SEERMAP

South-East Europe Electricity Roadmap

# RES-E policy and planning in GREECE

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# Questions Posed

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## 1. Present RES-E support scheme

Is your country on the path to reach its 2020 RES-E target?
Key barriers and success factors
Did any significant change occur in the RES regulation in the last years? Why?

## 2. Impact of 2014 State Aid Guidelines on RES-E support

How does your country plan to fulfil the requirements of the State Aid Guidelines with relation to RES-E?
    Competitive support allocation? New marketing rules?
Have your country started tendering RES-E support for certain technologies?
If not, do you plan to do so?
What are the main rules of tendering?

## 3. Long term energy/electricity vision - Greece

Do you have official long term energy plans?
    Up to what year? Regularly updated?
    Main characteristics? (modelling tool used and sectoral coverage)
What are the main assumptions regarding:
    a) Electricity demand b) Technology deployment c) Carbon pricing

# 1. Present RES-E support scheme

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**Greece** in the scope of the 20-20-20 targets and obligations has specified in Art 1 of Law 3851/2010 the following targets (in addition to the fixed ones i.e. 10% by RES of the transport energy and 6% on transport fuels, etc):

- **20%** (2% above the **18%** specified in Directive 2009/28/EC) of gross final energy consumption to be generated by RES by 2020
- **40%** of gross electricity consumption to be generated by RES by 2020

These targets were reiterated in Law 4414/16Aug2016 (Art 1)

Also GHG emissions from non-ETS sectors to decrease by **4%** by 2020 compared to 2005 as specified by the ESD, to increase to **16%** (tentatively) in 2030

Finally, the target for energy efficiency is for final consumption to reach **18.4Mtoe** by 2020 (2014 Final Consumption 15.7Mtoe)

# 1. Present RES-E support scheme

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| | 2020 Target | REF2016 | EUCO27 | RED-I method (50% flat rate, 50% GDP) | Alternative method 50% flat rate, 25% GDP & 25% land area |
|---|---|---|---|---|---|
| Belgium | 13 | 16 | 17 | 19 | 18 |
| Bulgaria | 16 | 28 | 31 | 22 | 25 |
| Czech Republic | 13 | 15 | 18 | 19 | 19 |
| Denmark | 30 | 39 | 44 | 38 | 38 |
| Germany | 18 | 21 | 23 | 26 | 24 |
| Estonia | 25 | 28 | 31 | 30 | 34 |
| Ireland | 16 | 18 | 22 | 25 | 25 |
| Greece | 18 | 30 | 34 | 26 | 28 |
| Spain | 20 | 27 | 31 | 28 | 28 |
| France | 23 | 26 | 26 | 30 | 30 |
| Croatia | 20 | 25 | 28 | 27 | 30 |
| Italy | 17 | 24 | 28 | 25 | 24 |
| Cyprus | 13 | 18 | 20 | 20 | 21 |
| Latvia | 40 | 42 | 46 | 47 | 54 |
| Lithuania | 23 | 25 | 27 | 30 | 34 |
| Luxembourg | 11 | 8 | 10 | 18 | 17 |
| Hungary | 13 | 14 | 15 | 19 | 20 |
| Malta | 10 | 13 | 14 | 19 | 17 |
| Netherlands | 14 | 16 | 16 | 21 | 19 |
| Austria | 34 | 37 | 41 | 41 | 41 |
| Poland | 15 | 18 | 20 | 21 | 22 |
| Portugal | 31 | 38 | 42 | 39 | 40 |
| Romania | 24 | 30 | 33 | 31 | 34 |
| Slovenia | 25 | 28 | 30 | 31 | 32 |
| Slovak Republic | 14 | 15 | 16 | 20 | 20 |
| Finland | 38 | 49 | 53 | 44 | 49 |
| Sweden | 49 | 61 | 66 | 55 | 60 |
| United | 15 | 17 | 20 | 23 | 22 |

