolished NII PV capacity distinction (P<100kW)

<table>
<thead>
<tr>
<th>Technology</th>
<th>FiT (€/MWh)</th>
<th>Technology</th>
<th>FiT (€/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind P&gt;50kW</td>
<td>87,5 IS 99,45 NII</td>
<td>Geothermal HT</td>
<td>99,45</td>
</tr>
<tr>
<td>Wind P&lt;50kW</td>
<td>250</td>
<td>Biomass</td>
<td>200, P&lt;1MW 175, 1MW&lt;P&lt;3MW 150, P&gt;5MW</td>
</tr>
<tr>
<td>SHPP P&lt;15MW</td>
<td>87,85</td>
<td>LfG</td>
<td>120 P&lt;2MW 99,45, P&gt;2MW</td>
</tr>
<tr>
<td>CSP</td>
<td>264,85</td>
<td>Biogas</td>
<td>220, P&lt;3MW 200, P&gt;3MW</td>
</tr>
<tr>
<td>CSP-storage</td>
<td>284,85</td>
<td>Other</td>
<td>87,85 IS 99,45 NII</td>
</tr>
<tr>
<td>Geothermal LT</td>
<td>150</td>
<td>LfG</td>
<td>120 P&lt;2MW 99,45, P&gt;2MW</td>
</tr>
</tbody>
</table>
3. Remuneration of renewables & market deficit

• New Legislative Framework in Greece (Law 4414/09.08.2016) regarding RES operation & remuneration
• The new Law sets the Reference Prices to each RES Technology
• Based on the EC Guidelines over the State Aid in the sectors of energy and environment (2014 – 2020):
  1. The existing FIT scheme is being replaced by a market oriented sliding FIP scheme with the exception of small RES plants (WF with $P_{\text{inst}}$ up to 3MW and rest RES with up to 0.5MW)
  2. RES producers are obliged to submit production forecasts and are entitled to a management bonus / penalty depending on their forecasts’ accuracy
  3. RES producers can be represented in the market mechanisms by aggregators.
  4. To that end, the Last Resort Aggregator is to be appointed
  5. The premium will be offered by means of tenders organized by RAE
  6. Within 2016 a pilot tender for 40MW of PV plants was carried out by RAE.
     ✓ Initial Strike Price 94€/MWh for PVs with PL, 104 €/MWh for PL exempted PVs (max 20% in total)
     ✓ Prerequisite: Binding Interconnection Terms or Interconnection Contract in force
3. Remuneration of renewables & market deficit

- Reference Tariffs per RES technology set in L. 4414/2016.

<table>
<thead>
<tr>
<th>Technology/Project category</th>
<th>Reference Tariff (€/MWh)</th>
<th>Technology/Project category</th>
<th>Reference Tariff (€/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind farms</td>
<td>98</td>
<td>Landfill gas P&gt;2MW</td>
<td>106</td>
</tr>
<tr>
<td>Sm. Hydro P&lt;3MWe</td>
<td>100</td>
<td>Biogas P&lt;3MW</td>
<td>225</td>
</tr>
<tr>
<td>Sm. Hydro P&gt;3MWe</td>
<td>97</td>
<td>Biogas P&gt;3MW</td>
<td>204</td>
</tr>
<tr>
<td>Biomass excluding gasification P&lt;1MW</td>
<td>184</td>
<td>Solar thermal without storage</td>
<td>257</td>
</tr>
<tr>
<td>Biomass including gasification P&lt;1MW</td>
<td>193</td>
<td>Solar thermal with storage (min. 2 hours)</td>
<td>278</td>
</tr>
<tr>
<td>Biomass 1MW&lt;P&lt;5MW</td>
<td>162</td>
<td>Geothermal P≤5MW</td>
<td>139</td>
</tr>
<tr>
<td>Biomass P&lt;5MW</td>
<td>140</td>
<td>Geothermal P&gt;5MW</td>
<td>108</td>
</tr>
<tr>
<td>Landfill gas P&lt;2MW</td>
<td>129</td>
<td>Other RES</td>
<td>90</td>
</tr>
</tbody>
</table>
3. Remuneration of renewables & market deficit

Typical Cost and performance parameters for RES projects in Greece

- The Reference Tariffs were set on the basis of the Levelized Cost of Electricity (LCoE) by using the typical project plus an internal rate of return in the order of 9-10%.

