

Συνάντηση Συνδέσμων Παραγωγών ΑΠΕ
4 Ιουλίου 2018

Εθνικός Ενεργειακός Σχεδιασμός και Ενεργειακά Μοντέλα: Συγκλίσεις και Αποκλίσεις

Δημήτρης Λάλας



European
Climate Initiative
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facets

further action on climate, environment, energy, economy, technology & sustainability



Στοιχεία μακροχρόνιου ενεργειακού σχεδιασμού

- Ενεργειακή Επάρκεια και Ασφάλεια
- Συμβολή στην Εθνική Οικονομία
- Προσιτό Ανταγωνιστικό Κόστος
- Διάθεση Ενεργειακών Προϊόντων και Υπηρεσιών με φιλικό προς το Περιβάλλον τρόπο
- Προστασία των Εγχώριων Πηγών Ενέργειας
- Συνδρομή στην Περιφερειακή Ανάπτυξη
- Εργαλείο Γεωπολιτικής της Χώρας

Βασικές Παραδοχές που αφορούν σε όλα τα Σενάρια

Main Cross-scenario Assumptions	CRES (TIMES-MARKAL)	EU 2016 Ref. Scenario (PRIMES)	NOA (ENPEP-BALANCE)	SEERMAP (EEMM suite)
GDP trajectory	GDP growth to go from ca 0.1 in 2016 to 2.5% in 2020 and 2.2% by 2030	From €200Bil in 2015 to €296Bil in 2050 (Greek growth rates -1.1% 2010-20, 0.8% in 2020-30, 1.4% in 2030-50) from the 2015 Ageing Report	As in "EU Reference Scenario 2016: Energy, transport and GHG emissions Trends to 2050", (from €200bil in 2015 to €296Bil in 2050 with rates -1.1% 2010-20, 0.8% in 2020-30, 1.4% in 2030-50)	From national strategies
Energy Demand	Provided exogenously by sector/subsector from GDP, population etc. through the specification of useful energy demand development	Calculated from GDP, population etc. & input from GEM-E3	Calculated endogenously by sector/subsector from GDP, population etc. through the specification of useful energy demand development	NA
Electricity demand	Calculated endogenously	Calculated endogenously	Calculated endogenously	Rates of change from EU 2016 Ref. Scenario from 2016 on
Fossil fuel prices	Adopt 2 scenarios for NG for electricity (i.e. 22-29€/MWh by 2020, 32-33€/MWh by 2030 and 35-36€/MWh by 2040)	From PROMETHEUS model results (€26.9/MWh in 2020, €31.6/MWh in 2030, €34.9/MWh in 2040, €36.5/MWh in 2050)	From IEA New Policies Scenario of "World Energy Outlook, 2016 Edition" (22.3€/MWh in 2020 to 32.4€/MWh in 2030 to 36.1€/MWh in 2004-50).	NG from EGMM model (17.9€/MWh in 2020, 22.6€/MWh in 2030, 28.5€/MWh in 2040 and 31.4€/MWh in 2050)
Cost of technologies	DOE (EIA), EWEA, IRENA (Biomass),	From latest market prices with learning by technology	Constant (in discounted 2015 values) except PV	EIA 2017 Outlook to 2050 (e.g. wind 1395€/kW in 2020 to 1125€/kW in 2050, PV from 1015€/kW in 2020 to 595€/kW in 2050)
WACC	Assume IRR for RES of 8% to 9% (vs 7.5-8% for conventional)	Discount rates of 7.5-8.5% for RES, 7.5% conventional, WACC of 8.5%	Discount rate 6% for energy industry	Country specific Calculated exogenously (10-15% in 2016 to 9.6-11.2% by 2050)
Carbon price	Electricity sector only. Adopt 2 scenarios (i.e. 8-9€/MWh by 2020, 20-30€/MWh by 2030 and 30-45€/MWh by 2050 plus EU 2016 Ref. values)	From €15/MWh in 2020 to 33.5€/MWh in 2030 to 48€/MWh in 2040 to 88€/MWh in 2050	From €10 in 2016 to €40 in 2050. Also, EU 2016 Ref. values	As in EU Reference scenario (from €15/MWh in 2020 to 33.5€/MWh in 2030 to 88€/MWh in 2050)
Capacity factors of RES	Differentiated by region, mean 17% for PV, 22% increasing to 28% for Wind	From 17% to 23% PV and 22% to 31% Wind	17% PV, 25% Wind	Derived using the GREEN-X model and previous 5 to 10-year data
Demand side management	Adhere to the 30% energy conservation nominal target for 2030 and technology rates after, fuel switching (transport),	Following Draft Ecodesign Regulations and CO ₂ targets for transport	Increasing efficiency by subsector	No measures before 2035. Shift of peak to base load by 3.5%
Cross border infrastructure	Existing and as currently planned by Greek TSO and ENTSO-E	In accordance with ENTSO-E TYNDP and PRIMES-gas module	Existing and as currently planned by Greek TSO	Available till 2050
Electricity imports/exports	Fixed at 12% from 2015 to 2020 and at 10% of electricity consumption afterwards	Calculated endogenously	least of last 5 years (net 210ktoe/yr after 2016) for security and adequacy	In accordance with ENTSO-E & G TYNDP

Βασικά Χαρακτηριστικά των Μοντέλων (2/2)

	TIMES-MARKAL overview (CRES)	PRIMES overview (EU 2016 Ref.)	ENPEP overview (WWF-ECF)	EEMM-GREEN-X overview (SEERMat)
Storage Tech. Inclusion	All available storage technologies	Several electricity storage technologies including hydro with reservoir, compressed air storage and hydrogen-based storage	All available except compressed air storage and hydrogen-based storage	Hydro storage
Transport Inclusion	Passenger and goods transport, including int. bunkers	Passenger and goods transport	Passenger and goods transport	NA
Residential Inclusion	User Defined dwelling types and Useful Energy Demand categories	5 categories of dwellings. 5 typical energy uses costs, Electric appliances are considered as a special subsector	User Defined dwelling types and Useful Energy Demand categories	NA
Cost Inclusion	Explicit cost analysis, including capital costs, variable O&M, cost of exogenous energy and imports, taxes, subsidies, certificate prices, tariffs for use of infrastructure, welfare loss	Explicit cost analysis, including capital costs, variable O&M, taxes, subsidies, certificate prices, congestion fees, tariffs for use of infrastructure	Explicit cost analysis, including capital costs, variable O&M, taxes, subsidies, certificate prices, congestion fees, tariffs for use of infrastructure	Explicit cost analysis, including capital costs, variable O&M, taxes, ETS price,
Analytical Approach	Bottom-up	Hybrid	Hybrid	Bottom-up
Underlying Methodology	Cost Optimization	Agent based	Agent based	Optimization
Math, Approach	Linear Programming	Partial Equilibrium model	Partial Equilibrium model	Linear programming
Data Requirements	Quantitative, monetary, disaggregated	Quantitative, monetary, disaggregated	Quantitative, monetary, disaggregated	Quantitative, monetary, disaggregated

