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HYDROELECTRIC PRODUCTION OF PPC S.A.

HIGH

- **AVAILABILITY**
- **RELIABILITY**
- **FLEXIBILITY**

Ioannis Argyrakis
Director
Hydroelectric Generation Department

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A

GENERAL INFORMATION FOR HPP's of PPC SA

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HPPs location

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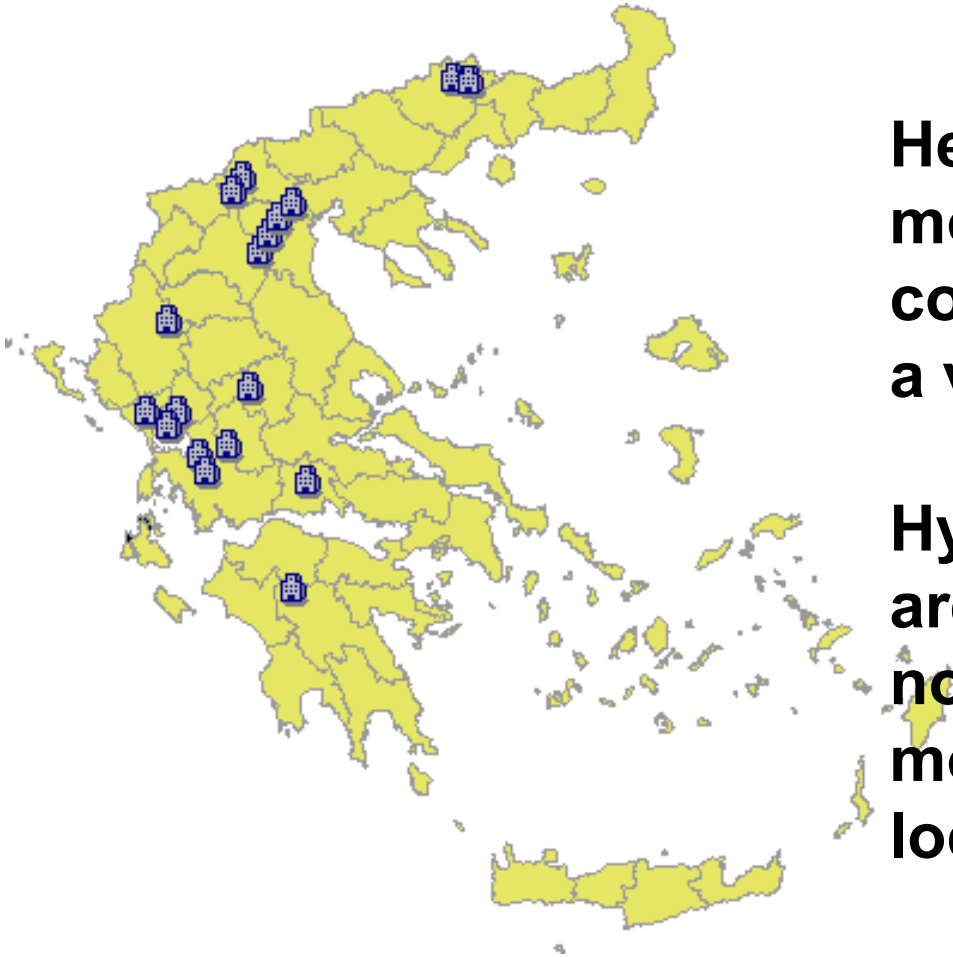
The Hydroelectric development from 1950 up to date



Hellas is an over 80 % mountainous country with a complicated rugged relief and a variety of climates

Hydroelectric Power Plants are situated in the northwestern part, where most of the mountains are located

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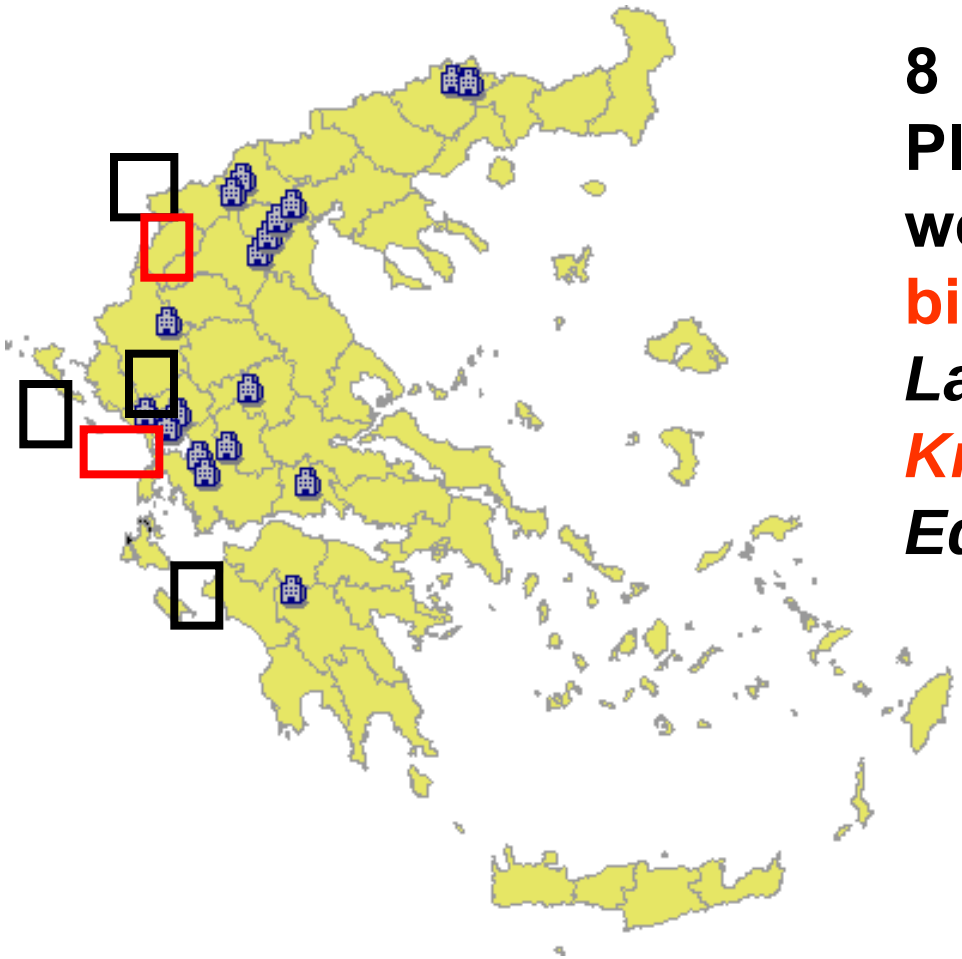
1950-1975



8 large Hydroelectric Power Plants, totalling 1.410 MW, were built. Among them the 3 biggest ones : *Agras, Ladhon, Louros, Tavropos, Kremasta, Kastraki, Edessaios, Polyphyto*

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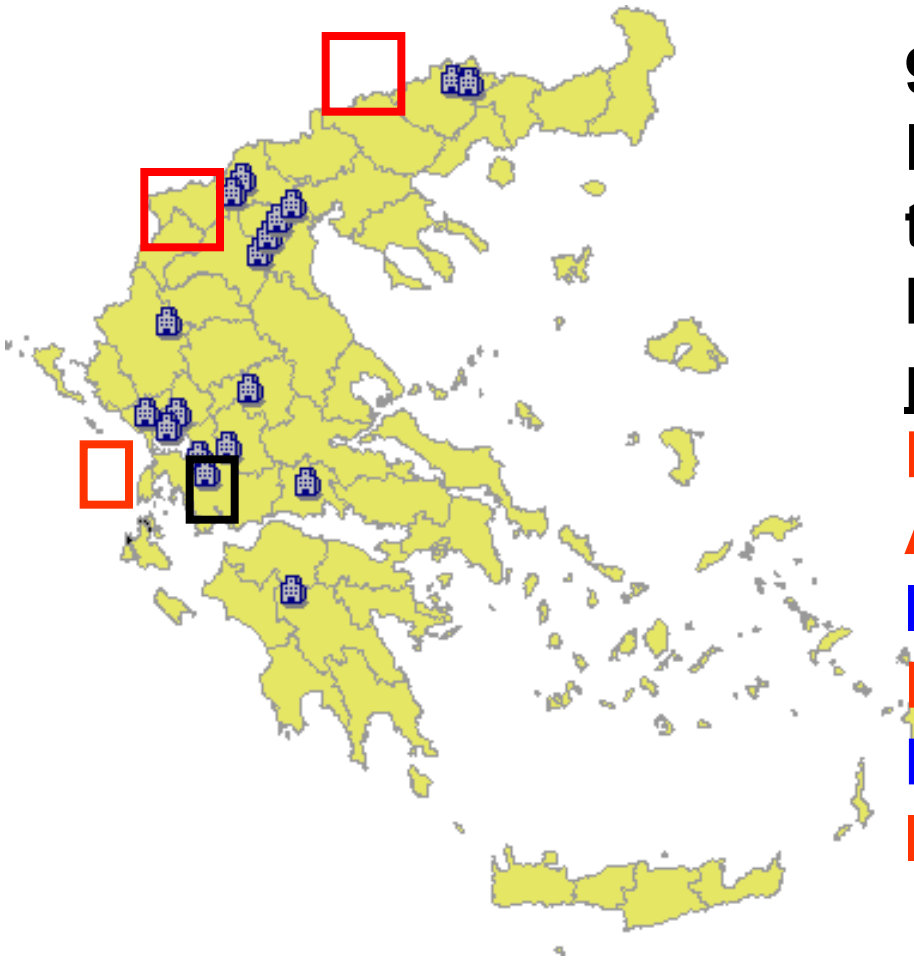
1976 up to date



9 large & 5 small Hydroelectric Power Plants, totalling 1.800,2 MW, were built. Among them the two pump storage plants: Pournari I & II, Sfikia, Assomata, Stratos I, Stratos II, Pighai Aoos, Thissavros, Platanovryssi, Ghiona, Makrochori, Aghia Varvara, Ilarion HPP, Ilarion SHPP

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HYDROELECTRIC POWER PLANTS of PPC S.A.
IN OPERATION