Initial views of EC on MS RES targets for 2030
SWD (2016) 418 final

# 1. Present RES-E support scheme

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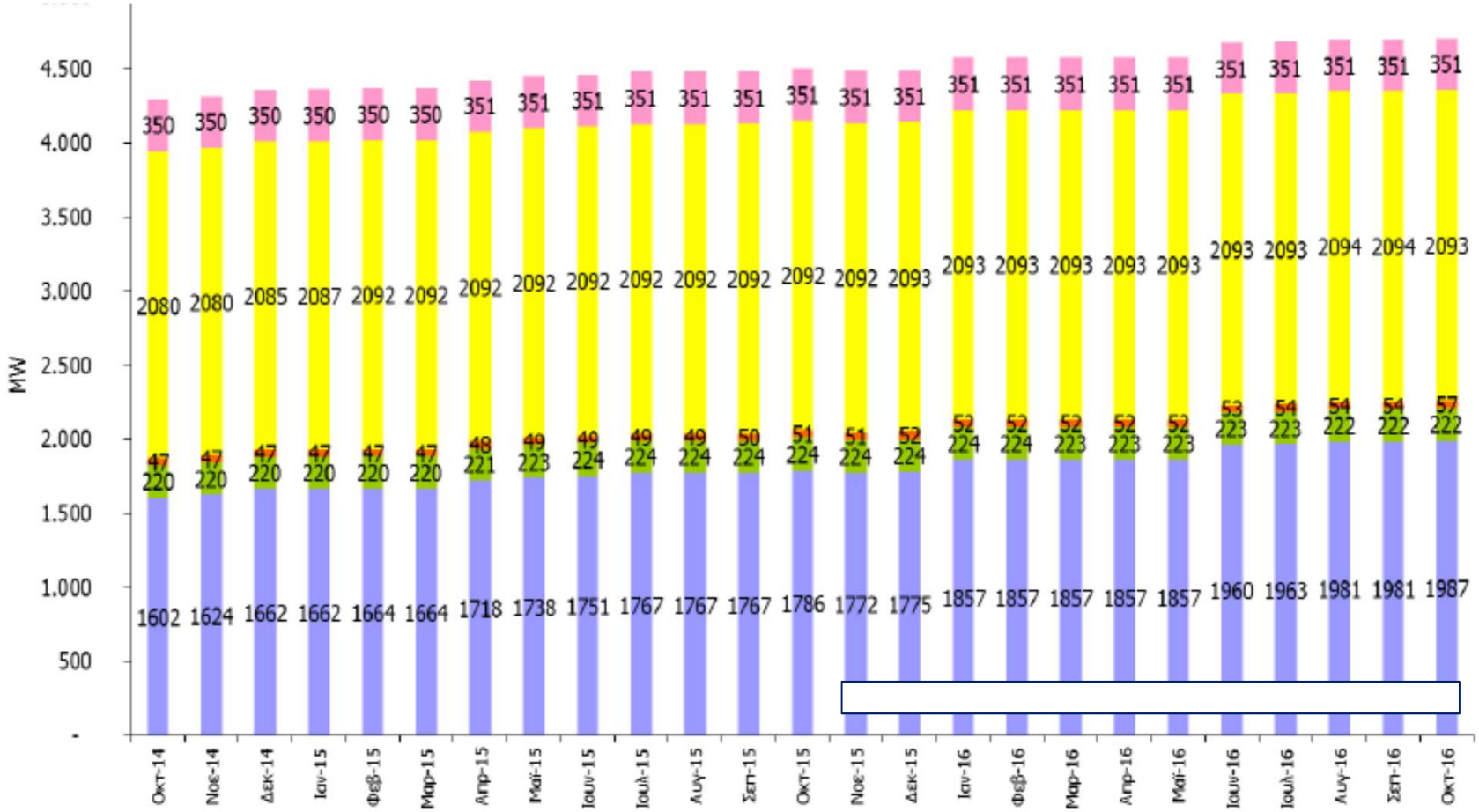
Installed Capacity (Wind, Small hydro, Biomass, PV, Roof PV)