<table>
<thead>
<tr>
<th>Technology-project category</th>
<th>Typical cost and performance parameters for RES projects in Greece</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CAPEX (€/kW)</td>
</tr>
<tr>
<td>Wind installations in the interconnected system</td>
<td>1250</td>
</tr>
<tr>
<td>Wind installations on the non-interconnected islands</td>
<td>1450</td>
</tr>
<tr>
<td>Offshore wind installations</td>
<td>3300</td>
</tr>
<tr>
<td>SHP ≤ 3 MW</td>
<td>1950</td>
</tr>
<tr>
<td>3 MW &lt; SHP ≤ 15 MW</td>
<td>1900</td>
</tr>
<tr>
<td>Special Rooftop PV Program</td>
<td>1250</td>
</tr>
<tr>
<td>PV ≤ 0.5 MW</td>
<td>1100</td>
</tr>
<tr>
<td>PV &gt; 0.5 MW</td>
<td>925</td>
</tr>
<tr>
<td>Geothermal stations ≤ 5 MW</td>
<td>5500</td>
</tr>
<tr>
<td>Geothermal stations &gt; 5 MW</td>
<td>4400</td>
</tr>
<tr>
<td>Solar thermal stations without storage</td>
<td>3450</td>
</tr>
<tr>
<td>Solar thermal stations with storage (min. 2 hours)</td>
<td>4700</td>
</tr>
<tr>
<td>Biomass through thermal processes ≤ 5 MW</td>
<td>3100</td>
</tr>
<tr>
<td>Biomass through thermal processes &gt; 5 MW</td>
<td>2650</td>
</tr>
<tr>
<td>Gas from landfills and biological sewage ≤ 2 MW</td>
<td>2000</td>
</tr>
<tr>
<td>Gas from landfills and biological sewage &gt; 2 MW</td>
<td>1700</td>
</tr>
<tr>
<td>Biogas from anaerobic digestion of biomass ≤ 3 MW</td>
<td>4500</td>
</tr>
<tr>
<td>Biogas from anaerobic digestion of biomass 3 MW</td>
<td>4200</td>
</tr>
</tbody>
</table>
3. Remuneration of renewables & market deficit

- Type of RES (technology and capacity) and support

<table>
<thead>
<tr>
<th>Technology</th>
<th>Power (MW)</th>
<th>Support Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Farms</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$P_{\text{inst}} &lt; 3\text{MW}$ or three production units</td>
<td>Feed-In Tariffs (FITs) without requirement of direct participation in the market</td>
</tr>
</tbody>
</table>
|                  | $3 \leq P_{\text{inst}} < 6\text{MW}$ or six production units | Prices with increase (premium) of the market price (SMP) without requirement for participation in competitive bidding processes  
- Obligation of direct participation in the market and balancing responsibilities |
|                  | $P_{\text{inst}} \geq 6\text{MW}$ or six production units | Prices with increase (premium) of the market price (SMP) with competitive bidding processes  
- Obligation of direct participation in the market and balancing responsibilities |
| Other RES        |                                   |                                                                                  |
|                  | $P_{\text{inst}} < 500\text{kW}$  | Feed-In Tariffs (FITs) without requirement of direct participation in the market |
|                  | $500\text{kW} \leq P_{\text{inst}} < 1\text{MW}$ | Prices with increase (premium) of the market price (SMP) without requirement for participation in competitive bidding processes  
- Obligation of participation in the market and balancing responsibilities |
|                  | $P_{\text{inst}} \geq 1\text{MW}$ | Prices with increase (premium) of the market price (SMP) with competitive bidding processes  
- Obligation of participation in the market and balancing responsibilities |

During the transitional stage covering the period 2015-2016, aid for at least 5% of the planned new electricity capacity from renewable sources should be granted in a competitive bidding process.
3. Remuneration of renewables & market deficit

- Pricing mechanism of RES according to the in force legal framework.
- Any amount paid to RES generators in excess of the applicable RT, will be returned to the Special Account for RES (see above) kept by the relevant market operator, as the case may be depending on the location of the project, for the payment of renewable electricity production.
3. Remuneration of renewables & market deficit