Σενάρια (1/3)

NOA	
BaU	<ul style="list-style-type: none"> • A <u>Business as Usual</u> scenario that reflects an evolution of the energy system based on already implemented or initiated policies, taking into account the economics of alternative technologies and the requirement to depreciate in a reasonable time the investments that have been or will be implemented in the future. • It includes the construction of the lignite unit Ptolemaida V, the environmental upgrading of the Ag. Demetrios I-IV (1220MW) so that they will be able to operate till 2030, the hours limitation of the Cardia and Amynteo I and II (600MW) stations to be withdrawn in 2023 and the withdrawal of the Megalopolis III and IV units (600MW) in 2025.
Lignite	<ul style="list-style-type: none"> • A <u>Lignite Expansion Scenario</u>, which emphasizes the maintenance of a significant share of lignite in the country's electricity mix • Two new lignite units, Ptolemaida V (800MW) and Meliti II (300MW) are constructed • The Amynteo I and II and Megalopolis IV (300MW) are retrofitted and continue to operate after 2023. • In the final consumption sectors, policies applied continue to be those of the BaU.
RES	<ul style="list-style-type: none"> • A <u>RES Penetration</u> scenario, which restricts the role of lignite in the electricity system and restructures the latter based on the estimated demand and economics of alternative technologies, while limiting the requirements for depreciation of already realized investments. • No new lignite unit is being constructed, while • The withdrawals of the existing lignite units are implemented as specified in the BaU. • In final consumption sectors, policies applied continue to be those of the BaU.
Conserve	<ul style="list-style-type: none"> • A <u>Energy Efficiency</u> scenario, in which enhanced energy saving policies in the final consumption sectors (electrification and modernization of vehicle fleets in transport, upgrading of the building stock, promoting more efficient equipment, etc.) are implemented • Lignite plants as in BAU. • The extension of the electrical system takes into account the economics of alternative technologies by limiting the requirements for depreciation of already realized investments.
Conserve+	<ul style="list-style-type: none"> • A <u>Energy Efficiency</u> scenario, as in "Conserve" • <u>Closure</u> of lignite plants with non-viable amount of operating hours • Enhanced energy saving policies in the final consumption sectors. • Lignite plants as in RES but with decommissioning in 2040-45

Σενάρια (2/3)

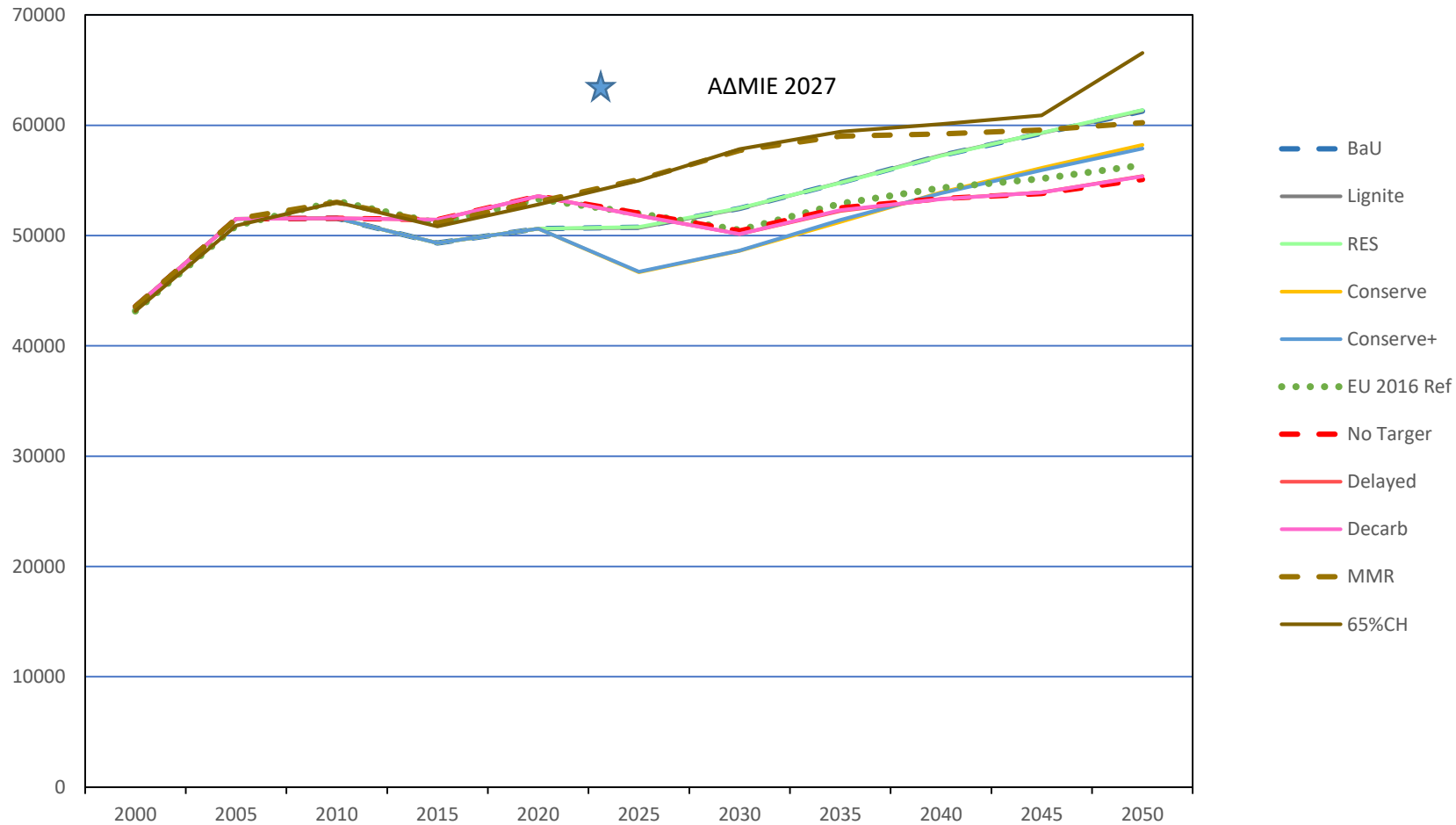
SEERMAP	
No Target	<ul style="list-style-type: none">• Implement current energy policy• No 2050 CO₂ target• Current RES support continues till 2020 and phasing out by 2025• Existing plans for closure and construction of PP followed• 2020 EU targets met
Delayed	<ul style="list-style-type: none">• Implement current energy policy until 2035• CO₂ target of 94% by 2050 for the SE Europe region• Current RES support continues till 2020, slight increase till 2035 and appropriate increase to meet target till 2050• Existing plans for closure and construction of PP followed
Decarb	<ul style="list-style-type: none">• Start implementing RES penetration enhancement measures now• CO₂ target of 94% by 2050 for the SE Europe region• Appropriate RES support continues till 2050 to meet target• Construction of conventional PP only if final decision by 2016