# 1. Present RES-E support scheme

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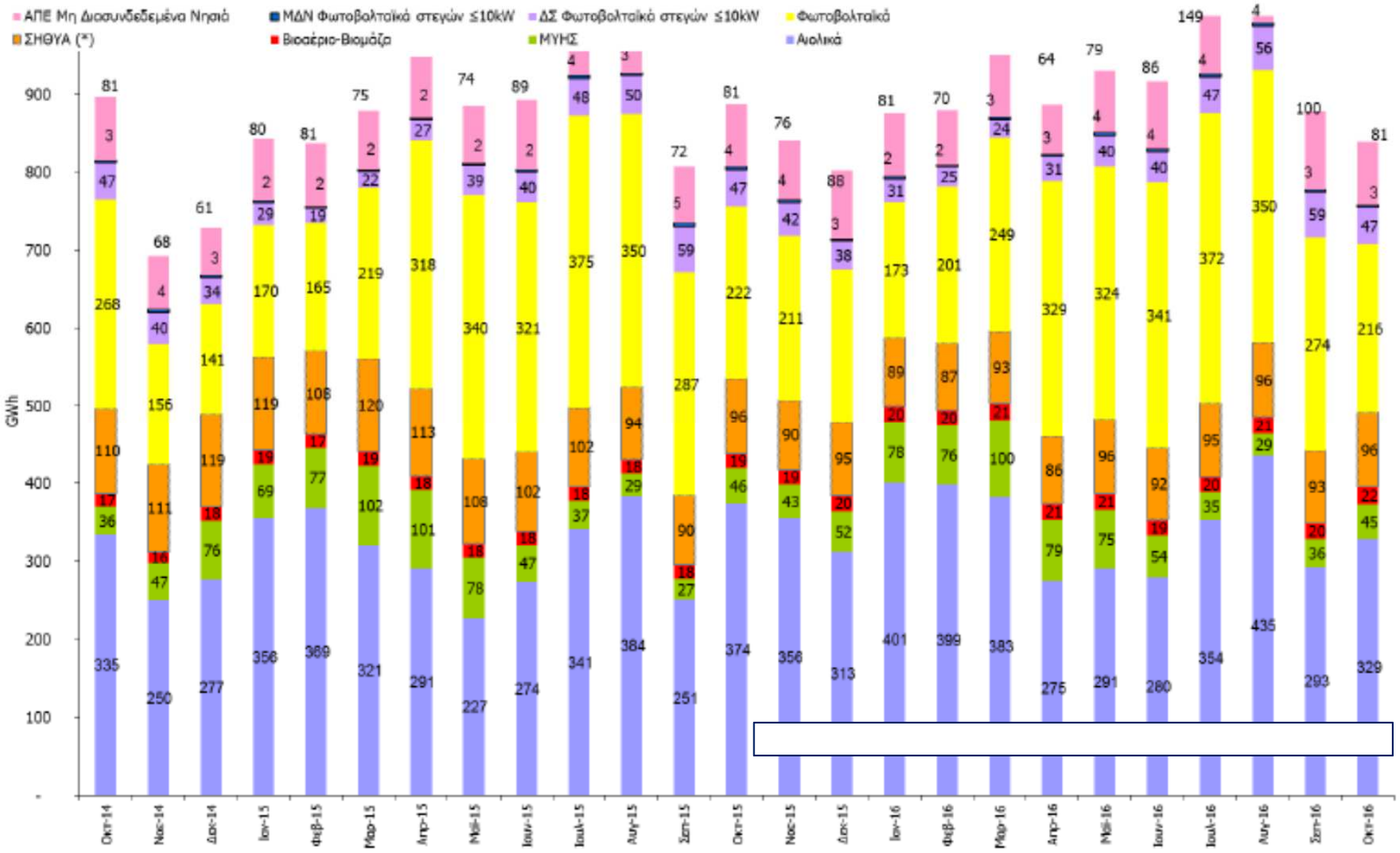
RES Production (Wind, Small Hy, Bio, CHP, PV, Roof PV, PV Isle, Isle)



# 1. Present RES-E support scheme

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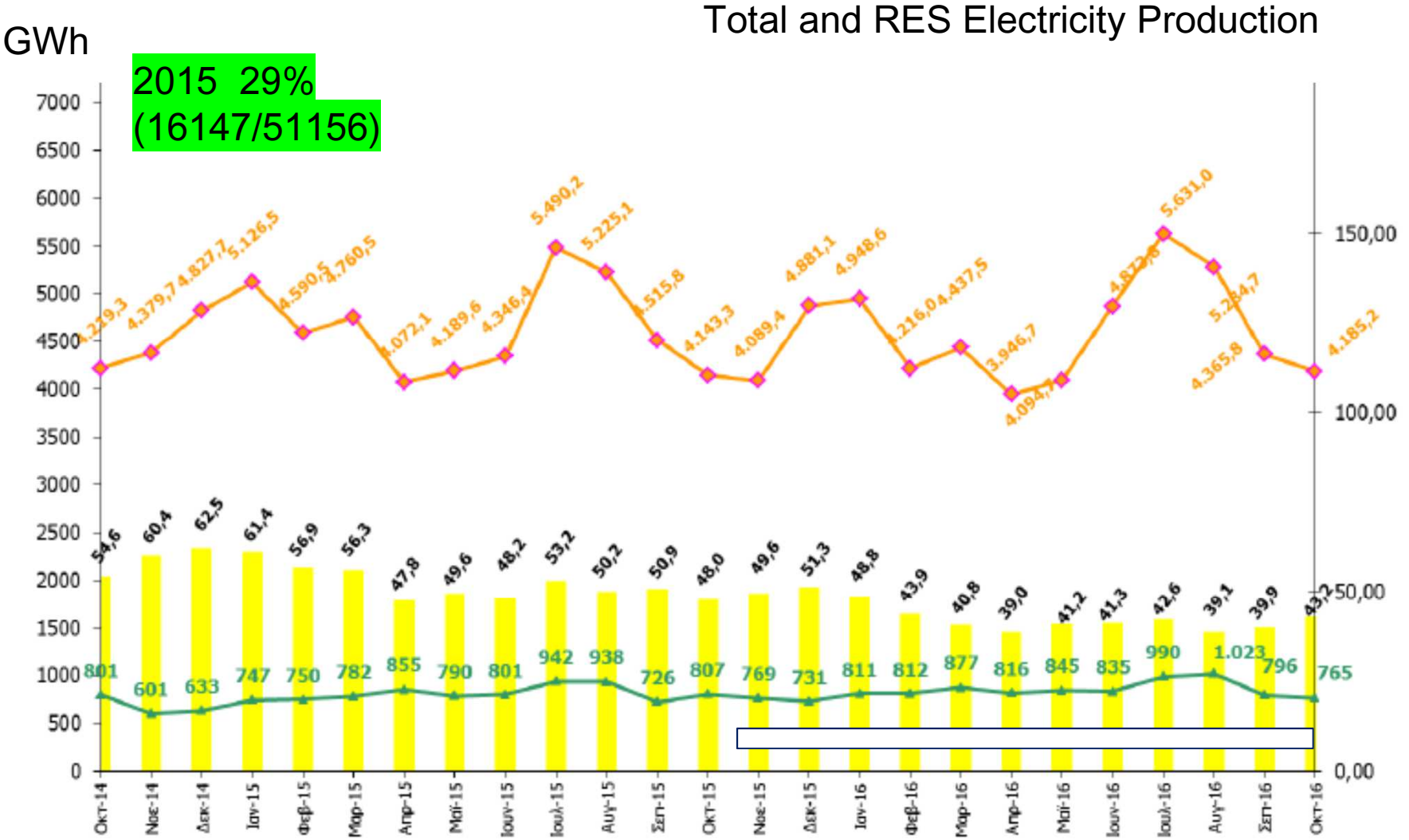
Total and RES Electricity Production