✓ Difference between FiTs and market price is covered by a RES levy paid by all consumers
✓ A number of other inputs (e.g. CO₂ permits auction) reduce the RES Levy
✓ However, a number of reasons created a significant deficit that set the whole market under severe pressure
  ▪ The most significant: High PVs remuneration in conjunction with strong investors interest
✓ Up to 9 months payments delays
✓ Reaction:
  ▪ RAE reviews every semester the deficit and readjusts the RES Levy
  ▪ A monitoring mechanism was established by the Market Operator (LAGIE), who publishes every month the latest developments and deviations from the estimated values
  ▪ Corrective measures were undertaken in order to restore the market
3. Remuneration of renewables & market deficit

✓ Repeated PV FiT adjustments
✓ Increase of RES-Levy to consumers (~28€/MWh)
✓ Fee in the energy produced by lignite plants (2€/MWh)
✓ FiT according to the date of electrification not PPA signature
✓ Suspension of PV new licensing from Nov. 2012
✓ Removal of market distortions that reduced SMP (2014)
✓ “New Deal” L. 4254/ April 2014
  ▪ introduced FiT reductions for all RES for new and operating projects (~25% w.a.)
  ▪ enforced 2013 discount from RES producers (10-37,5%)
  ▪ abandoned annual inflation FiT adjustment
  ▪ set capacity caps for FiT for PV, CSP, Biomass & Biogas
✓ L. 4414/2016 imposed an additional charge to the Suppliers based on the difference between actual SMP and the virtual SMP of the market without any RES in the System (Hourly Calculation capped at 15€/MWh, 7 €/MWh on average the last year)
3. Remuneration of renewables & market deficit

- Structure of inflows and outflows of RES account

**Market Inflows**
- SMP inflows
- Suppliers’ Charge

**Other Sources Inflows**
- CO₂ Emission Allowances
- Lignite Fee

**RES LEVY to consumers**

**RES Account** (Art. 143 of L. 4001/2011)

**Marginal Production Cost in NII**

**RES Producers**
3. Remuneration of renewables & market deficit

- Development of RES market Deficit as a function of time and measures taken.

- Initial Situation
  - Prior to L.4254
  - The Deficit is expected to be zero by the end of 2017.

- Following L. 4414/2016
  - Forced Discount €305m.

The Deficit is expected to be zero by the end of 2017.
4. Connection issues & integration of renewables

- Regarding the Interconnection of RES units to the electricity System, in Greece the Directives 2009/28/EC regarding RES penetration and 2009/72/EC as regards the development of the internal market are fully implemented.

- Rules and principles:
  - The transmission and distribution of electricity from RES units is guaranteed.
  - These units have priority/guaranteed access to the electricity grid.
  - RES units have priority in dispatch in the context of the operation of the electricity market.
  - Facilitation of their connection in case of bottlenecks/congestion problems to be provided by the Network Operators especially for small scale RES generation units.

- Special Case Study: Penetration of RES in the Non Interconnected Islands.
  - Due to technical limitations of thermal plants and the uncertainty in the RES production the integration of RES is limited.
  - Every two years the respective TSO or DSO on the basis of updated data reassess the restrictions and communicates to RAE the new margins per isolated island.
  - RAE decides on the new margins and on the terms and conditions for their allocation to the different RES Technologies.
4. Connection issues & integration of renewables

**Licensing Treatment of RES plants**

I. Following the issue of the Production License, the RES producers submit simultaneously an application for the issue of:
   a. Non-binding Interconnection Terms
   b. Environmental Terms Approval (ETA) or exemption of it.

II. The Non-Binding Interconnection Terms are to be issued within 4 months. The application if the capacity of the project is above 8 MW is submitted to the TSO, otherwise to the DSO.

III. In the Non-Binding Interconnection Terms, the cost for the connection of the Project is calculated. The per unit costs (lines, cables, Substations etc.) used in the calculations are set by virtue of RAE Decision.