Σενάρια (3/3)

EU 2016 Reference Scenario	
2016 Ref	<ul style="list-style-type: none"> • A fully reference scenario • 2020 EU targets are met • All requirements from Directives and Regulations adopted by 2015 are adhered to (Detailed lists in Annex 4.1)
EU CO Scenarios	
EUCO27	<ul style="list-style-type: none"> • 2020 EU targets are met • All requirements from Directives and Regulations adopted by 2015 are adhered to (Detailed lists in Annex 4.1) • At least 40% GHG reduction (wrt to 2005) • At least 27% share of RES in GFEC • 27% reduction in Primary Energy Consumption compared to baseline scenario (i.e. 20% wrt to 2005)
EUCO30	<ul style="list-style-type: none"> • As above but 30% reduction in Primary Energy Consumption (i.e. 23% wrt to 2005)
EUCO+33, +35, +40	<ul style="list-style-type: none"> • As above but with 33%, 35%, 40% reduction in PEC
EUCO3030	<ul style="list-style-type: none"> • As EUCO30 but with 30% RES in GFEC.

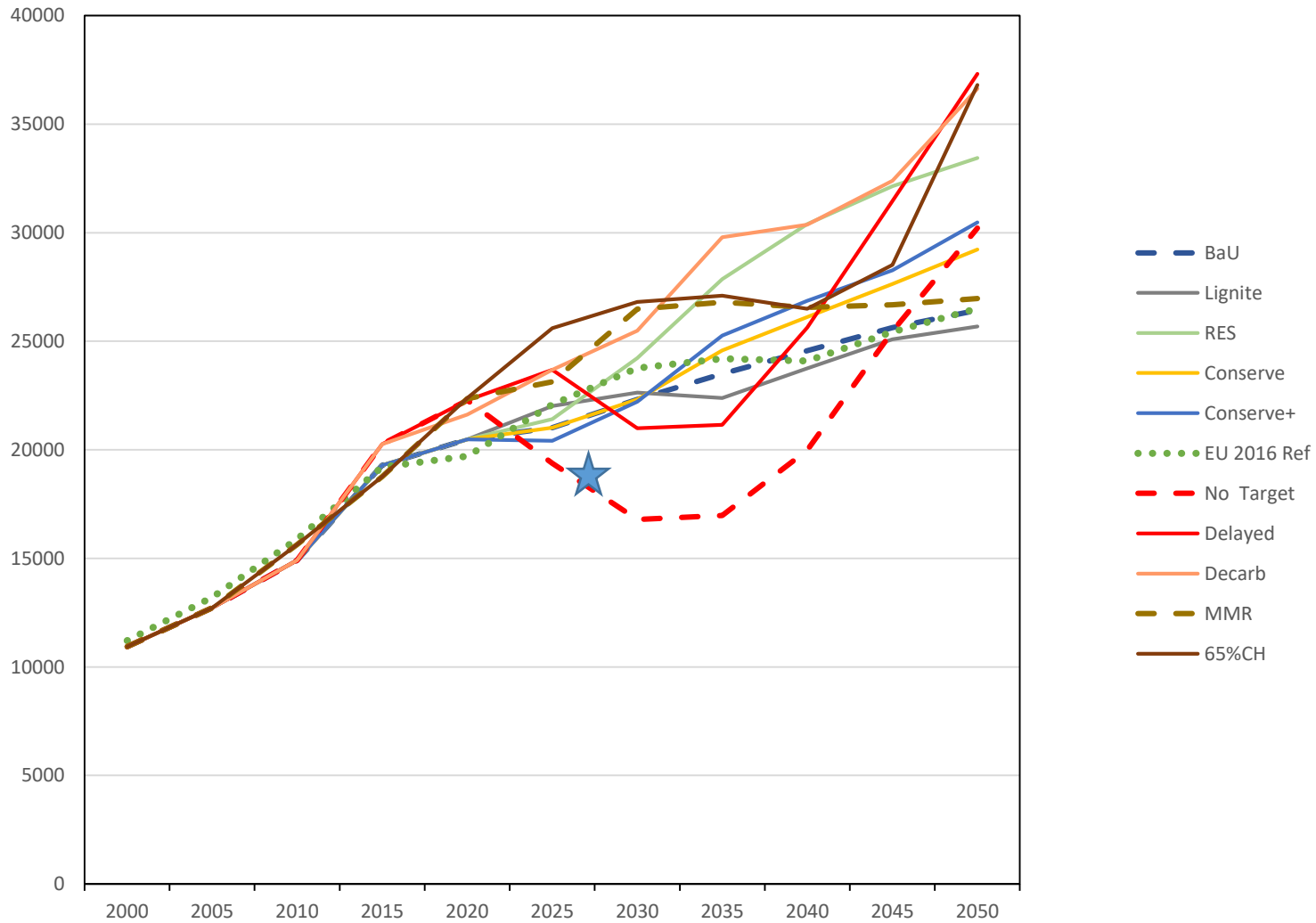
CRES	
65%HC	<ul style="list-style-type: none"> • High NG prices for electricity from EU 2016 Ref. Scen. • High CO₂ prices from EU 2016 Ref. Scen. • 18% of RES on gross final consumption in 2020, no constraint after • Electricity imports fixed at 10% of generation • Constraint of 65% reduction of GHG by 2050 • Energy Efficiency (meet ESD targets)
MMR	<ul style="list-style-type: none"> • Low NG prices for electricity • Low CO₂ prices from international experts' projections (WEO/IEA) • 18% of RES on gross final consumption in 2020, no constraint after • Electricity imports fixed at 10% of generation • No constraint of GHG by 2050 • Energy Efficiency (meet ESD targets)

Ζήτηση Ηλεκτρικής Ενέργειας (GWh)