# 1. Present RES-E support scheme

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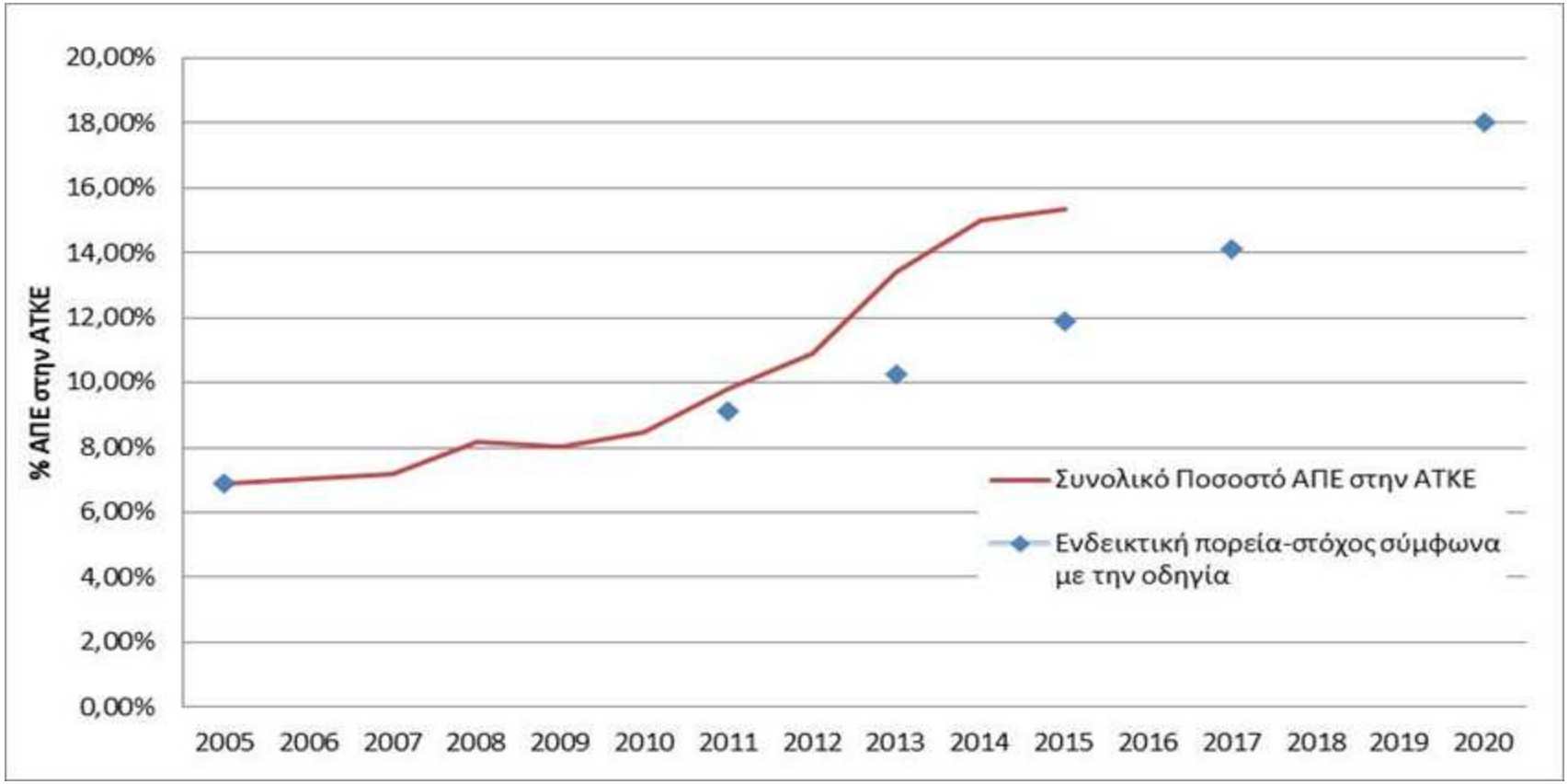
## Progress toward target for RES production