IV. Following the issue of ETA, the Binding Interconnection Terms are issued. Their validity period is 3 years.

   **Precondition:** The RES producer must submit a letter of guarantee to the respective TSO or DSO (from 42€/kW for projects up to 1 MW gradually declining to 7 €/kW for projects with capacity above 100 MW).

V. The Binding Interconnection terms are used for the Connection Agreement with the relevant system operator and the PPA with the Marker Operator (LAGIE).
4. Connection issues & integration of renewables

**Schematic Diagram**

- **Production License** (RAE, 25 years)
  - Application for

- **Non Binding Interconnection terms**
  - Environmental terms Approval
  - Issued

- **Binding Interconnection Terms (3 years)**
  - Connection Agreement
  - Power Purchase Agreement (20 or 25 years)

- **Installation License** (2+2+1.5 years)
  - Following a Trial Period

- **Operation License** (20 or 25 years)
4. Connection issues & integration of renewables

- All the necessary works (Substations, HV Transmission Lines and Cables) to be carried out in the Transmission System for the interconnection of RES are included in the Ten Year Network Development Plan (TYNDP) of the TSO.
- These works are to be financed by the SPVs of the RES plants.

**Special Case: RES and Interconnection of Non Interconnected Islands (NII)**

- The Greek State in order to:
  a) terminate the electrical isolation of the islands
  b) to reduce the expenses (Public Services Obligations, PSO) for the electrification of the islands through inefficient polluting thermal plants (~€700-800 m./year)
  c) to exploit the rich RES (mainly wind) potential
  d) to meet the strict EU environmental emissions’ targets
  e) to accelerate the operation of an electricity open market

subsidies the installation of RES on NII when it is combined with the interconnection of the specific NII.
- The subsidy has the form of an increase up to 25% in the Reference Tariff of the RES plant depending on the decrease of the PSO arising out of the interconnection.
- Up to now, 18 Wind farms’ Clusters on NII in the Aegean Sea with a total capacity of 4.9GW have been awarded the Production License, of which 2 with an aggregated capacity of 2GW on Crete.
4. Connection issues & integration of renewables

**Special Case: RES and Interconnection of Non Interconnected Islands (NII)**

- The TSO on the basis of the Non Binding Connection Terms issued to these RES projects, conducted a preliminary study for the interconnection of the NII, the results of which were included in the TYNDP.
- Next stage: Finalization of the results in the context of RES projects licensing progress and maturity.
5. Self-generation, self-consumption & “energy communities”

The new trend in the energy world.

• Currently there are mainly four community involvement models in the energy sector that correspond to different purposes:
  1. The *Open Investment Model* where individuals or small/medium enterprises can participate financially in a project e.g. in the form of holding a bond or another form of financial stake
  2. The *Compensation Model*, by which the local community receives some form of benefit from a RES project, independently of who owns the financial shares
  3. The *Community Connected Model*, which is a partnership between professional developers or/and municipal communities and/or the local community suitable especially for wind farms. The local community owns up to 49% of the shares of the project and can own or even operate the project.
  4. The *Community Based Model* where the local community holds at least 50% of the decision making power.

• Some benefits: increase of local acceptance of the RES projects, participation and active involvement of the local communities in the benefits of the project, familiarization of people with the RES technologies and faster deployment, local value – added cycles as profits are channeled back to communities, support of countryside against depletion.
5. Self-generation, self-consumption & “energy communities”

The new trend in the energy world.

- Currently in Greece there are two support methods widely implemented:
  - The Open Investment Model, where local individuals and SME develop their own projects as a result of the favorable legislation and remuneration. Two cases developed so far:
    - The self generation, regarding the development of small PVs on rooftops with capacity up to 10kWp remunerated in the form of a FiT (since 2009). Due to the extreme lucrative remuneration (550€/MWh), the development was extremely strong in the beginning (370MW within the period 2011-2014), but now the pace has slowed down (currently the FiT is set at 100 €/MWh).
    - The self consumption (“net metering” applications) by means of PV systems, where the energy consumed and the energy produced in the same connection point are weighted.
      - Capacities from 5kWp up to 500kWp per connection point depending on the installation and the user (private, public utility or SME).
      - Currently 7.7 MWp in operation.
      - Application of “virtual net metering” for Public Organizations and Agricultural Bodies. The PV station and the consumption point shall be located in the same Prefecture (not in the same network point) and at the same voltage level.
      - The excess of energy on an annual basis is not entitled to reimbursement.
      - suitable dimensioning of the PV installation
5. Self-generation, self-consumption & “energy communities”
The new trend in the energy world.