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MAIN CHARACTERISTICS OF PPC's HYDROELECTRIC POWER PLANTS

		HYDROELECTRIC POWER PLANT								WATER INFLOW		RESERVOIR							DAM			
	Name of HPP	number of units	nom. power of each unit (MW)	total power station (MW)	start of commercial operation	Height of water fall (m)	water flowing from units operation (m^3/sec)	* Mean annual production (GWh)	specific consumption (m^3/kwh)	* River flow (m^3/sec)	* Annual inflow (mcm)	min. power pool (m)	max. power pool (m)	Useful capacity (mi. m^3)	Energy volume (GWh)		max. level (m)	Volume at max. level (mi. m^3)	Surface area at max. level (km^2)	type	height (m)	length (m)	volume (m^3)
ACHELOOS r. HYDROELECTRIC SCHEME	KREMASTA	4	109,3	437,2	i-iii, 1966 iv 1967	132	392	836	3,2	116	3.658	227,0	276,0	2.858	694	1.471	282,0	3.222	81	earthfill	165	460	8.200.000
	KASTRAKI	4	80	320,0	1969	75	499	580	5,6			142,0	146,0	98	25		146,0	98	24	earthfill	96	547	5.200.000
	STRATOS_I	2	75	150,0	1989	37	468	255	11,2			67,0	68,6	12	1		69,0	15	8	earthfill	26	1900	2.800.000
Small HPP	STRATOS_II	2	3,1	6,2	1988	15	43	13	24,8														
Small HPP	GHIONA	1	8,5	8,5	1988	37	23	33	9,5											runoff river			
Small HPP	GLAFKOS	2	1 X 1,8 1 X 2,3	4,1	1926 1997	150	3	10	3,1											runoff river			
ALIAKMON r. HYDROELECTRIC SCHEME	ILARION	2	2 X 76,5	153,0	2014	104	160	320	4,1	46	1.448	366,0	398,5	270	72	945	398,5	270	17	earthfill	130	540	8.800.000
	POLYPHYTO	3	125	375,0	i-ii 1974, iii 1975	146	311	417	3,0			270,0	290,0	1.089	342		291,0	1.300	74	rockfill	112	296	3.459.000
	SFIKIA	3	105	315,0	i,iii 1985, ii 1986	60	635	389	7,3			141,8	146,5	18	3		147,0	20	4	earthfill	82	220	1.620.000
	ASSOMATA	2	54	108,0	1985	42	303	129	10,1			80,5	85,5	10	1		87,0	14	3	earthfill	52	205	1.450.000
Small HPP	ILARION	1	4,2	4,2	2015		6	9	5,0														
Small HPP	AGHIA VARVARA	1	0,92	0,92	2008	18	8	4	32,0											earthfill	16	2400	1.000.000
Small HPP	MAKROCHORI	3	3,6	10,8	1992	17	84	31	27,9			38,8	42,2						1	earthfill			
HPP	AGRAS	2	25	50,0	1954	156	37	27	2,7	2	73	477,8	480,3						6	earthfill	5	630	40.200
HPP	EDESSAIOS	1	19	19,0	1970	125	19	21	3,6			251,6	256,6						0	runoff river			
Small HPP	VERMIO	2	1 X 0,7 1 X 0,64	1,3	1936	96	2	5	4,8											runoff river			
ARACHTHOS r. HYDROELECTRIC SCHEME	PIGHAI AOOS	2	105	210,0	i 1990, ii 1991	675	36	159	0,6	50	1.577	1315,0	1343,0	144	242	329	1346,0	170	13	earthfill	78	300	3.200.000
	POURNARI_I	3	100	300,0	1981	79	453	261	5,4			100,0	120,0	304	50		120,0	304	21	earthfill	88	580	9.000.000
	POURNARI_II	3	2 X 16 1 X 1,6	33,6	i-ii 1998, iii 1999	14	294	41	31,5			33,4	40,0	4	0		46,8	11	1	earthfill	15	2000	700.000
Small HPP	LOUROS	3	2 X 2,5 1 X 5,3	10,3	i-ii 1954, iii 1964	56	22	44	7,7			95,5	96,4					1	0	concrete gravity arch	22	97	12.400
NESTOS r. HYDROELECTRIC SCHEME	THISSAVROS	3	128	384,0	i,ii 1997 iii 1998	154	288	516	2,7	34	1.082	320,0	380,0	563	180	285	385,8	677	20	rockfill	172	480	12.000.000
	PLATANOVRYSSI	2	58	116,0	1999	74	181	196	5,6			223,5	227,5	12	11		228,5	15	3	RCC	95	270	450.000
HPP	LADON	2	35	70,0	1955	239	34	222	1,8	14	450	400,0	420,0	46	25	25	420,2	47	4	concrete butress gravity	56	102	34.000
HPP	N. PLASTIRAS	3	43,3	129,9	i 1960, ii 1961, iii 1962	577	27	182	0,8	5	146	776,0	792,0	300	392	392	794,0	400	25	concrete arch	83	220	100.000
Small HPP	ALMIROS CRETE	1	0,3	0,3	1954	7		1												runoff river			
Hydroelectric Power Plants [ ]		**41**		**3.171**			**4.137**	**4.551**	**2,1**	**267**	**8.434**			**5.728**		**3.447**		**6.564**	**306**				
[Pumped storage / Pumped capacity]		6		699																			
Small HPP [Runoff River]		**16**		**47**			**190**	**150**		**18**	**578**												
TOTAL		**57**		**3.217**			**4.327**	**4.701**															

* Average 1981-2015

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The actual situation of PPC Hydroelectric Power Plants

- **Acheloos r.** Hydro Scheme (Kremasta, Kastraki, Stratos-I): **907,2 MW**
- **Aliakmon r.** Hydro Scheme (Ilarion, Polyphyto, Sfikia, Assomata / Agras, Edessaios): **1020,0 MW**
- **Arachthos r.** Hydro Scheme (Pournari-I, Pournari-II / Aoos): **543,6 MW**
- **Nestos r.** Hydro Scheme (Thissavros-Platanovryssi): **500 MW**
- **N. Plastiras HPP** (Tavropos r.): **129,9 MW**
- **Ladon HPP** (Ladon r.): **70 MW**
- **Small HPP: 46,7 MW**

TOTAL: 3.217,4 MW

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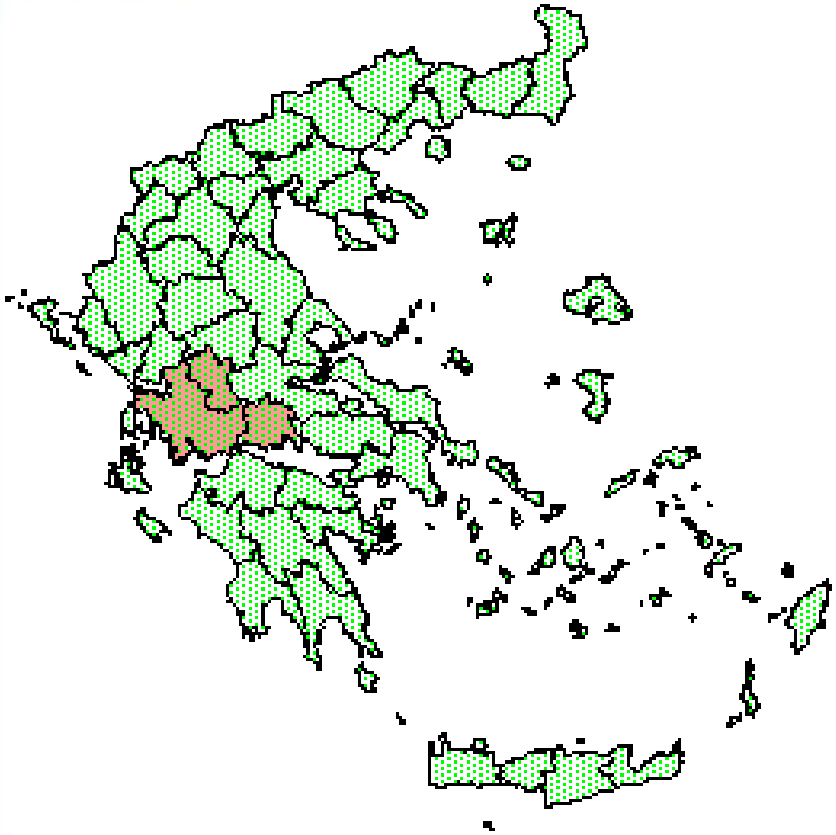
Small Hydroelectric Power Plants

- **SHPP Stratos II** on Acheloos river in Western Greece: **Capacity 6.2 MW**
- **SHPP Giona** on Mornos river in Central Greece: **Capacity 8.5 MW**
- **SHPP Glafkos** on Glafkos river in South-Western Greece: **Capacity 4.1 MW**
- **SHPP Ilarion** on Aliakmon river in North-Western Greece: **Capacity 4.2 MW**
- **SHPP Aghia Varvara** on Aliakmon river in North Greece: **Capacity 0.92 MW**
- **SHPP Makrochori** on Aliakmon river in North Greece: **Capacity 10.8 MW**
- **SHPP Vermio** on Tripotamos river in North Greece: **Capacity 1.34 MW**
- **SHPP Louros** on Louros river in Western Greece: **Capacity 10.3 MW**
- **SHPP Almiros** on Almiros river on Crete island: **Capacity 0.3 MW**

TOTAL: 46.7 MW

Energy for everyone



Acheloos r. Hydroelectric Scheme in Western Greece

[Western Continental territory]

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Acheloos Hydroelectric Scheme			
Acheloos river	Dam height (m)	Res. net capacity (mi M3)	Installed Power (MW)
Kremasta HPP	165	3300	437,2
Kastraki HPP	96	53	320
Stratos-I HPP	26	11	150
Stratos-II small HPP	-	-	6,2
Total			913,4
Ghiona small HPP (upstream of a dissipation structure on a branch of the Mornos r. reservoir - Athens water supply conduit)	-	-	8,5
Glafkos small HPP (Glafkos river)	-	-	3,7
Total			12,2
GRAND TOTAL			925,6

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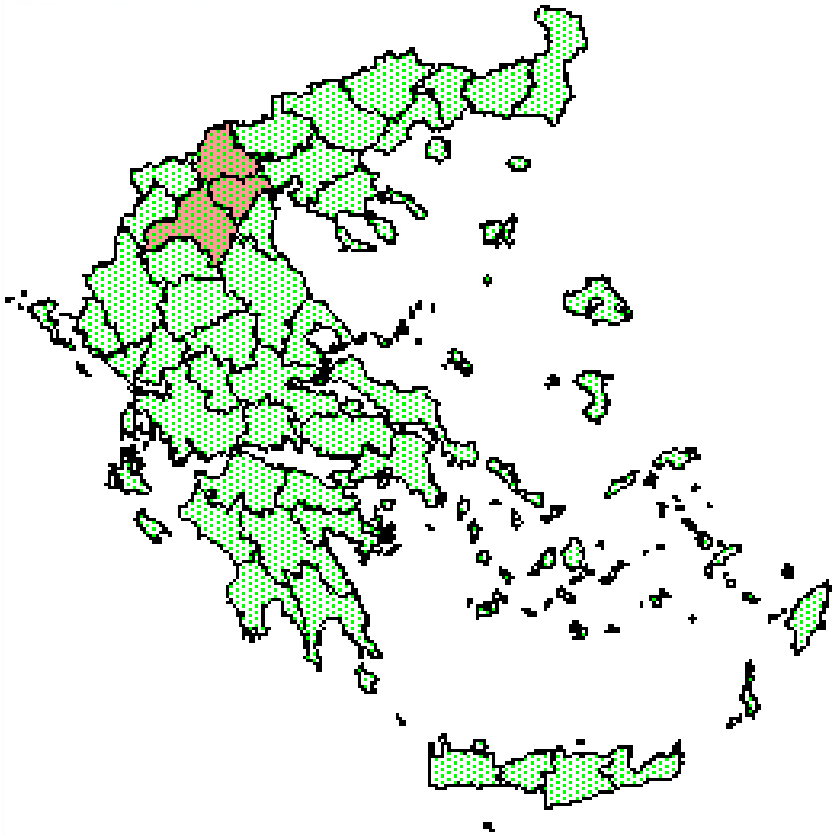

Aliakmon r. Hydroelectric Scheme in Northern Greece

[Western/Central Macedonia territory]

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Aliakmon Hydroelectric Scheme			
Aliakmon river	Dam height (m)	Res. net capacity (mi M3)	Installed Power (MW)
Ilarion HPP	130	270	153
Ilarion Small HPP			4,2
Polyphyto HPP	112	1220	375
Sfikia HPP (pump-storage)	82	18	315
Assomata HPP	52	10	108
Aghia Varvara Small HPP			0,9
Makrochori Small HPP	-	-	10,8
Total			966,9
Aliakmon tributaries			
Vermio small HPP (Tripotamos r.)	-	-	1,34
Agras HPP (Vodas r.)	-	-	50
Edessaios HPP (Vodas r.)	-	-	19
Total			70,3
GRAND TOTAL			1037,3

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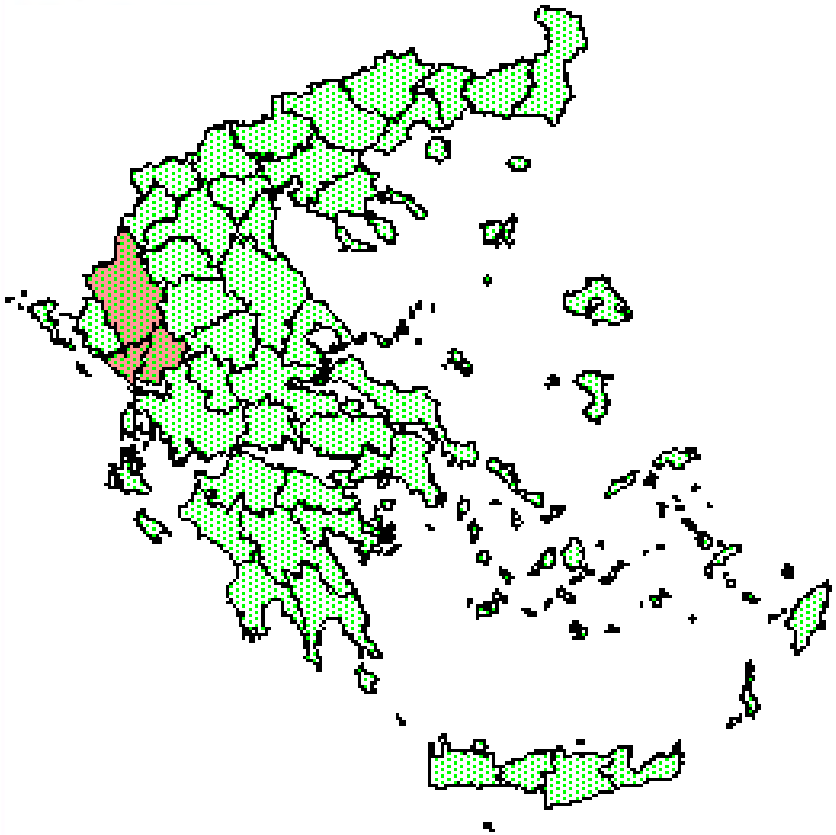