# 1. Present RES-E support scheme

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## Favorable factors

- Large RES potential (large insolation, strong winds)
- Strong interest despite adverse economic conditions
- Experienced installation/construction enterprises

## Barriers – difficulties

- Difficulties in securing finance
- Bureaucratic difficulties
- NIMBY effect

# 1. Present RES-E support scheme

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**Licenses and applications status November Oct2016**

| RES Plants at various stages 11/2016 | (MW) |
|---|---|
| In operation | 4986 |
| Wind | 2310 |
| PV | 2229 |
| Small Hydro, biomass etc | 429 |
| With PPA, not in Operation | 2299 |
| Exempt licensing, w/o PPA | 654 |
| With production license w/o PPA | 25242 |
| Roof PV operating | 375 |
| **Total** | **33556** |

# 1. Present RES-E support scheme

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| preliminary projections for new installed capacity until 2020 (study for the assessment of the national RES special account) in MW | |
|---|---|
| Biomas and Biogas | **48** |
| Small hydro | **24** |
| Wind parks | **1353** |
| PV (incl net-metering) | **1102** |
| Geothermal | **43** |

**Total 2550MW**

# 1. Present RES-E support scheme

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**Law 4414 of 16 August 2016 on the Support of RES/CHP and officially by DG COMP under the Decision C(2016)7272**

- Latest of a succession of laws from 2006 which specified a FIT regime
- Framework law with a large number of JMDs to be issued for details
- Introduces a FIP regime for large projects
- Introduces auctions for RES capacity starting with PV in 2016
- Provides a transition regime for projects in the pipeline
- Requires that all large installations take on obligations of notification and/or participation in the scope of the day- ahead and intra-day markets
- Provides for contracts for remuneration of 20Yrs duration

**Law 4425 of 30 September 2016 on the operation of the Market**

- Introduces 4 markets (Forward, Day-ahead, Intraday and Balancing)
- Specifies the Market Operators and their remit (2 existing, 1 or more new)
- Provides for a new set of Codes for the operation of the markers
- Authorizes the Regulatory Agency for Electricity to supervise the codification and operations and tasks it to provide inputs for new legislation as required
- Authorizes the Minister, upon recommendation from RAE to declare the commencement of the Market operation

# 1. Present RES-E support scheme

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Starting on 1Jan2017 all RES to be installed are to be auctioned (L4414)

Feed in Premium => Day Market Marginal Price + (P2- P1)

- P1= Reference Market Price per technology computed taking into account MSP, wholesale price, variable cost of thermal stations (decided by a Ministerial Decree)
- P2= RES reference price as per published list by technology or as auctioned
- If small (0.5MW PV, 3MW wind) P2 or as auctioned

Contracts with 20YR duration (25YR for rooftop PV)

All RES have to submit day ahead generation forecasts

- Penalties if there is large deviation (ca. < 7€/MWh deviation)

Transition provisions for those with licenses and/or power purchase contracts

# 1. Present RES-E support scheme

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## RES Reference Market Prices (Law 4414, Art. 4)

- Wind: 98€/MWh
- Small Hydro 97€/MWh - 100€/MWh
- Biomass 140€/MWh - 193€/MWh
- Biogas 204€/MWh - 225€/MWh
- Biogas from waste 106€/MWh - 129€/MWh
- Solar thermal 257€/MWh - 278€/MWh
- Geothermal 108€/MWh - 139€/MWh
- Rest 90€/MWh
- High Performance NG CHP 61€/MWh - 92€/MWh plus NG price adjustment
- Rest High Performance CHP 85€/MWh

# 2. Impact of 2014 State Aid Guidelines on RES-E support

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From 1Jan2017 all RES to be installed are to be auctioned (Art.7.1)

The general rules are decided by Ministerial Decree upon recommendation by RAE (Art. 7.2-7.3). This includes:

- The technologies involved (also excluded), the amount of capacity per technology to be installed per year, the number of tenders, the acceptable price spread
- The means to satisfy “technology neutral” tendering rules
- The methodology to be used
- The portion to be allocated to countries in the European Economic Space if any, if there exists cross-border energy trade