Topology of the metering devices in “net metering” applications
- Basis of all the calculations the amount:

\[ E \text{ (energy extracted)} = \Pi \text{ (Energy Produced)} - A \text{ (Energy Consumed)} \]
5. Self-generation, self-consumption & “energy communities”
The new trend in the energy world.

✓ The other Model is the Compensation Model, where:
  • 3% of the Gross RES project sales (pro taxes) are given to the local communities as follows: 1.7% to the Municipalities for the construction of necessary public infrastructure works (roads, networks, sewage plants etc.), 1% directly to electricity bills of the consumers and 0.3% to the “Green Fund” for the financing of projects related to the environment (reforestation, recreation areas, landfills etc.)
  • In case of Small Hydro Power projects located in Protected areas (Natura 2000) additional 1% is directed to the Organization in charge of its protection.
  • Excluded are PVs and RES installations on buildings.
  • In general, this tool has a positive influence towards the implementation of many RES projects, first and foremost Wind Farms.
5. Self-generation, self-consumption & “energy communities”

The new trend in the energy world.

The new era: Energy Communities

- The Recast of Directives EC 2009/72 regarding internal market and 2009/28 on RES deployment, place huge emphasis on the development of the Energy Communities (EN.CO.) on the basis of the Community Connected Model or / and Community Based Model.

- Basic Principles (EC 2009/72):
  - Local energy communities can be an efficient way of managing energy at community level by consuming the electricity they generate either directly for power or for (district) heating and cooling, with or without a connection to distribution systems.
  - To ensure that such initiatives can freely develop, own or operate Distribution networks (thermal or electrical)
  - The EN.COs. shall have access to the energy market and take over the role of aggregator, consumer, producer, supplier or even DSO with the same rights and responsibilities as they other market participants without any discriminations.
  - The new framework requires Member States to put in place appropriate legal frameworks to enable EN.COs. activities.
5. Self-generation, self-consumption & “energy communities”
The new trend in the energy world.

- **Special Attention to the RES Energy Communities (2009/28)**
  - SPVs in the form of SMEs or Non-Profit Organizations
  - The shareholders or the members shall be natural persons, local authorities (municipal bodies included) or SME active in the RES sector (local character)
  - At least 51% of the shareholders or members with voting rights are natural persons (participation of citizens)
  - At least 51% of the shareholders or members with voting rights in the EN.CO. belong to local bodies, e.g. representatives of local organizations or natural persons leaving in the same areas
  - At least 51% of the BOD or governing bodies of EN.COs are to be held by local bodies/natural persons
  - Restriction: installation of units with average capacity of 18MW per year the last 5 years
  - Some privileges: tax exemptions, specific amount of MWs dedicated to EN.COs in RES tenders, easier licensing procedure, exemption of some obligations
  - **In Greece** the above scheme has been fully adopted.
Thanks for your attention!

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Appendix 1:

The new support scheme in a snapshot – The PV pilot tender in 2016

► In Greece, the pilot tender procedure for mature (with Interconnection Terms & Environmental Terms Approval PVs), took place in 12.12.2016, and it has been widely considered to be simple, transparent and trustworthy, in line with a specific Regulation issued by RAE.

► The projects have been divided in two categories: a) ≤1MW (20% of the auctioned capacity), and b) >1MW.

► Max capacity per project: 10MW

► The RT was set beforehand by law at 104€/MWh (category A) and 94 €/MWh (category B)

► Pay as bid tendering pricing

► Predefined deadlines for the realization of the projects: 18months (category a) and 24months (category b)

► It has been very successful as big reductions of prices have been achieved:
  
a) **Category A** (PV ≤1MW): Prices from 94,97€/MWh to 104€/MWh, in average: 98,78€/MWh.

b) **Category B** (PV >1MW): Prices from 79,97€/MWh to 88€/MWh, in average: 83,3€/MWh.
Appendix 2:

Monthly Average Supplier Charge as a function of time