Arachthos r. Hydroelectric Scheme in Northwestern Greece

[Epirus territory]

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Arachthos Hydroelectric Scheme			
Springs of Aoos river	**Dam height (m)**	**Res. net capacity (mi M3)**	**Installed Power (MW)**
Pighai Aoos HPP	78	144,3	210
Arachthos river			
Pournari_I HPP	87	303	300
Pournari_II HPP	15	4	33,6
Louros river			
Louros small HPP	22	0,37	10,3
TOTAL			553,9

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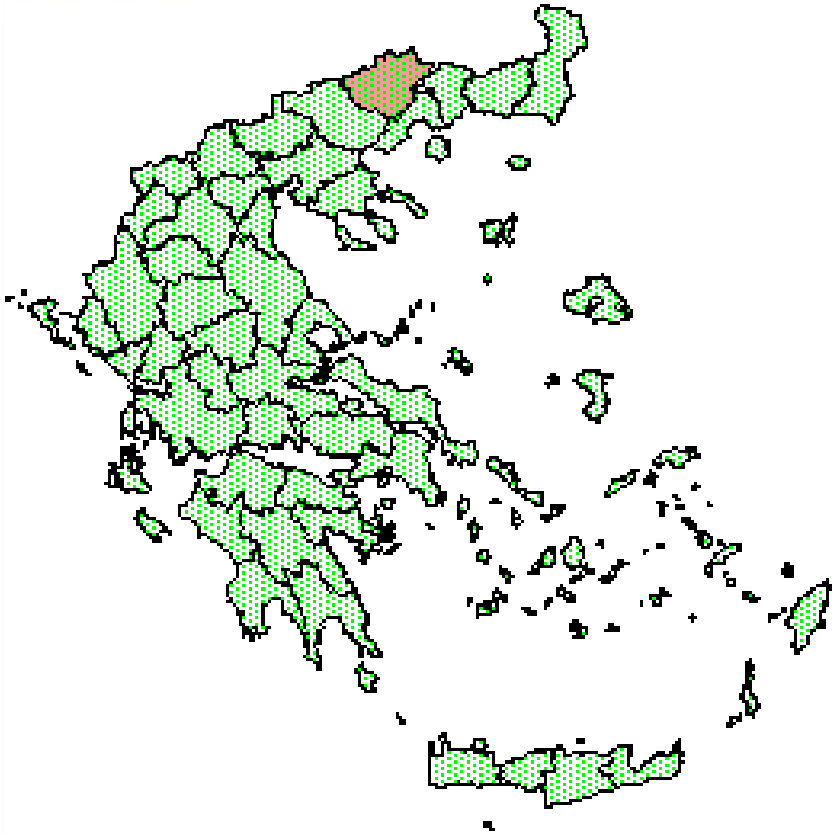

Nestos r. Hydroelectric Scheme in Northern Greece

(Eastern Macedonia territory)

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Nestos Hydroelectric Scheme			
Nestos river	Dam height (m)	Res. net capacity (mi M3)	Installed Power (MW)
Thissavros HPP (pump-storage)	172	565	384
Platanovryssi HPP	95	57	116
TOTAL			500

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Ladon hydroelectric power plant in Southern Greece

[Peloponnese territory]

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Ladon Hydroelectric Power Plant
(Ladon river)

Location: Central Peloponnese,
Arcadia prefecture
Purpose: hydropower,
water supply
Commercial operat.: 1955
Installed power: 70 MW
(2x35)
Francis type turbines
Mean an. Product.: 260 GWH
Dam: concrete buttres gravity,
56 m height
Reserv. net cap.: 46,2 m.c.m.

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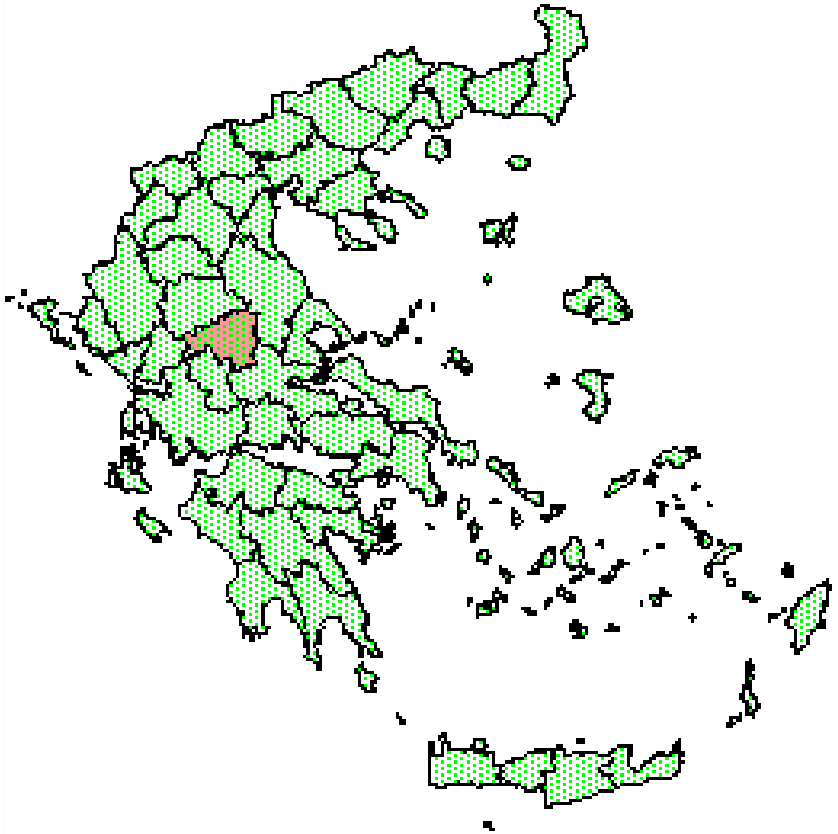

N. Plastiras hydroelectric plant in Central Greece

[Thessalia territory]

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N. Plastiras Hydroelectric Power Plant (Tavropos river)

Location: Thessaly,
Karditsa prefecture
Purpose: hydropower,
irrigation
water supply
Commercial operat.: 1962
Installed power: 129,9 MW
(3x43,3)
Francis type turbines
Mean an. Product.: 198 GWH
Dam: concrete arch,
83 m height
Reserv. net cap.: 300 m.c.m.

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The multiple role of HPP

- Produce “clear” renewable energy, cover peak load demands and offer ancillary services to the Grid
- Flood control
- Retain water flows and use during draught
- Irrigation & Cities Water supply
- Water supply for cooling PPC’s Thermal Plant units and other industry needs
- Fishing, maritime sports, alternative tourism, etc
- Road construction and other substructures in the local region
- In general, hydropower plants upgrade the environment by providing ecological flow into the river beds and constituting water habitats of unique beauty for the local aquatic fauna

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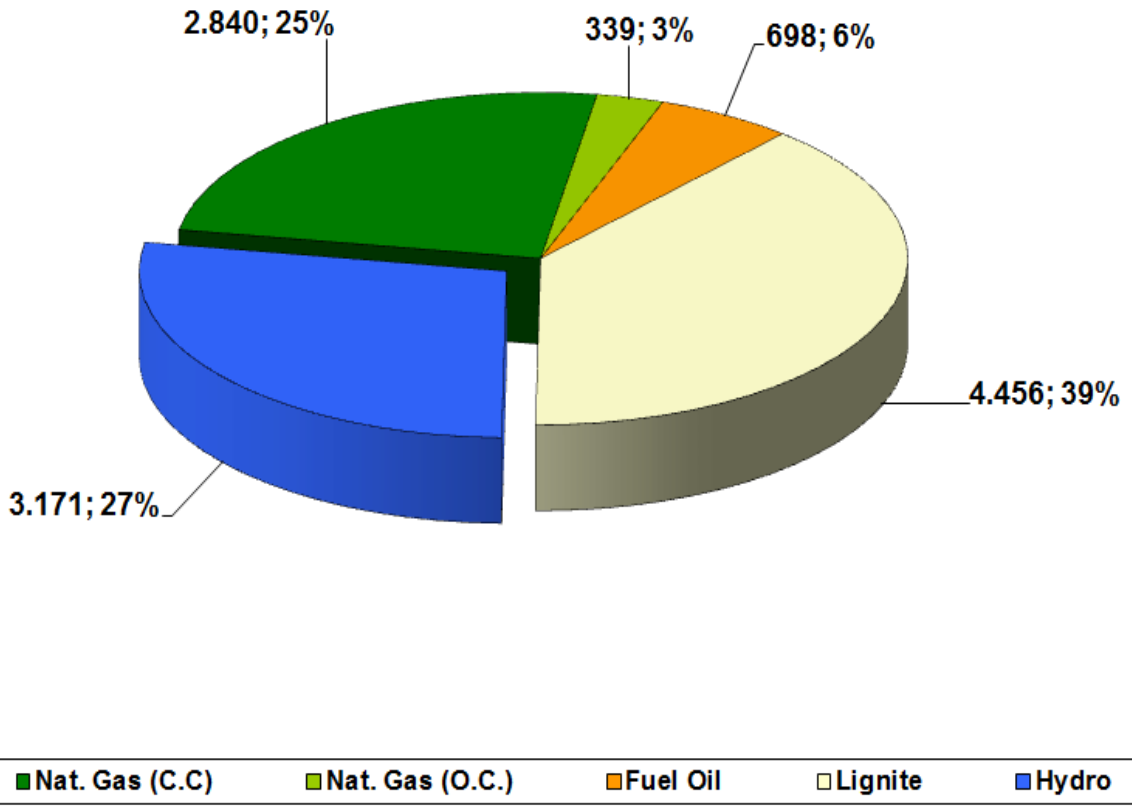
Installed Capacity by type of fuel

YEAR 2015: 11.216 MW [source: ADMIE]



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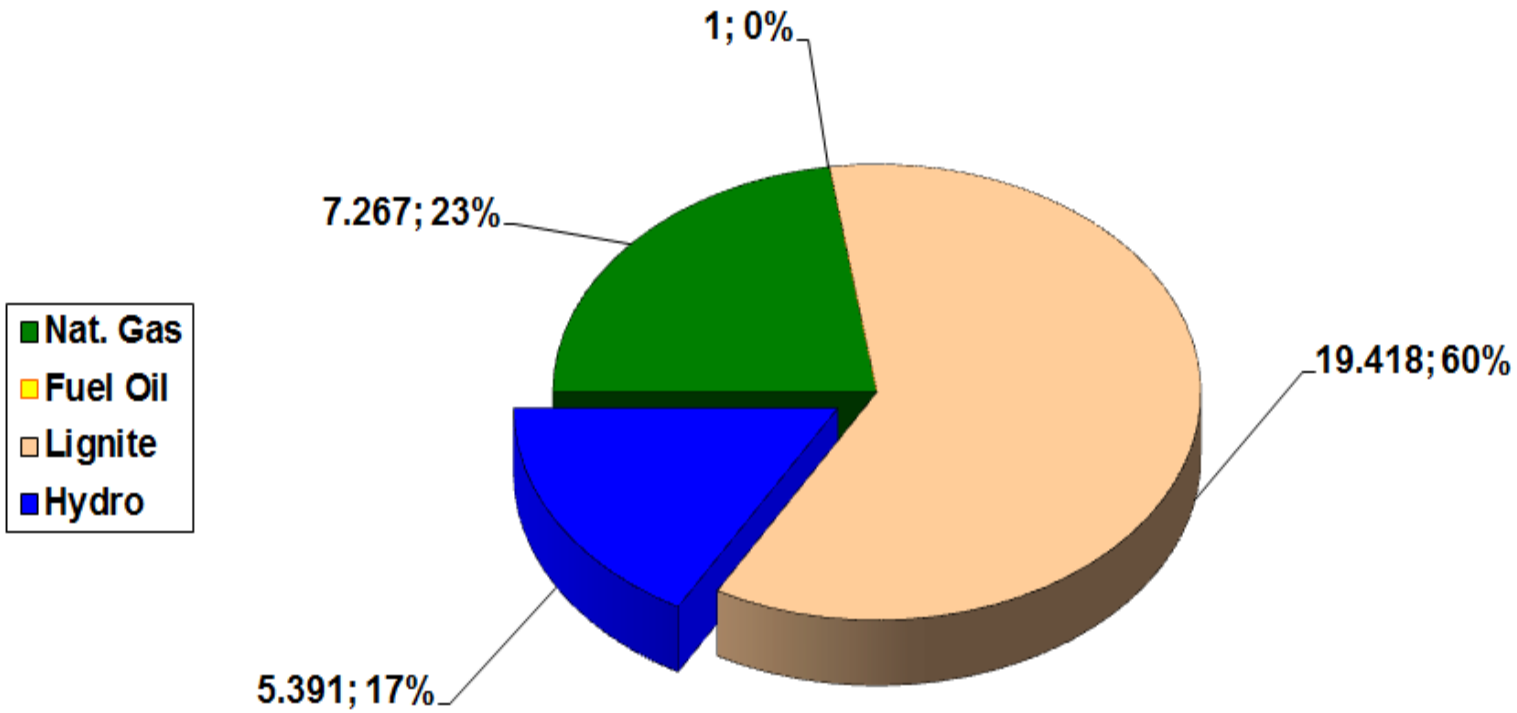
Energy Production by type of fuel / year 2015: 32.077 GWH