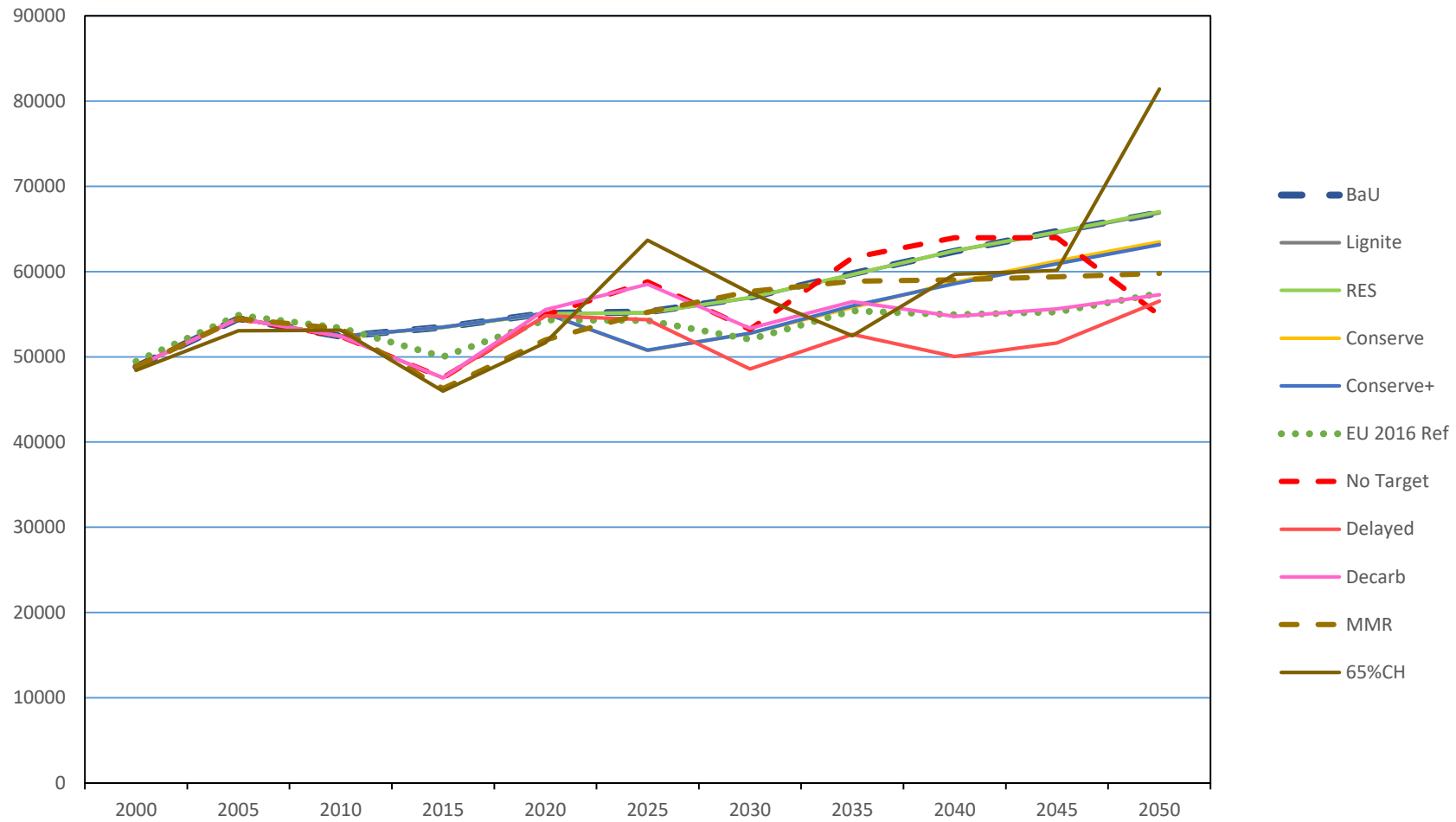
Μικρή αύξηση της
τάξης του 0.3-0.6%
ετησίως μετά το 2025

Συνολική Εγκατεστημένη Ισχύς (MW)



“Reference”
Scenarios ca.
27000MW

Καθαρή Παραγωγή Ηλεκτρισμού (GWh)



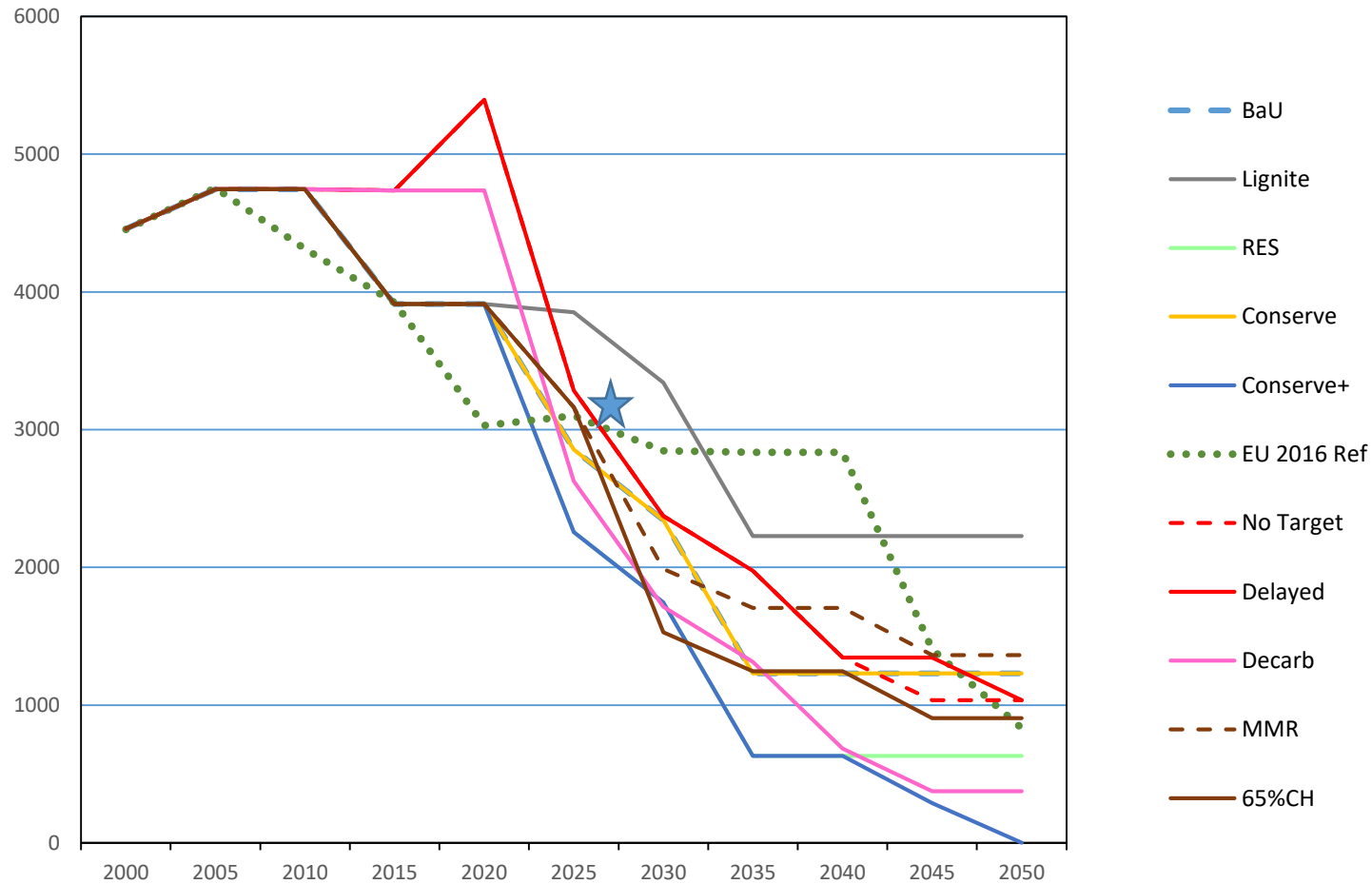
Καθαρές Εισαγωγές (GWh)