RAE’s recommendation to take into account:

- The National RES development plan
- Grid limits and related costs involved
- The influence on the market price & distortions, and the funds available

RAE is in charge of carrying out the auctions

One-off pilot auction by the end of 2016 for PV (art. 7.8-7.10)

# 2. Impact of 2014 State Aid Guidelines on RES-E support

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On 12 December 2016 the first auction (L4414, Art. 7) for PV

Total amount: 40MW

2 Tranches: 4.8MW for installations < 1MW

35.2MW for installations >1MW

The offers have to be 40% over the tranche amount

Electronic bidding (descenting order) and Pay-as-bid

Tranche A results:

13 tenders, 9 selected for a total of 4.80MW

3 for 100kW, 3 for 500MW, 3 for 1MW)

Prices offered: from 94.97€ to 104.0€ (aver. weighted 98.3€)

Tranche B results:

12 tenders, 7 selected for a total of 35.12MW

from 1.5MW to 9MW

Prices offered: from 79.97€ to 93.94€ (83.3€)

# 2. Impact of 2014 State Aid Guidelines on RES-E support

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## Additional provisions of L4414

- FIT for small-scale RES projects (<500kW , <3MW wind).
- Special conditions for RES projects on the non-interconnected islands and for RES Hybrid plants. Also provisions if they are connected
- Monitoring process for the revision of the Reference Prices.
- Provisions for the extension of the net-metering scheme to other RES technologies as well as the establishment of virtual net-metering under special conditions.
- Framework for the establishment of RES aggregators as market participants ( also for the last resort aggregator)..
- Transfer of balancing responsibilities to RES generators upon the operation of a liquid intraday market.
- Opening of the RES support scheme to generators from other EEA, Energy Community countries (i.e. in terms of tendered capacity and grid interconnection).

# 2. Impact of 2014 State Aid Guidelines on RES-E support

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## Transitional provisions of L4414 (Art. 3)

- Operators of >5MW RES installations with FIT contracts can switch to FIP
- Licensees with PPAs by 31Dec2015 can still get FIT if operational by 30June2018
- Roof PV to continue under its own regulation
- Increasing power of existing plants to be under FIP
- Major renovation/repowering of existing plants to be under FIP but with special tendering considerations
- For wind provisional “forecast preparation” bonus (2 or 3 €/MWh)
- Methodology for the assessment of aid accumulation (investment aid vs operating aid).

# 3. Long term energy/electricity vision - Greece

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## Energy Planning

- Until 2014 there existed a National Energy Planning Committee
- The Greek Road Map to 2050 was produced in 2012 (but never officially adopted) under its auspices
- The Committee has not met since January 2014 when its membership changed
- In 2014 it was tasked to produce within 3 months a draft energy plan to be put out for consultation for 3 weeks
- No new official energy plan has been presented.
- The Greek National Center for Renewable Energy Sources (CRES) has been producing a number of scenarios to support the Ministry of Environment and Energy with the latest (Oct 2016) presented to a Parliament committee but none have been officially adopted.
- In addition the NREAP and NEEAP have been submitted on time as have the 2nd biennial progress reports in 2015 and 2016 respectively

# 3. Long term energy/electricity vision - Greece

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## CRES 2030 Energy Roadmap (till 2050) – Basic assumptions

- GDP growth to go from ca 0.1 in 2016 60 2.5% in 2020 and 2.2% by 2030
- Meet the 2020 and 2030 RES targets of 20% and 30% respectively
- Reach a 65% reduction of GHG emissions by 2050 compared to 2005
- Adopt 2 scenarios (i.e. 14-15€/MWh by 2020, 22-25€/MWh by 2030 and 35-40€/MWh by 2050) for NG prices till 2050
- Adopt 2 scenarios (i.e. 28-32€/MWh by 2020, 31-33€/MWh by 2030 and 45-60€/MWh by 2050) for EU-ETS allowances till 2050
- Follow the planned existing lignite plant retirement schedule till 2030
- Assume IRR for RES of 8% to 9% ( vs 7.5-8% for conventional)
- Adhere to the 30% energy conservation nominal target for 2030
- Crete and selected islands connected to mainland grid
- 12 scenarios to cover NG and ETS prices, forced RES % on electricity
- **Seek least-cost solutions**

**Models used**: TIMES-MARKAL, CRES model of the daily electricity market, IAEA statistical convolution of RES production and demand, WASP