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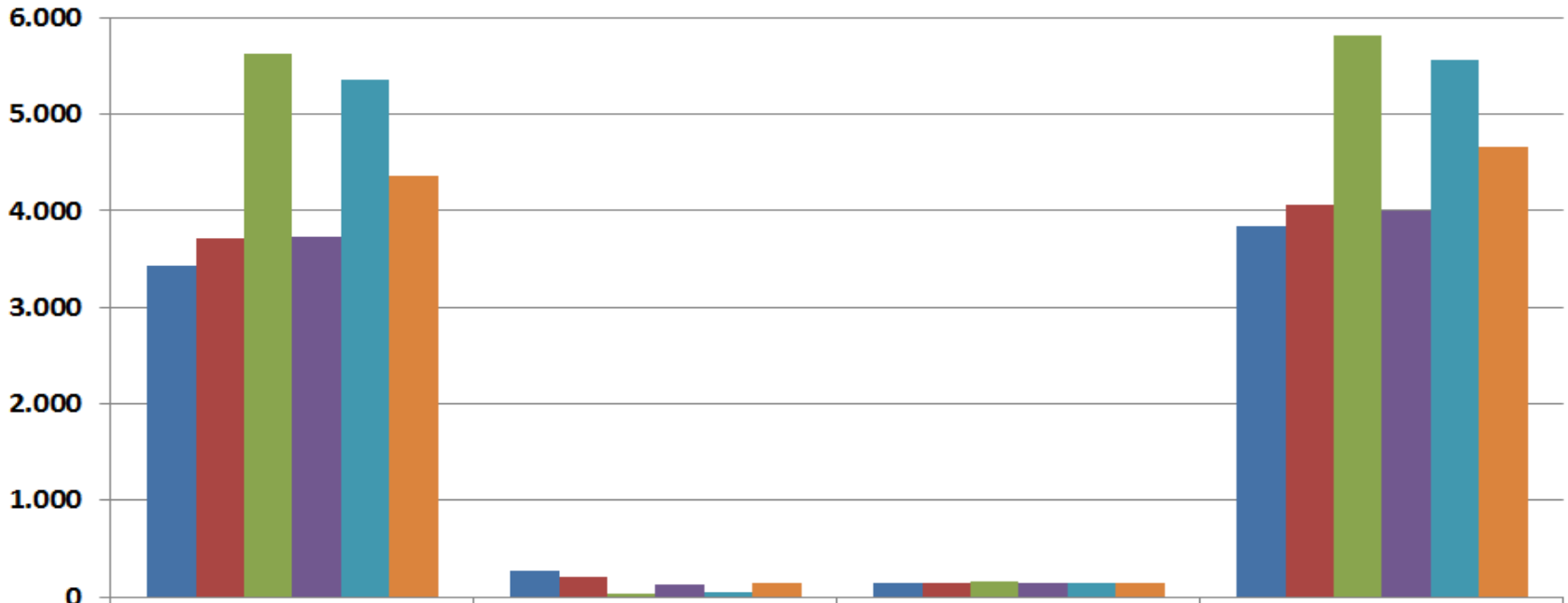
Annual Hydroelecric Energy Production (GWH)



	HPP	Pumping	Small HPP	TOTAL
2011	3.426	267	147	3.841
2012	3.716	205	144	4.065
2013	5.627	36	159	5.823
2014	3.725	135	138	3.998
2015	5.354	52	152	5.558
5yr avrg	4.370	139	148	4.657

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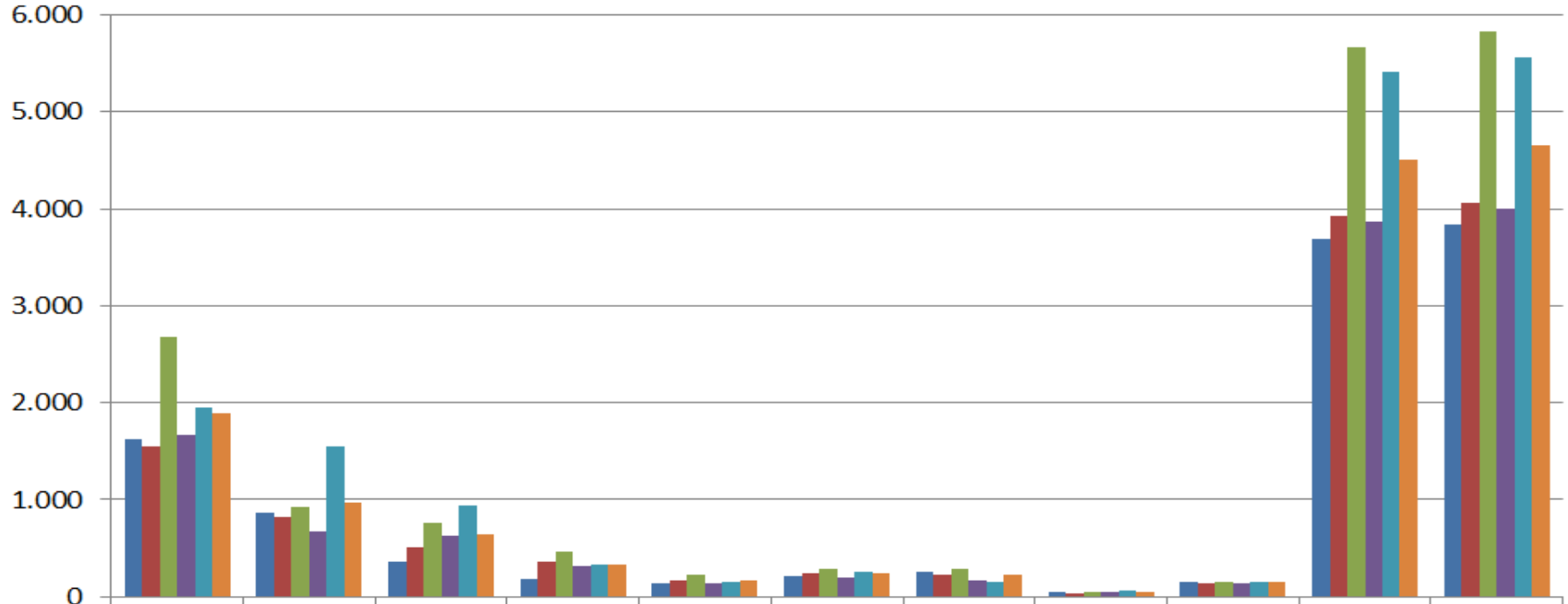
Annual Energy Production by River Hydroelectric Scheme (GWH)



	Acheloos	Aliakmon	Nestos	Arachthos	Aoos	Ladon	Tavropos	Vodas	Small HPP	HPP	HPP+SHPP
2011	1.625	863	356	185	145	209	262	48	147	3.694	3.841
2012	1.551	816	514	360	170	240	231	40	144	3.921	4.065
2013	2.671	919	758	465	228	292	280	51	159	5.664	5.823
2014	1.673	676	628	311	145	203	175	49	138	3.860	3.998
2015	1.957	1.545	933	324	154	264	159	70	152	5.406	5.558
5yr avrg	1.895	964	638	329	168	242	221	52	148	4.509	4.657

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WATER NEEDS FOR VARIOUS USES
[AVERAGE 2011-2015]

USE	(mi.m3)
Irrigation (250.000 ha are watered in the downstream areas of the HPP)	1.725
Water supply (Thessaloniki, Agrinio, Karditsa, etc.)	133
Cooling PPC's Thermoelectric Plants	66
Ecological flow into the river beds	1.319
TOTAL	3.243

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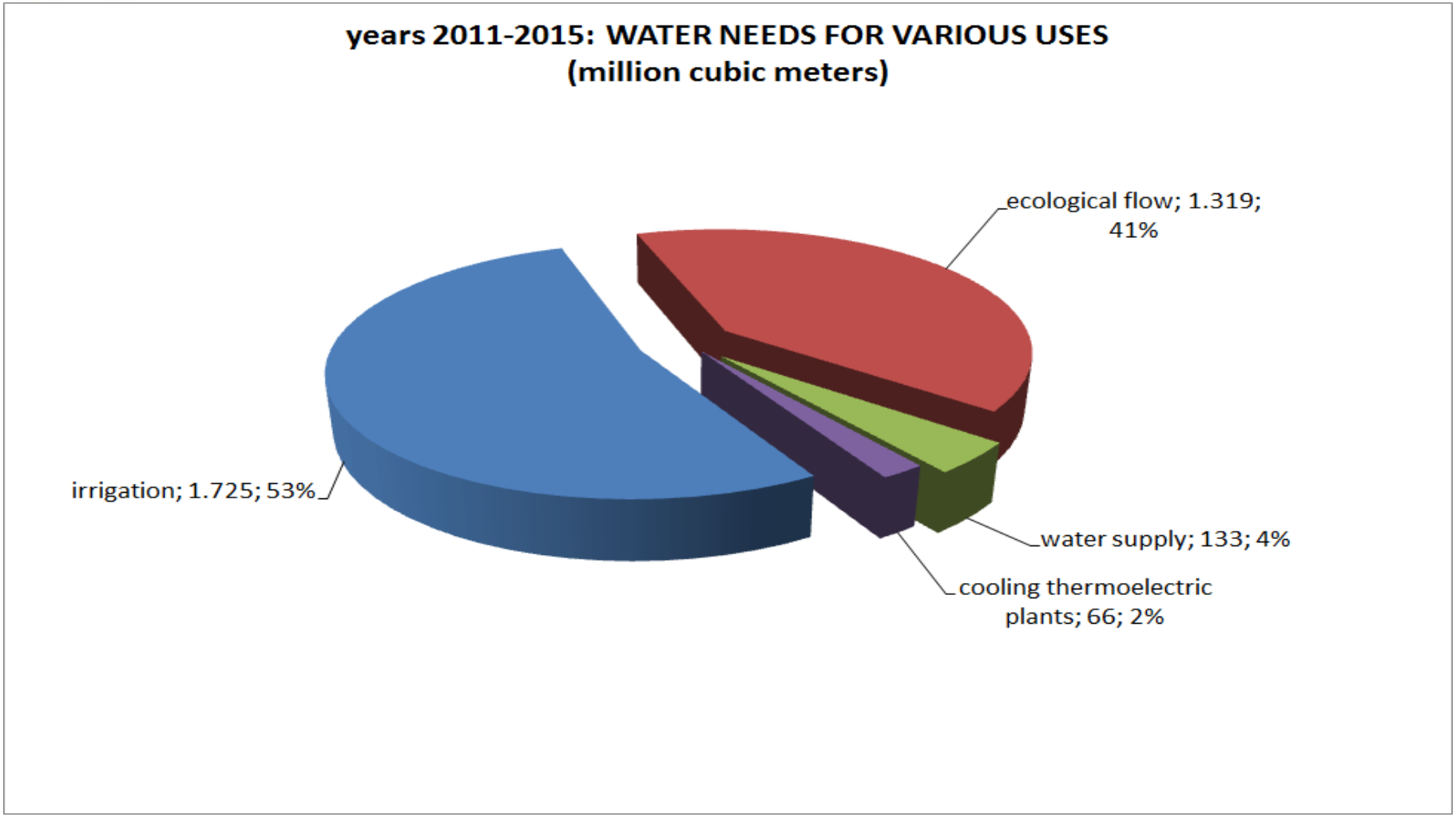

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PPC's NEW HYDROELECTRIC PROJECTS

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PPC' s NEW HYDROELECTRIC PROJECTS

UNDER CONSTRUCTION

- MESSOCHORA HEP
- IKARIA HYBRID POWER PROJECT
- METSOVITIKO HEP

RESENTLY FINISHED

- PAPADIA DAM
- AG. VARVARA REREGULATING PROJECT
- ILARION HEP

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B

OPERATION OF HPPs OF PPC SA AND THEIR CONTRIBUTION IN WATER MANAGEMENT

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1. GENERAL

- HPPs OF PPC SA manage a great portion of water reserves in Greece ,and as multipurpose schemes provide additional services and water uses for third parties(flood control, irrigation, water supply, recreation etc).
- Mean annual water quantity that PPS SA manages is about 8 billion cu. Meters.
- Net actual storage capacity of PPC´s reservoirs is about 5,73 bill.cub meters ,corresponding to 3350 Gwh (max)

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2. STRATEGIC TARGET IN HPP's EXPLOITATION

- As a General Target related to the HPPs exploitation strategy , is to optimize the value of water inflows not only from the energy production point of view but also by covering the needs of water to third parties , while keeping in a high degree the safety of the dams, avoiding as much as it is possible water spilling.