NOA 1800GWh
CRES 10% εγχ. παραγωγής

- BaU
- Lignite
- RES
- Conserve
- Conserve+
- EU 2016 Ref
- No Target
- Delayed
- Decarb
- MMR
- 65%HC

Ισχύς Λιγνιτικών Σταθμών (MW)



Από το 2045 γύρω ή
κάτω από 1000MW

Μέχρι το 2025 διαφορές
λόγω παραδοχών για την
αναβάθμιση ή απόσυρση

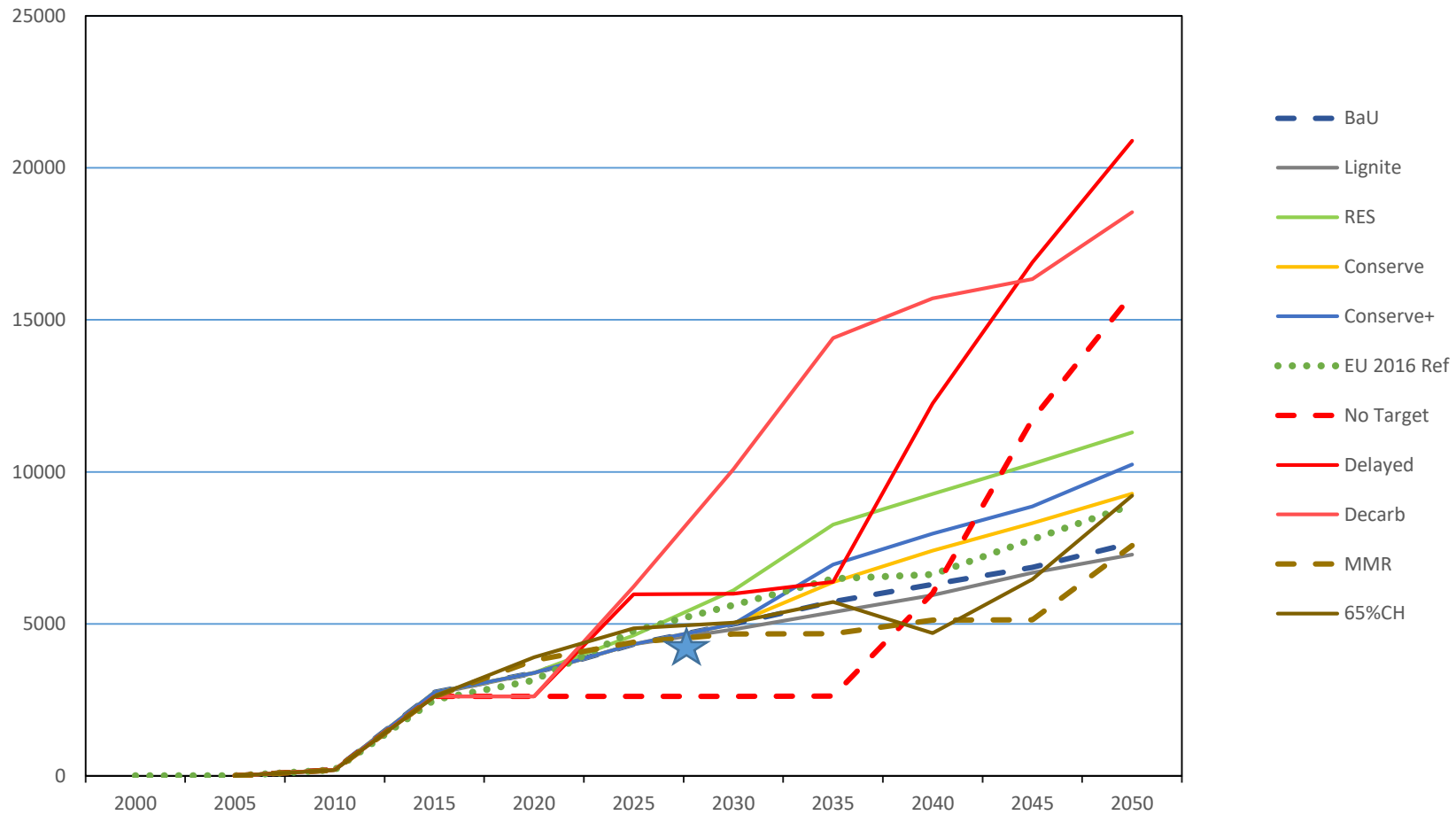
Ωρες Λειτουργίας Λιγνιτικών Σταθμών

Lignite Plants Operating Hours per Year								
	2015	2020	2025	2030	2035	2040	2045	2050
EU 2016 Ref.	6819	7553	6326	4205	4462	3304	1296	0
NOA BaU	5848	4703	5970	6060	6604	6689	6462	6500
NOA Lignite	5833	4941	5362	5897	6826	6998	6993	7045
NOA RES	5848	4703	6186	5932	5585	5400	5253	5345
NOA Conserve	5833	4703	5550	5624	5612	5546	5517	5489
NOA Conserve +	5833	4703	5964	5945	5769	5714	5835	0
SEERMAP No Target	4555	4887	5101	4576	4595	4989	3566	262
SEERMAP Delay	4555	4887	5089	4313	4230	4578	1635	432
SEERMAP Decarbon	4555	4555	4544	3279	2336	2288	1072	53
CRES 65%CH	4964	1671	2554	2785	2930	2970	52	0
CRES MMR	4964	3592	5558	6593	6591	6577	6561	6569