# 3. Long term energy/electricity vision - Greece

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CRES Oct2016 scenario results

| Installed Capacity [GW] | | ΧΦΑ-ΧΔΕ | | ΧΦΑ-ΥΔΕ | | ΥΦΑ-ΧΔΕ | | ΥΦΑ-ΥΔΕ | |
|---|---|---|---|---|---|---|---|---|---|
| | 2014 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 |
| Solid fuel – Lignite | 4,3 | 4,5 | 2,0 | 4,5 | 2,0 | 4,5 | 2,0 | 4,5 | 2,0 |
| Oil | 1,9 | 2,1 | 2,1 | 2,1 | 2,1 | 2,1 | 2,1 | 2,1 | 2,1 |
| Natural Gas | 4,5 | 5,3 | 5,3 | 5,3 | 5,3 | 5,3 | 5,3 | 5,3 | 5,3 |
| Fuel Cells NG | 0,0 | 0,0 | 0,1 | 0,0 | 0,1 | 0,0 | 0,1 | 0,0 | 0,1 |
| Biomass, Biogas | 0,1 | 0,1 | 0,3 | 0,1 | 0,3 | 0,1 | 0,3 | 0,1 | 0,3 |
| Hydro | 2,7 | 3,0 | 3,1 | 3,0 | 3,1 | 3,0 | 3,1 | 3,0 | 3,1 |
| Pumped Storage Hydro | 0,7 | 0,7 | 1,5 | 0,7 | 1,5 | 0,7 | 1,5 | 0,7 | 1,5 |
| Wind | 1,9 | 3,6 | 8,7 | 3,6 | 8,7 | 3,6 | 8,7 | 3,7 | 8,7 |
| PV | 2,6 | 3,8 | 4,4 | 3,8 | 4,3 | 3,8 | 4,3 | 3,8 | 4,3 |
| CSP | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| Geothermal | 0,0 | 0,1 | 0,2 | 0,1 | 0,2 | 0,1 | 0,2 | 0,1 | 0,2 |
| **Total** | **18,7** | **23,0** | **27,3** | **23,0** | **27,3** | **23,0** | **27,3** | **23,0** | **27,3** |

# 3. Long term energy/electricity vision - Greece

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## Lignite Power Plants

| Unit name | Installed capacity-nominal [MW] | Net as reported by ITSO | (Expected) year of commissioning | Expected year of decommissioning | Type |
|---|---|---|---|---|---|
| **Lignite Power Plants** | | | | | |
| Agios Dimitrios I | 300 | 274 | 1984 | 2039 | ST |
| Agios Dimitrios II | 300 | 274 | 1984 | 2039 | ST |
| Agios Dimitrios III | 310 | 283 | 1985 | 2040 | ST |
| Agios Dimitrios IV | 310 | 283 | 1986 | 2041 | ST |
| Agios Dimitrios V | 375 | 342 | 1997 | 2052 | ST |
| Amyntaio I | 300 | 273 | 1987 | 2042 | ST |
| Amyntaio II | 300 | 273 | 1988 | 2043 | ST |
| Kardia I | 300 | 275 | 1975 | 2031 | ST |
| Kardia II | 300 | 275 | 1975 | 2030 | ST |
| Kardia III | 306 | 280 | 1980 | 2035 | ST |
| Kardia IV | 306 | 280 | 1981 | 2036 | ST |
| Liptol II. | 30 | 30 | 1985 | Decomm. 2014 | ST |
| Megalopolis III | 300 | 255 | 1975 | 2030 | ST |
| Megalopolis IV | 300 | 256 | 1991 | 2046 | ST |
| Melitis II | 330 | 289 | 2008 | 2038 | ST |
| Melitis I | 330 | | Signed MOU ???? | | |
| Ptolemais II | | 0 | | Decomm. 2014 | ST |
| Ptolemais III | 125 | 116 | | Decomm. 2015 | ST |
| Ptolemais IV | 274 | | 1981 | | ST |
| Ptolemais V | 660 | | 2018??/fully licensed | | ST |

# 3. Long term energy/electricity vision - Greece

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## CRES Oct2016 scenario results