- Maximizing the energy potential, we have to keep the reservoir's level higher and operate the hydro units at the best efficiency load.

- Operation in peak loads contributes in maximizing the value of energy produced by a certain quantity of water

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3. CONSTRAINS IN HPPs OPERATION (1)

Maximizing the value of Water Inflows and securing water reserves for covering water demand means:

- **High level in reservoirs**
- **Peak operation**

Risks to be taken:

- **Water spilling**
- **Decreased flood control capability**
- **Dam safety**

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3. CONSTRAINS IN HPPs OPERATION (2)

Meteorological forecasts are stochastic especially for long period so the methodology for water management is based on:

- **Statistic data for 20 years**
- **Technical data of the installations**
- **Water needs**
- **Energy demand**
- **Constrains in the exploitation procedure (limits in water discharges down stream)**
- **Experience**

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4. WATER DEMAND (average 2011-2015)

USE	DEMAND in million cubic meters	Corresponding to GWH
WATER SUPPLY	133	90
IRRIGATION	1725	926
ECOLOGICAL FLOW	1319	600
COOLING Thermoelectric Plants	66	35
TOTAL	3243	1651

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5. WATER MANAGEMENT

WATER RESERVES DEVELOPMENT
TARGET:END OF MAY WATER RESERVES……..2650-3130 Gwh

- **OCTOBER ……..1650 – 1850 (average 1750) Gwh**
- **DECEMBER …….. 1750 – 2050 (average 1900) Gwh**
- **MARCH …….. 2210– 2625 (average 2420) Gwh**
- **MAY (END) …….. 2650 – 3130 (average 2880) Gwh**

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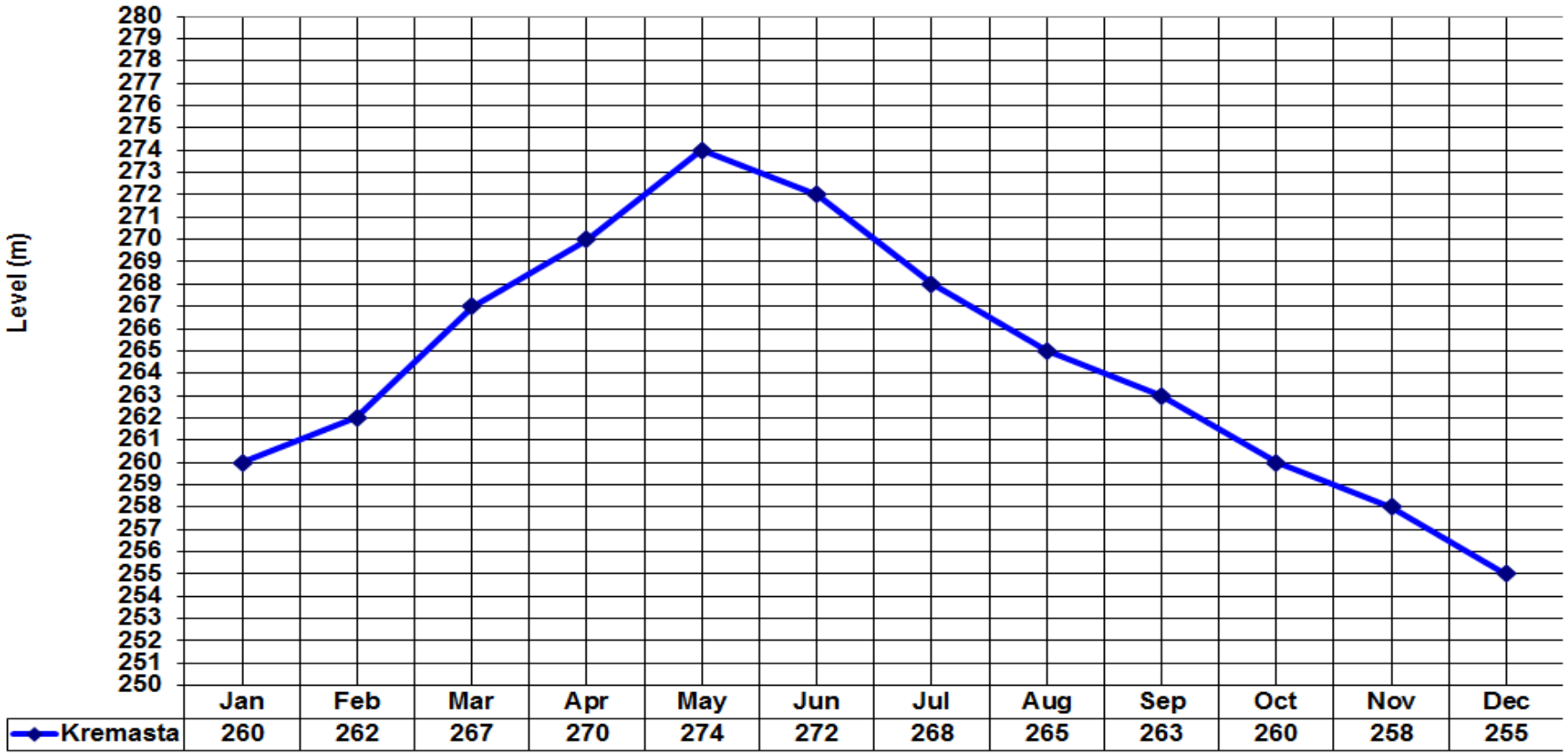
Kremasta: Reservoir Level at the end of the month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kremasta	260	262	267	270	274	272	268	265	263	260	258	255

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Pournari: Reservoir Level at the end of the month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pournari	110	112	112	115	118	119	117	115	114	112	112	110

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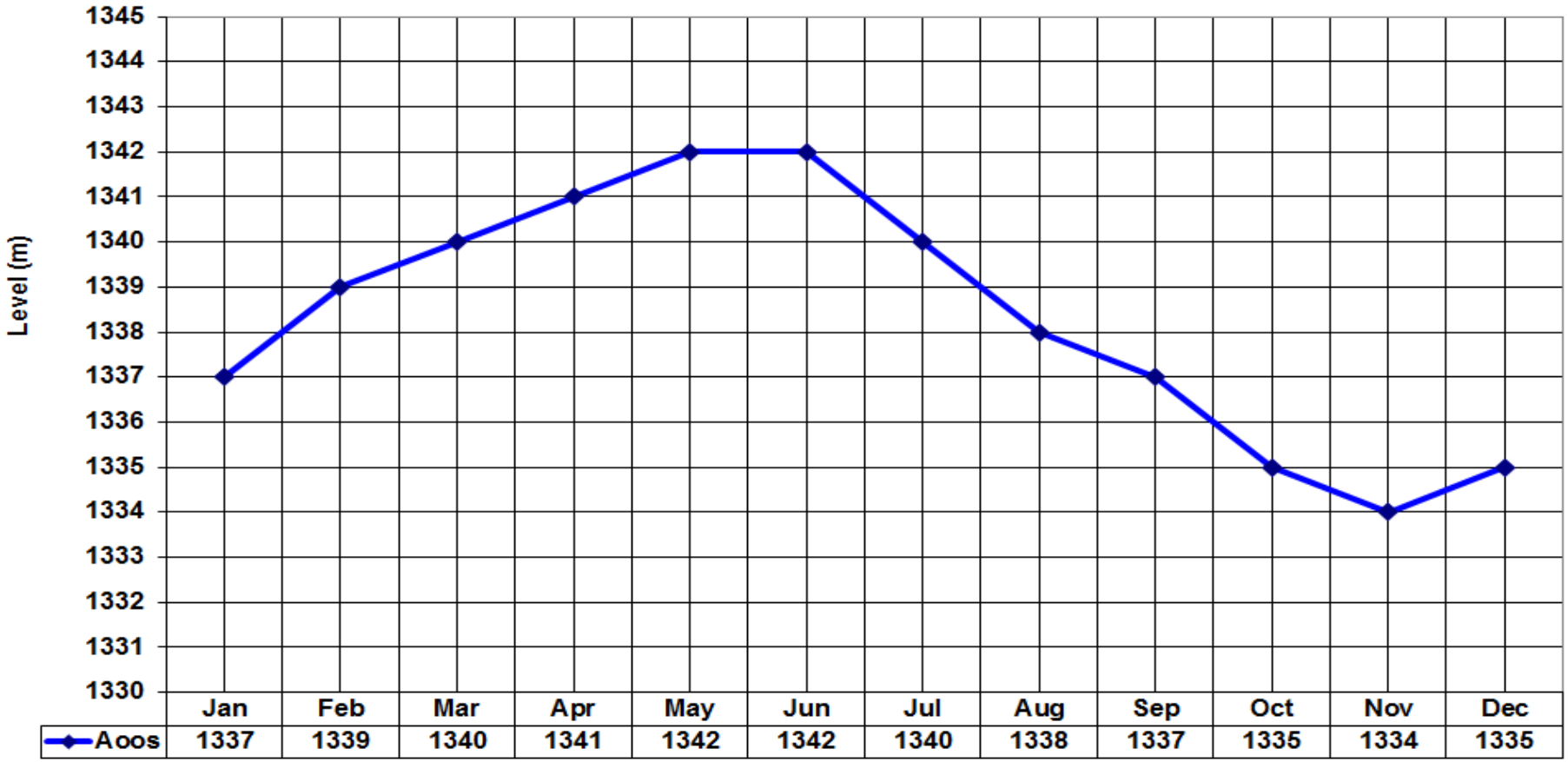
AOOS: Reservoir Level at the end of the month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Aoos	1337	1339	1340	1341	1342	1342	1340	1338	1337	1335	1334	1335

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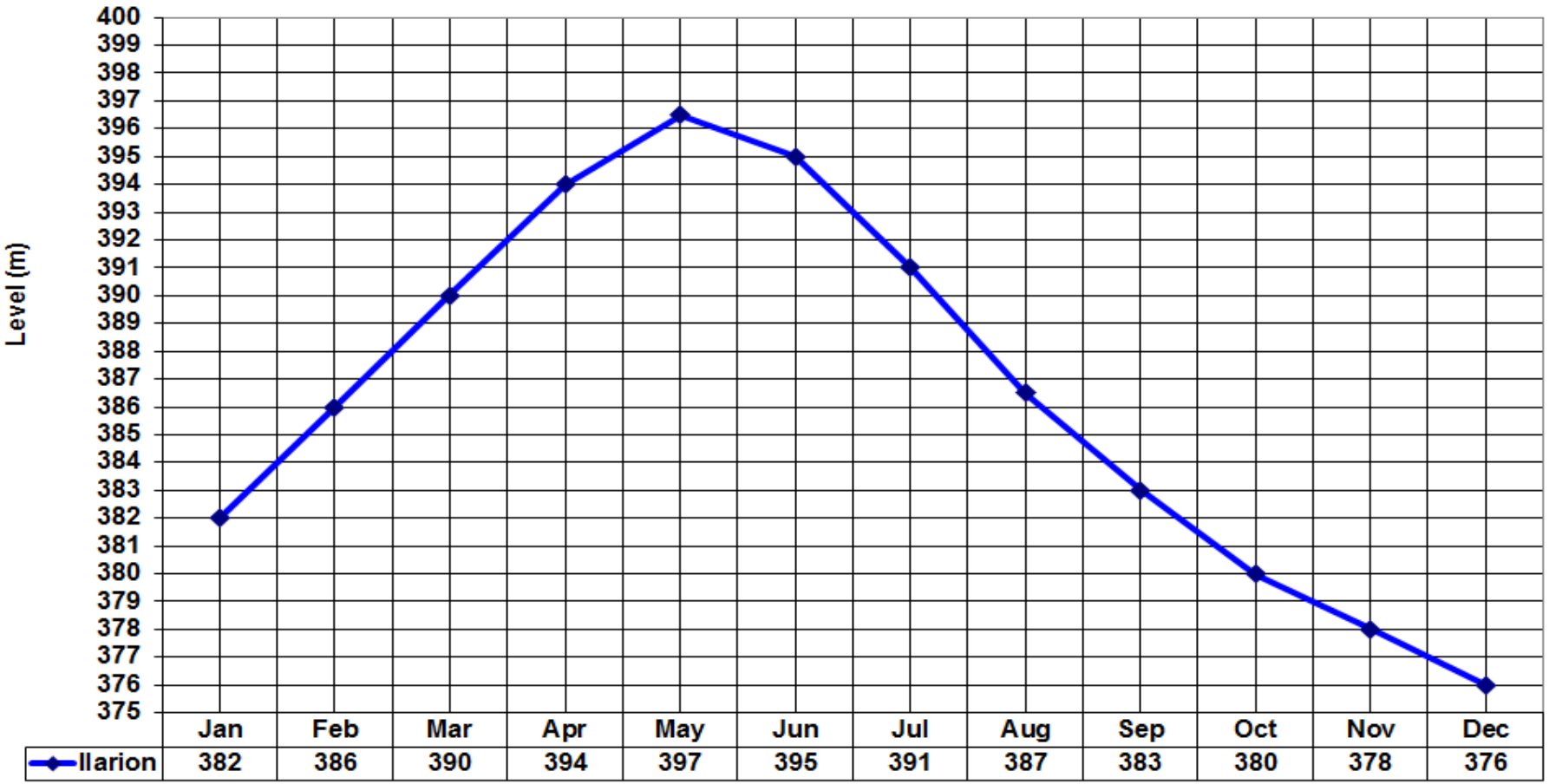
Ilarion: Reservoir Level at the end of the month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ilarion	382	386	390	394	397	395	391	387	383	380	378	376