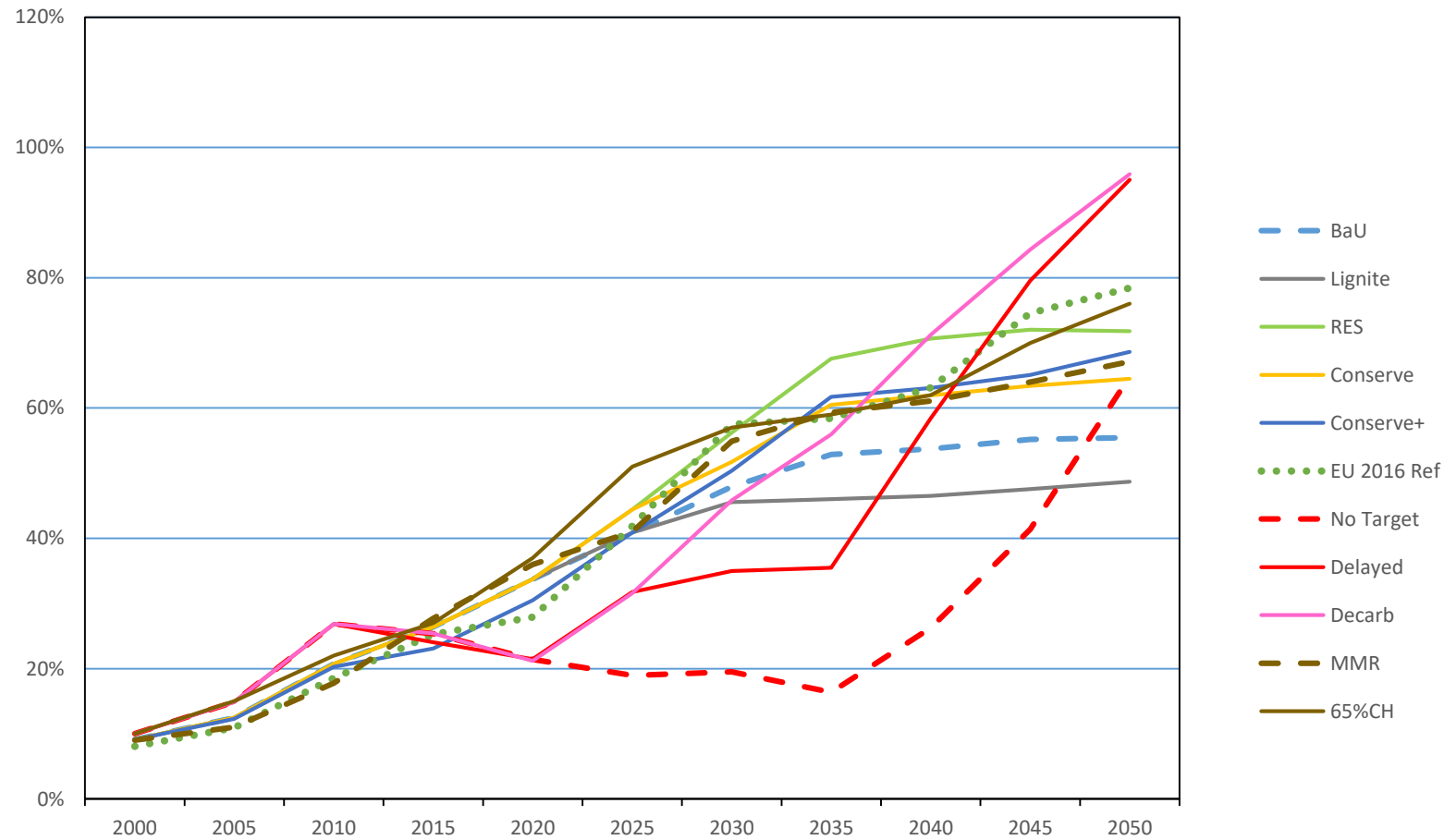
Ωρες Λειτουργίας Σταθμών ΦΑ

	2015	2020	2025	2030	2035	2040	2045	2050
EU 2016 Ref.	1742	2608	2171	2382	2578	3042	2858	2568
NOA BaU	2414	2791	2605	2867	3746	3862	3948	4091
NOA Lignite	2414	2627	1894	2062	3165	3322	3414	3479
NOA RES	2414	2791	2818	2706	2928	2771	2746	2892
NOA Conserve	2414	2791	1988	2257	2807	2881	2896	2932
NOA Conserve +	2414	2791	2432	2589	2968	3015	3315	3363
SEERMAP No Target	2322	2475	4930	5543	6390	7003	7076	4835
SEERMAP Delay	2684	3055	3586	4223	5394	5047	4212	2061
SEERMAP Decarbon	2321	3391	4457	4338	4459	4756	4198	2037
CRES 65%CH	1763	3882	2732	2875	3195	3747	2988	2950
CRES MMR	1763	2555	1959	1532	1652	1986	2277	2250

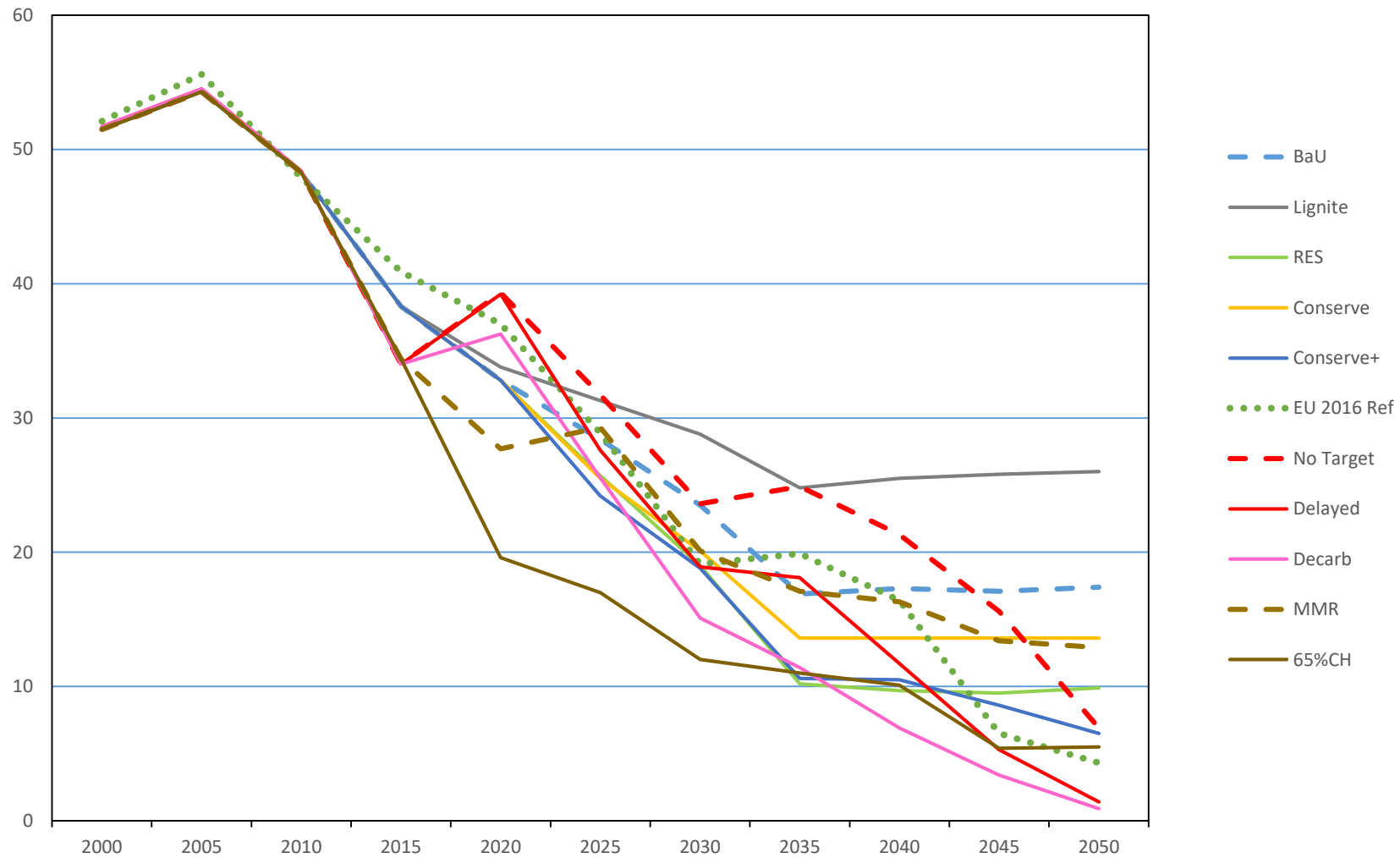
Ισχύς ΦΒ Σταθμών (MW)