| Electricity Production [TWh] | | ΧΦΑ-ΧΔΕ | | ΧΦΑ-ΥΔΕ | | ΥΦΑ-ΧΔΕ | | ΥΦΑ-ΥΔΕ | |
|---|---|---|---|---|---|---|---|---|---|
| | 2014 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 |
| **Total** | **47,1** | **52,0** | **59,3** | **51,9** | **59,3** | **52,2** | **59,3** | **52,2** | **59,3** |
| Solid fuel-Lignite | 22,7 | 14,1 | 8,6 | 11,1 | 7,9 | 19,5 | 8,6 | 18,3 | 7,9 |
| Oil | 5,0 | 4,3 | 2,5 | 4,3 | 2,5 | 4,3 | 2,5 | 4,3 | 2,5 |
| Natural Gas | 7,7 | 13,4 | 12,9 | 16,1 | 13,5 | 8,1 | 12,9 | 9,1 | 13,4 |
| NG- Fuel Cells | 0,0 | 0,0 | 0,4 | 0,0 | 0,5 | 0,0 | 0,4 | 0,0 | 0,5 |
| Biomass & Biogas | 0,2 | 0,4 | 1,1 | 0,4 | 1,1 | 0,4 | 1,0 | 0,4 | 1,1 |
| Hydro | 4,5 | 5,7 | 6,1 | 5,7 | 6,1 | 5,7 | 6,1 | 5,7 | 6,1 |
| Wind | 3,7 | 8,4 | 20,2 | 8,5 | 20,3 | 8,5 | 20,3 | 8,5 | 20,3 |
| PV | 3,6 | 5,7 | 6,5 | 5,7 | 6,5 | 5,7 | 6,5 | 5,7 | 6,5 |
| CSP | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| Geothermal | 0,0 | 0,4 | 1,4 | 0,4 | 1,4 | 0,4 | 1,4 | 0,4 | 1,4 |
| **Total installed RES (GW)** | 8.0 | 8.3 | 18.2 | 8.3 | 18.1 | 8.3 | 18.1 | 8.3 | 18.1 |
| **% RES in Final Consumption** | 15% | 20% | 30% | 20% | 30% | 20% | 30% | 20% | 30% |
| **% RES in Electricity** | 24% | 37% | 57% | 37% | 57% | 37% | 57% | 30% | 57% |

# 3. Long term energy/electricity vision - Greece

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CRES Oct2016 scenario results

| Final Consumption (ktoe) | | 2014 | ΧΦΑ-ΧΔΕ 2020 | ΧΦΑ-ΧΔΕ 2030 | ΧΦΑ-ΥΔΕ 2020 | ΧΦΑ-ΥΔΕ 2030 | ΥΦΑ-ΧΔΕ 2020 | ΥΦΑ-ΧΔΕ 2030 | ΥΦΑ-ΥΔΕ 2020 | ΥΦΑ-ΥΔΕ 2030 |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Total** | **15850** | **17152** | **18230** | **17151** | **18221** | **17154** | **18230** | **17150** | **18220** |
| By Sector | Industry | 3134 | 3552 | 4286 | 3553 | 4278 | 3556 | 4287 | 3554 | 4278 |
| | Residential | 3813 | 3948 | 4046 | 3946 | 4045 | 3946 | 4045 | 3945 | 4044 |
| | Tertiary/Agri | 2558 | 2964 | 3598 | 2964 | 3598 | 2964 | 3598 | 2964 | 3597 |
| | Trasmport | 6344 | 6688 | 6300 | 6688 | 6300 | 6688 | 6300 | 6688 | 6300 |
| By fuel kind | Solid fuels | 244 | 246 | 248 | 246 | 246 | 246 | 248 | 246 | 246 |
| | Oil | 8917 | 9215 | 8526 | 9226 | 8527 | 9230 | 8529 | 9230 | 8528 |
| | Natural Gas | 886 | 1272 | 1745 | 1273 | 1748 | 1273 | 1743 | 1274 | 1748 |
| | Electricity | 4291 | 4597 | 5108 | 4596 | 5107 | 4596 | 5109 | 4595 | 5107 |
| | Heat | 39 | 38 | 95 | 38 | 95 | 38 | 95 | 38 | 95 |
| | RES | 1473 | 1784 | 2507 | 1772 | 2497 | 1772 | 2506 | 1767 | 2496 |

# 3. Long term energy/electricity vision - Greece

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CRES Oct2016 scenario results

| Targets | | ΧΦΑ-ΧΔΕ | | ΧΦΑ-ΥΔΕ | | ΥΦΑ-ΧΔΕ | | ΥΦΑ-ΥΔΕ | |
|---|---|---|---|---|---|---|---|---|---|
| | 2014 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 |
| GHG Emissions (Mt $CO_2$eq) | **93** | **80** | **65** | **77** | **64** | **86** | **65** | **84** | **64** |
| Non-ETS emissionsκπομπές (Mt $CO_2$eq) | **43** | **42** | **40** | **42** | **40** | **42** | **40** | **42** | **40** |
| Reduction in non-ETS (wrt 2005) | 33% | 34% | 38% | 34% | 38% | 34% | 38% | 34% | 38% |
| % RES on Gross Final Consumption | **15%** | **20%** | **30%** | **20%** | **30%** | **20%** | **30%** | **20%** | **30%** |
| % RES on electricity production | **24%** | **37%** | **57%** | **37%** | **57%** | **37%** | **57%** | **37%** | **57%** |
| % RES on Final Thermal Consumption | **26%** | **27%** | **33%** | **27%** | **33%** | **27%** | **33%** | **27%** | **33%** |
| % Βιofuels in transport (re RED) | **2,8%** | **4,1%** | **7,8%** | **4,1%** | **7,8%** | **4,1%** | **7,8%** | **4,1%** | **7,8%** |

Thank you for your attention

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