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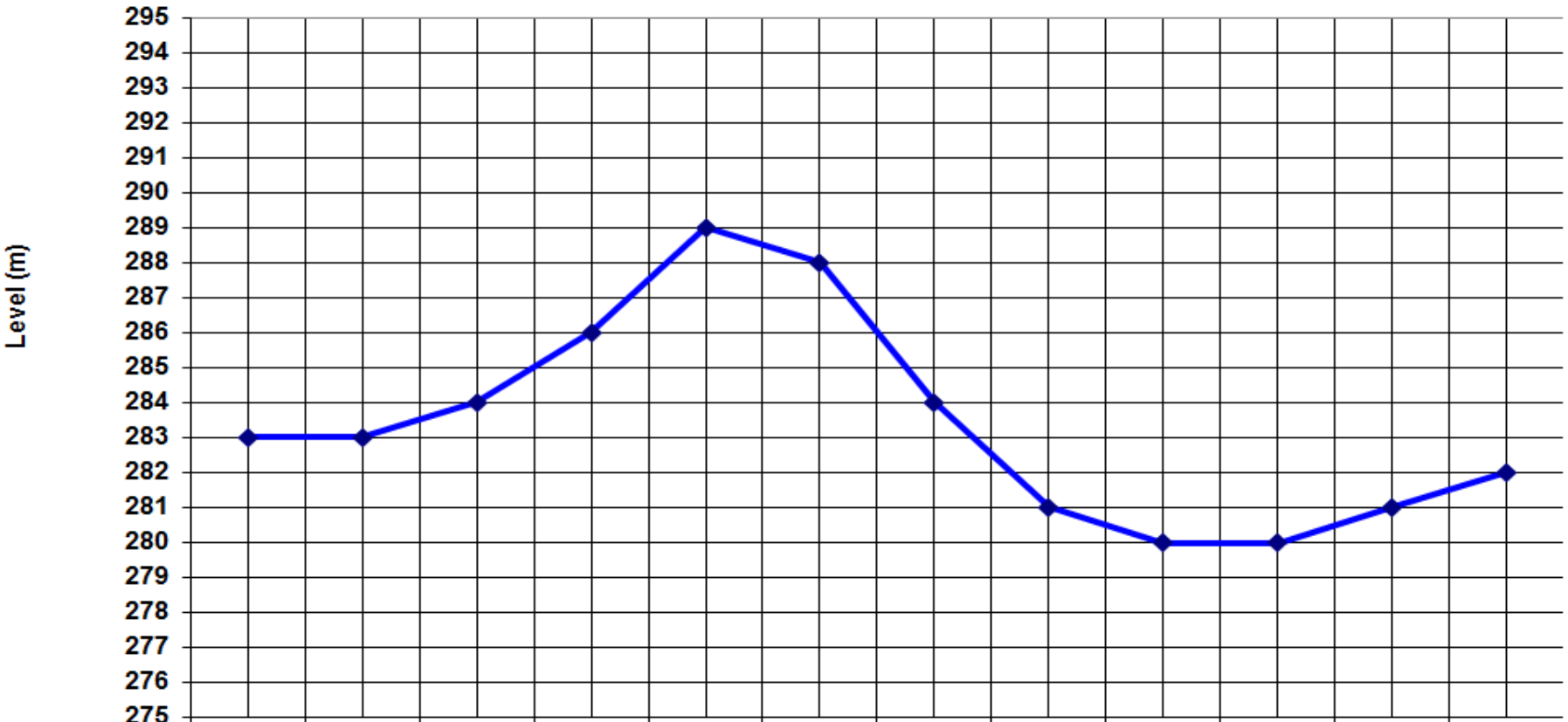
Polyphyto: Reservoir Level at the end of the month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Polyphyto	283	283	284	286	289	288	284	281	280	280	281	282

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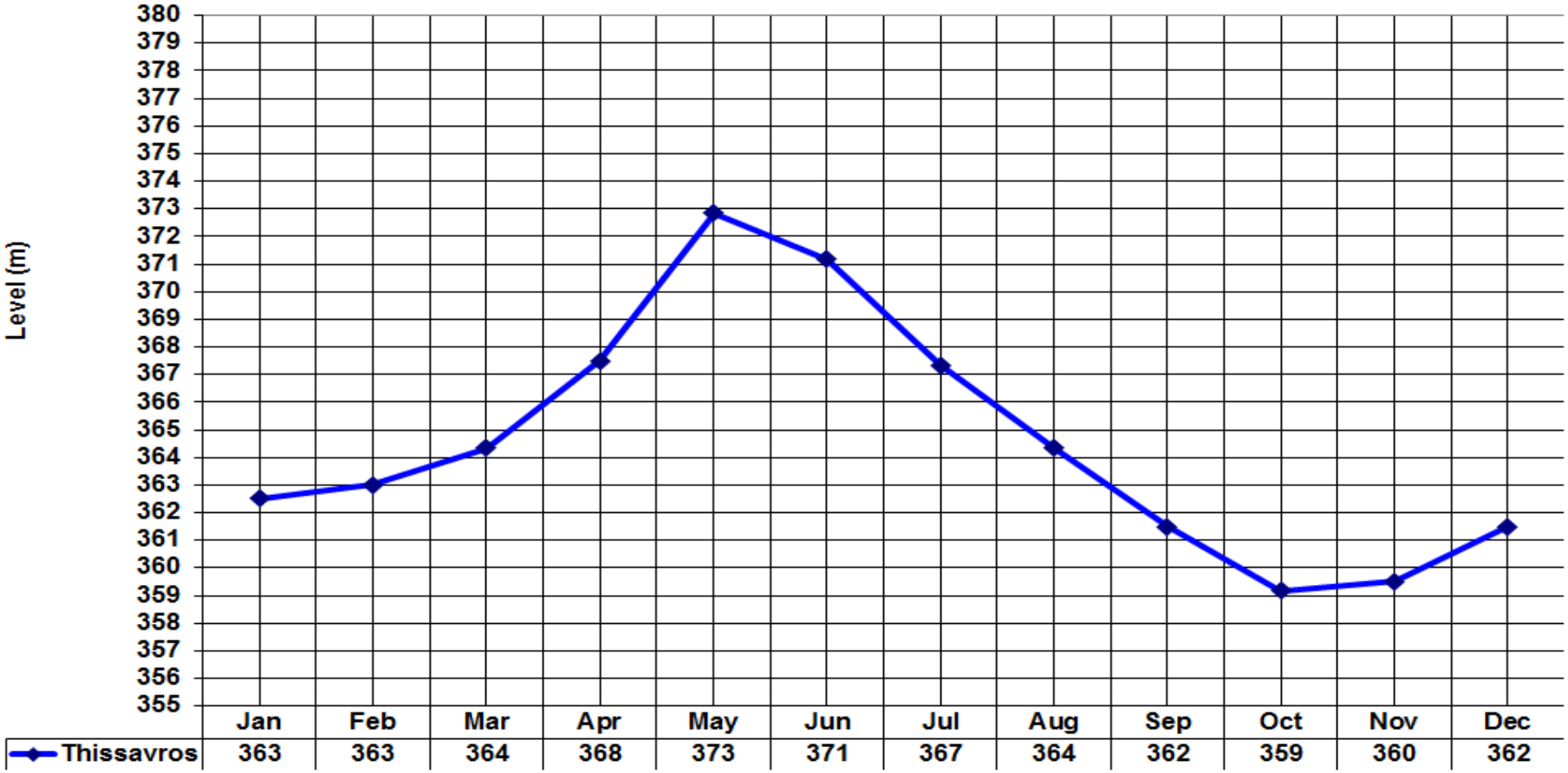
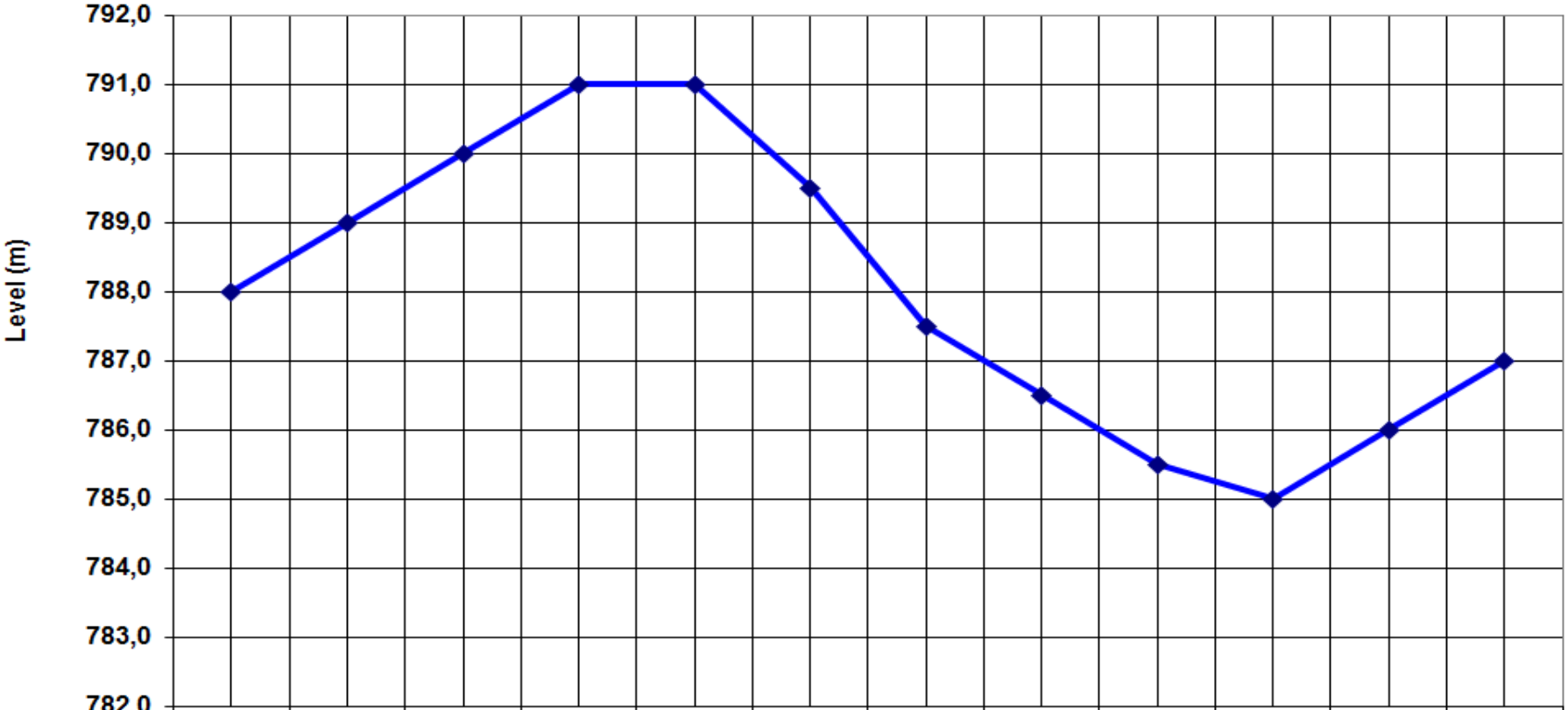
Thissavros: Reservoir Level at the end of the month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Thissavros	363	363	364	368	373	371	367	364	362	359	360	362