Ποσοστό ΑΠΕ στην Συνολική Παραγωγή Ηλεκτρισμού



Εκπομπές CO₂ από την Παραγωγή Ηλεκτρισμού (MtonCO₂eq)



Κόστος ηλεκτρισμού

	2020	2025	2030	2035	2040	2045	2050
EU 2016 Ref. (in 2013€/MWh)							
Price to final demand sectors	137	146	155	154	149	153	154
Cost of gross electricity generation	97	99	100	92	87	72	64
EUCO 27 (in 2013€/MWh)							
Price to final demand sectors	137	150	160				
Cost of gross electricity generation	97	103	102				
EUCO 30 (in 2013€/MWh)							
Price to final demand sectors	137	149	157				
Cost of gross electricity generation	97	102	99				
EUCO 35 (in 2013€/MWh)							
Price to final demand sectors	135	140	155				
Cost of gross electricity generation	94	93	98				
EUCO 40 (in 2013€/MWh)							
Price to final demand sectors	131	137	156				
Cost of gross electricity generation	91	90	98				
EUCO 3030 (in 2013€/MWh)							
Price to final demand sectors	137	149	161				
Cost of gross electricity generation	97	102	100				
EU Allowance price (€/tCO2)	15	22.5	33.5	42	50	69	88
NOA (Levelized cost in 2015€/MWh)							
BaU	91	102	101	103	104	103	103
Lignite	92	105	103	104	105	105	103
NOA RES	91	102	103	104	104	103	102
Conserve	91	106	103	104	104	102	102
Conserve +	91	105	103	103	104	102	101
NOA Allowance price (€/tCO2)	6	25	25	30	30	40	40
SEERMAP (wholesale price in 2016€/MWh)							
No Target	41	52	60	68	78	91	91
Delay	41	50	59	67	80	86	73
Decarb	42	51	59	63	81	86	74
SEERMAP Allowance price (€/tCO2)	15	22.5	33.5	42	50	69	88
CRES (levelized cost in 2015€/MWh)							
65%CH	105	105	102	98	94	90	90
MMR	104	102	98	94	89	87	80
CRES MMR Allowance price (€/tCO2)	8	13.1	20	22.5	26.5	30	30
Decarb	42	51	59	63	81	86	74
CRES (levelized cost in 2015€/MWh)							
65%CH	105	104	103	99	93	89	90
MMR	104	102	98	94	89	87	80
CRES MMR Allowance price (€/tCO2)	8	13.1	20	22.5	26.5	30	30

Επενδύσεις ανά πενταετία (σε €₂₀₁₅Millions)

		2020	2025	2030	2035	2040	2045	2050	Cummulat	%RES/Total
EU 2015 Ref.		NA	NA	NA	NA	NA	NA	NA		
NOA										
BaU	RES invest.	2239	2873	3467	3653	2727	4885	2790	22634	
	Total invest.	2515	4262	3467	3653	2727	4885	2790	24299	93%
Lignite	RES invest.	2227	2883	2494	1524	2727	4731	3287	19873	
	Total invest.	2789	5351	2494	1524	2727	4731	3287	22903	87%
RES	RES invest.	2239	4153	5683	6920	4833	5757	3419	33004	
	Total invest.	2516	4153	5683	6920	4833	5757	3419	33281	99%
Conserve	RES invest.	2239	2873	3462	5061	3250	5480	3904	26269	
	Total invest.	2516	4262	3462	5061	3250	5480	3904	27935	94%
Conserve+	RES invest.	2238	2873	4232	6025	3412	5791	5117	29688	
	Total invest.	2515	2873	4232	6025	3412	5791	5117	29965	99%
SEERMAP										
No Target	RES invest.	27	14	449	1429	4994	5370	4734	17017	
	Total invest.	2532	14	816	3261	6091	5370	4734	22818	75%
Delay	RES invest.	27	4458	790	2646	7288	6685	8522	30416	
	Total invest.	2532	4458	790	3379	7288	6685	8522	33654	90%
Decarb	RES invest.	27	5915	5005	7616	6484	5596	7666	38309	
	Total invest.	808	5915	5005	7616	6484	5596	7666	39090	98%
CRES										
65%CH	RES invest.	1426	5487	4285	3271	2036	6848	6592	29945	
	Total invest.	2977	7063	4290	3292	2097	7006	7879	34605	87%
MMR	RES invest.	767	387	1907	6622	2552	5574	2948	20757	
	Total invest.	1678	1939	1912	7746	2614	5595	3570	25054	83%

Συμπεράσματα (1/2)