Energy for everyone

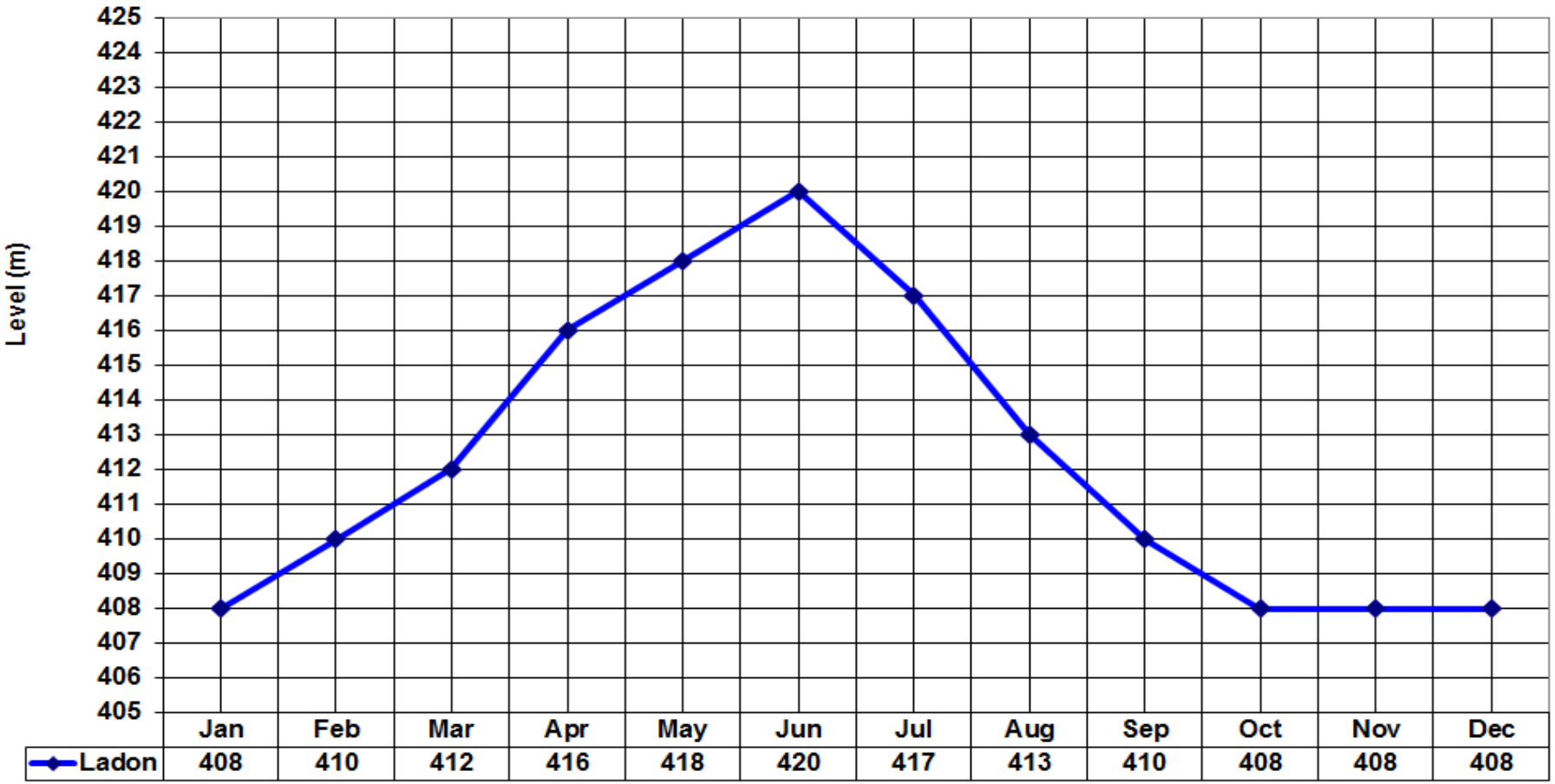
Plastiras: Reservoir Level at the end of the month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plastiras	788,0	789,0	790,0	791,0	791,0	789,5	787,5	786,5	785,5	785,0	786,0	787,0

Energy for everyone

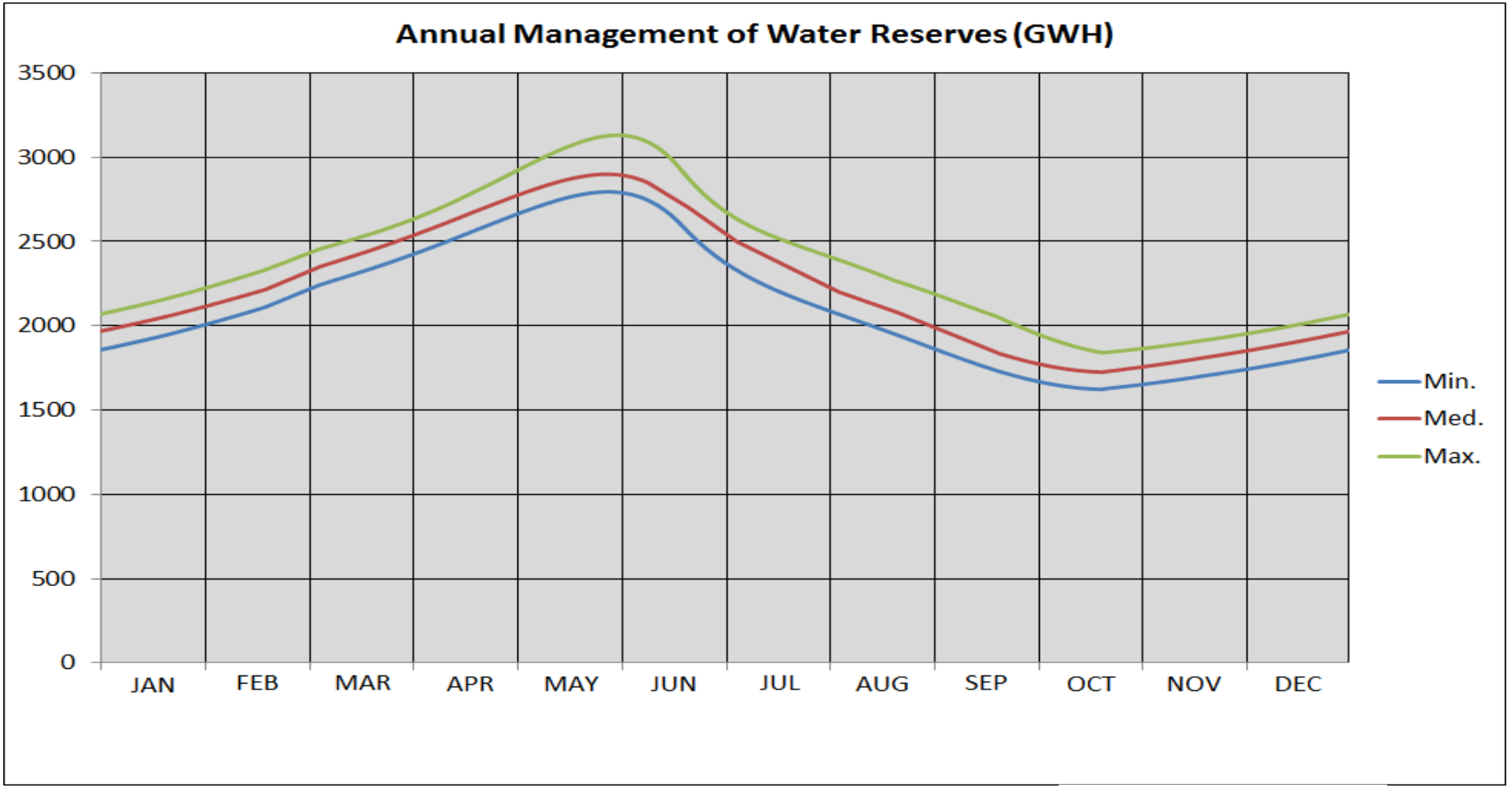
Ladon: Reservoir Level at the end of the month



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ladon	408	410	412	416	418	420	417	413	410	408	408	408