- Η απανθακοποίηση του τομέα της ηλεκτρικής ενέργειας στην Ελλάδα είναι αναπόφευκτη με ή χωρίς νέα μέτρα και πολιτικές και ακόμη και χωρίς πολύ υψηλές τιμές CO₂. (>50% σε σύγκριση με το 2005 και μέχρι 90% το 2050).
- Όλα τα μοντέλα, και μάλιστα σχεδόν για όλα τα σενάρια, δείχνουν ότι η αύξηση της ζήτησης ηλεκτρικής ενέργειας αναμένεται να είναι μικρή της τάξης του 10-15% σωρευτικά μέχρι το 2050.
- Η εγκατεστημένη ισχύς θα αυξηθεί σημαντικά σε όλα τα σενάρια και σχεδόν σε ορισμένες περιπτώσεις θα διπλασιαστεί.
- Στα περισσότερα σενάρια, περίπου το 5-8% της ελληνικής ζήτησης ηλεκτρικής ενέργειας καλύπτεται από εισαγωγές αλλά υπάρχουν μεγάλες διαφορές μεταξύ των σεναρίων με ορισμένα να δείχνουν καθαρή εξαγωγή.
- Η ύπαρξη ουσιαστικών διασυνδέσεων με όλες τις γειτονικές χώρες παρέχει πρόσθετη ασφάλεια στη σταθερότητα του δικτύου ενόψει της μεγάλης διεύδυσης των ΑΠΕ στην Ελλάδα αλλά και στις γειτονικές χώρες

Συμπεράσματα (2/2)

- Η εγκατεστημένη ισχύς των ΑΠΕ σε όλα τα σενάρια φτάνει έως το 2050 σε ποσοστό μεγαλύτερο του 70% της συνολικής εγκατεστημένης ισχύος (19500 MW έως 35000 MW ΑΠΕ, από περίπου. 8920 MW στις 31/12/2017).
- Η συμβολή των ΑΠΕ, κυρίως αιολικών και ηλιακών φωτοβολταϊκών, στην παραγωγή ηλεκτρικής ενέργειας στα περισσότερα σενάρια, υπερβαίνει το 60%.
- Η μεγάλη αύξηση της δυναμικότητας ΑΠΕ σε όλα τα σενάρια εξαρτάται από την ουσιαστική αναβάθμιση της υπάρχουσας υποδομής δικτύου και την κατασκευή πρόσθετων δυνατοτήτων του εθνικού δικτύου και των διασυνδέσεων.
- **Για να επιτευχθεί αυτό, πρέπει να αρχίσει το συντομότερο η απαιτούμενη διοικητική προετοιμασία και προγραμματισμός.**

Σύγκριση Μερικών Βασικών Παραμέτρων για το 2030

	2015 data	EU Ref.	EUCO 27	EUCO 30	EUCO+35	EUCO+40	EUCO 3030	NOA BaU	NOA Ligni	NOA RES	NOA Cons.	NOA Cons	No Target	Delay	Decarb	65%HC	60%HC	MMR
Electricity Demand (GWh)	56,568	50,497	50,578	46,543	43,706	39,577	45,566	52,463	52,440	52,475	48,602	48,637	50,423	50,134	50,128	57,848	57,708	57,708
Net Electricity Produced (GWh)	46,962	52,063	52,101	48,108	44,995	40,650	47,263	56,975	56,917	56,947	52,777	52,777	53,206	48,568	53,337	57,525	57,672	57,672
Res generation -hydro (GWh)	9,567	26,022	31,694	32,098	28,736	27,731	36,740	21,259	19,899	25,981	21,259	22,353	5,922	12,490	19,759	28,330	28,331	14,654
Hydro generation (GWh)	5,391	5,578	5,578	5,577	5,577	5,577	5,577	6,036	6,035	6,035	6,036	6,036	4,459	4,500	4,668	5,951	5,891	5,875
Net Imports (GWh)	9,606	2,570	2,570	2,570	2,128	2,128	2,128	1,791	1,791	1,791	1,791	1,791	(2,783)	1,567	(3,209)	5,752	5,768	5,768
Total Installed Capacity (MW)	19,273	23,760	26,804	27,010	24,877	24,197	29,555	22,315	22,636	24,223	22,315	22,215	16,794	20,995	25,484	26,815	26,480	26,480
Lignite Plants (MW)	4,462	2,845	2,865	2,865	2,910	2,948	2,865	2,345	3,341	1,745	1,231	1,745	2,374	2,374	1,714	1,529	1,988	1,988
NG Plants (MW)	4,552	4,738	4,738	4,738	4,737	4,730	4,737	5,188	5,188	5,188	5,188	5,188	5,766	5,366	5,366	5,286	5,203	5,203
Hydro Installations (MW)	3,201	3,571	3,571	3,571	3,579	3,579	3,571	3,580	3,580	3,580	3,580	3,580	4,357	2,400	4,486	4,513	4,491	4,491
Wind (Installed MW)	2,091	6,038	6,996	7,157	6718	6,653	7,812	5,522	5,022	6,922	5,522	6,022	1,307	4,383	3,176	8,091	7,753	7,753
PV (Installed MW)	2,604	5,616	7,632	7,678	5946.0	5,304	9,534	4,993	4,818	6,103	4,993	4,993	2,614	5,987	10,082	5,042	4,662	4,662
RES in Net Electr. Generated (%)	29	61	72	78	78	82	90	48	46	56	52	50	20	35	46	59	57	57
Electricity in Transport (%)	0.7	1	1.3	1.6	1.9	2.3	1.6	1.1	1.3	1.3	2.9	2.9	N/A	N/A	N/A	1	1	1.1
Electricity Sector GHG Emissions (MtCO ₂ eq.)	35	19	14	13	14	13	9	24	29	19	20	18	23.6	18.9	15.1	12.0	20.1	20.1

EUCO27 27% efficiency & 27% RES

EUCO30 30% efficiency & 27% RES

EUCO3030 30% efficiency & 30% RES

EUCO3232? 32% RES & 32.5%? efficiency (28/6/2018)

N3851/2010 (ΚΥΑ 19598) και Εγκατεστημένη Ισχύς ΑΠΕ

Technology	Target Installation (MW)		Installed Capacity (MW)	
	2014	2020	30 Jun 2014	31 Dec 2017
Hydro <15MW	300	350	200	229
Hydro - large	3400	4300	3382	3382
PV (incl. roof)	1500	2200	2213	2604
Solar thermal	120	250	0	0
Wind	4000	7500	1893	2624
Biomass	200	350	47	61

Στόχοι για Εθνικούς Στόχους

Εθνικοί Στόχοι			
	2015	2030	2050
ΑΠΕ στην ΑΤΚΕ	15.4%	32%	42%
ΑΠΕ στην καθαρή παραγωγή ηλεκτρισμού	29%	80%?	95%?
Μείωση των εκπομπών CO ₂ από ηλεκτρισμό (wrt 2005)	37%	80%	95%
Μείωση ΑΤΚΕ (wrt 2005)	20%	36%	45%

Ευχαριστώ για την προσοχή σας

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