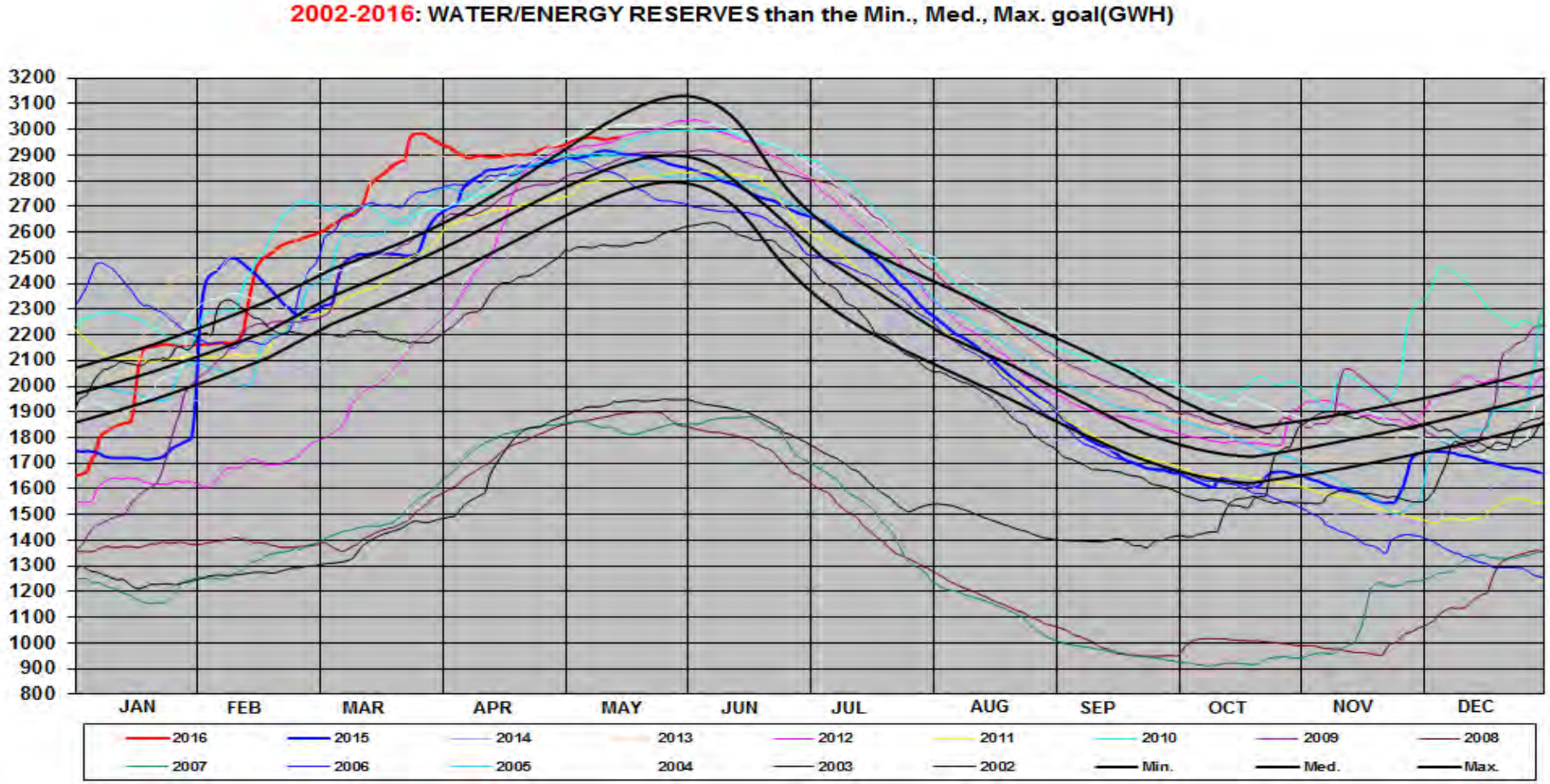
Energy for everyone

STATISTICAL CURVES FOR WATER RESERVES FOR EACH MONTH



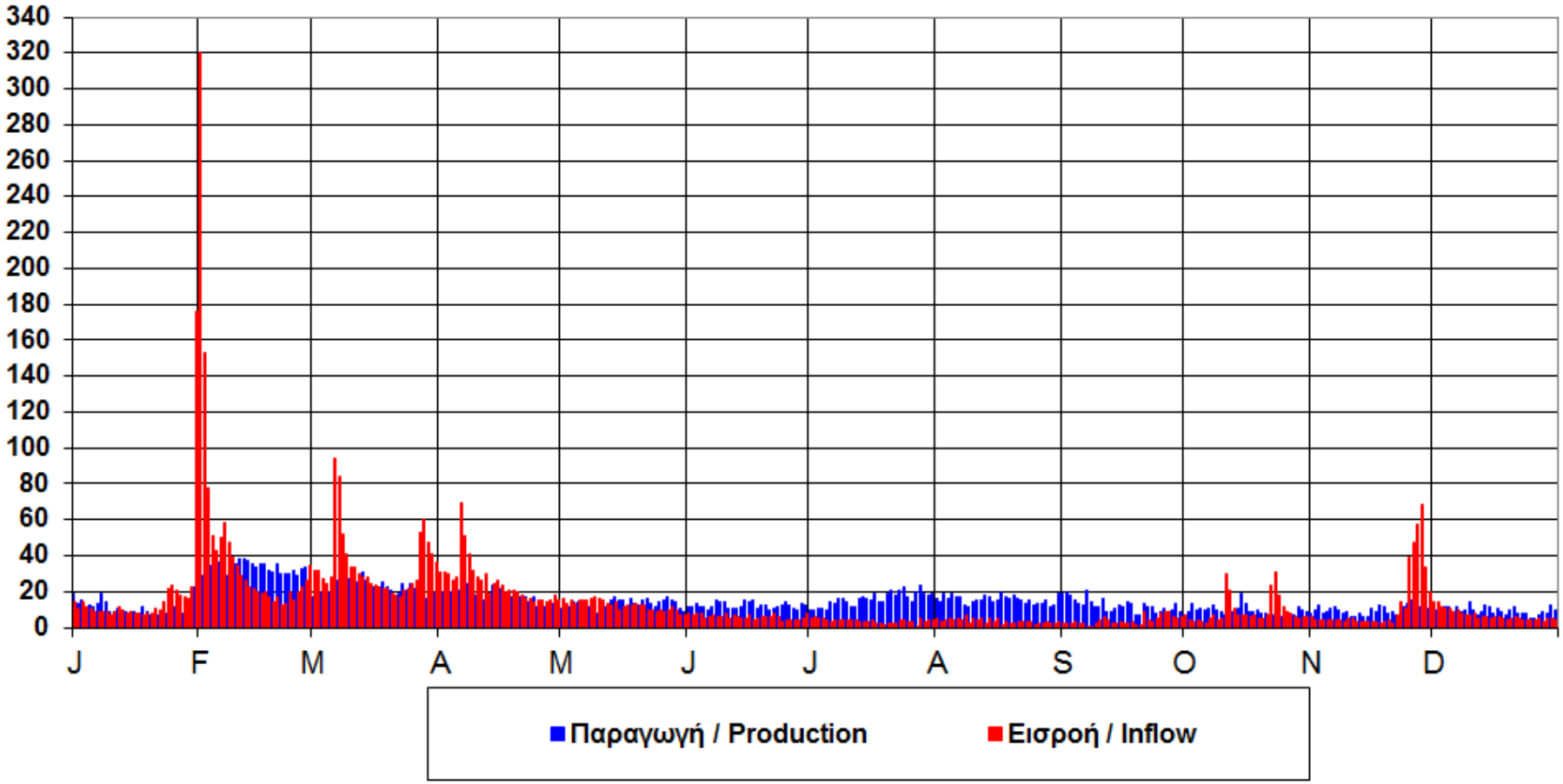
Energy for everyone

ACTUAL CURVES FOR WATER RESERVES FOR EACH MONTH



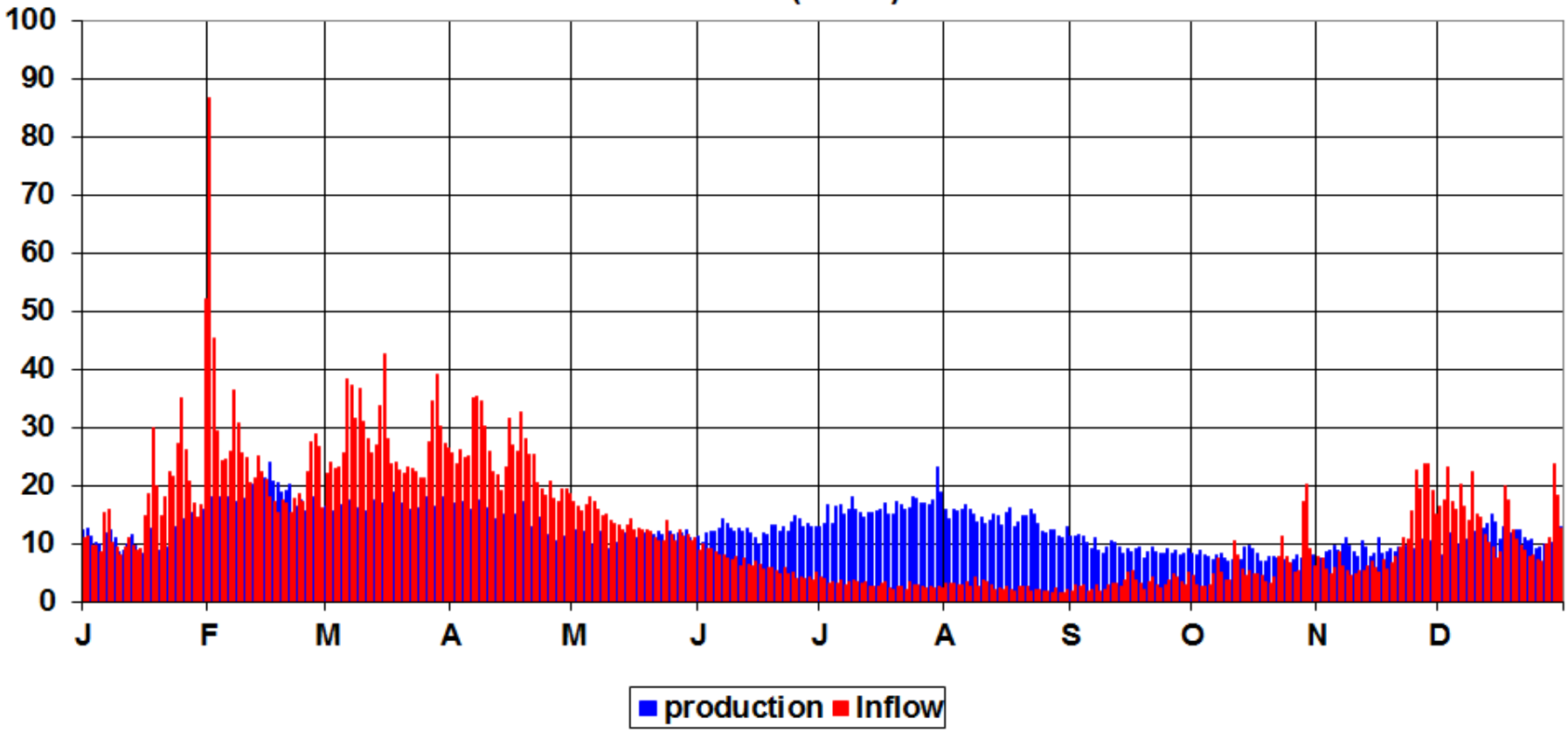
Energy for everyone

Year 2015: Hydroelectric Production - Water Inflow into Reservoirs (GWH)



Energy for everyone

Year 2011-2015: Hydroelectric Production - Water Inflow into Reservoirs (GWH)



C

CAPACITY AVAILABILITY

1. BASED ON SCHEDULING

The water reserve formed practically at 8 main reservoirs (Kremasta, Ilarion, Polyphyto, Thissavros, Pournari, Ladon, Plastiras, Aoos).

For each main reservoir there is "guide curve" with temporal variation of water level corresponding to the optimal statistics storage compared to the safety of the dam, the water available to third parties, the volume of water that can be diverted to the riverbed, avoiding overflow, etc.

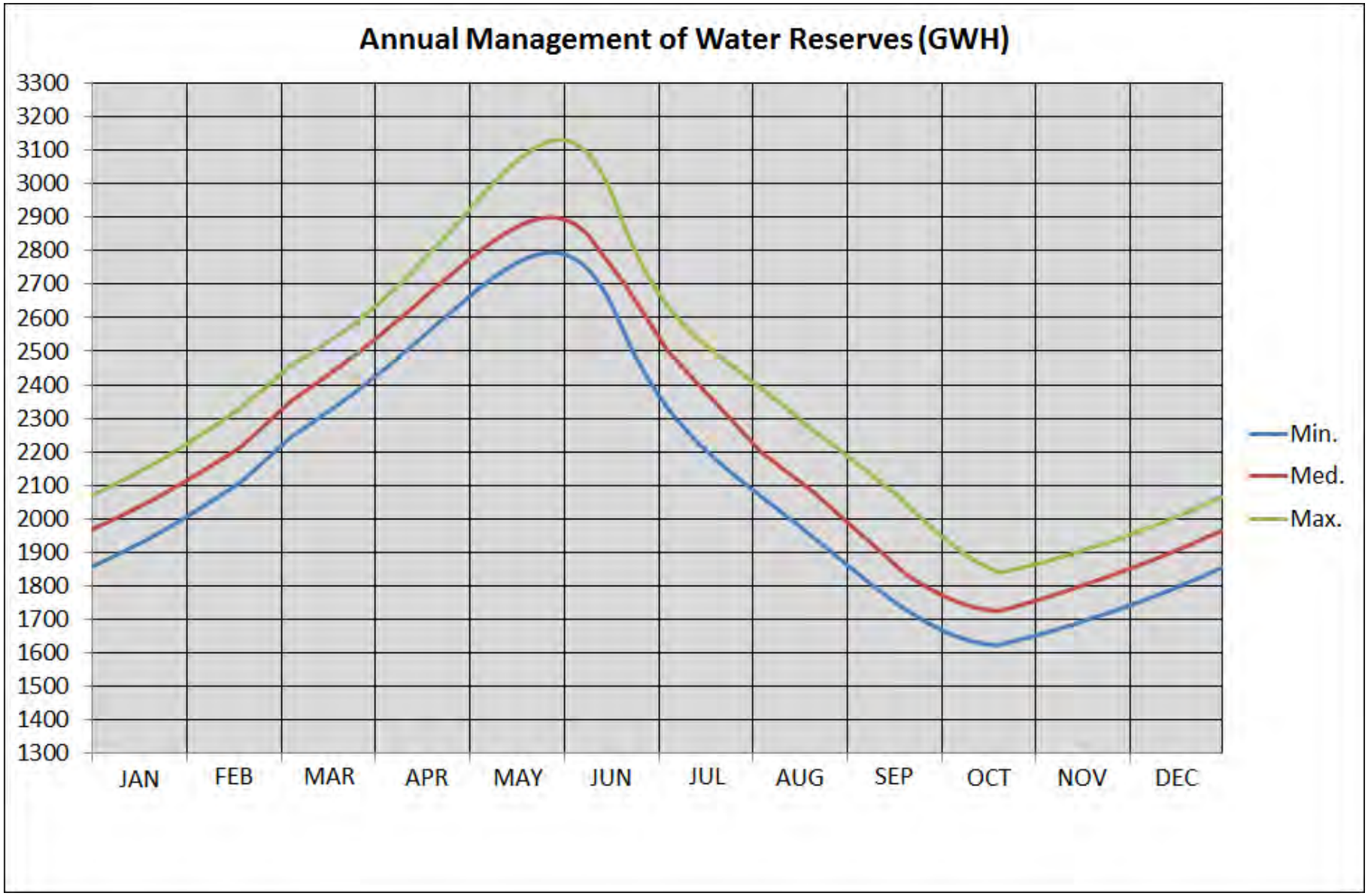
The “water level guide curve" (tries to be followed in each reservoir management) can be expressed as a curve varying water reserve and thus as an energy inventory change curve for each reservoir.

The composition of 8 "guide curves" originates the best guide curve for three storage zones (max., med., min.) for optimal utilization of water reserve.

Varying the level of Principal Reservoir, it has a very small impact on the power units supplied by them, while the intermediate reservoirs maintain practically constant level and thus stable power units of HPP which feed.

If by assigning varying the power of the HPP Units as described above are affected by the change in level of the respective reservoirs shows the graph of the change in the total power of HPP corresponding to the desired storage area.

Of the total available power curve we conclude that the minimum available hydro power is ~ 2840 MW at certain period (So available power ≥2840 MW).

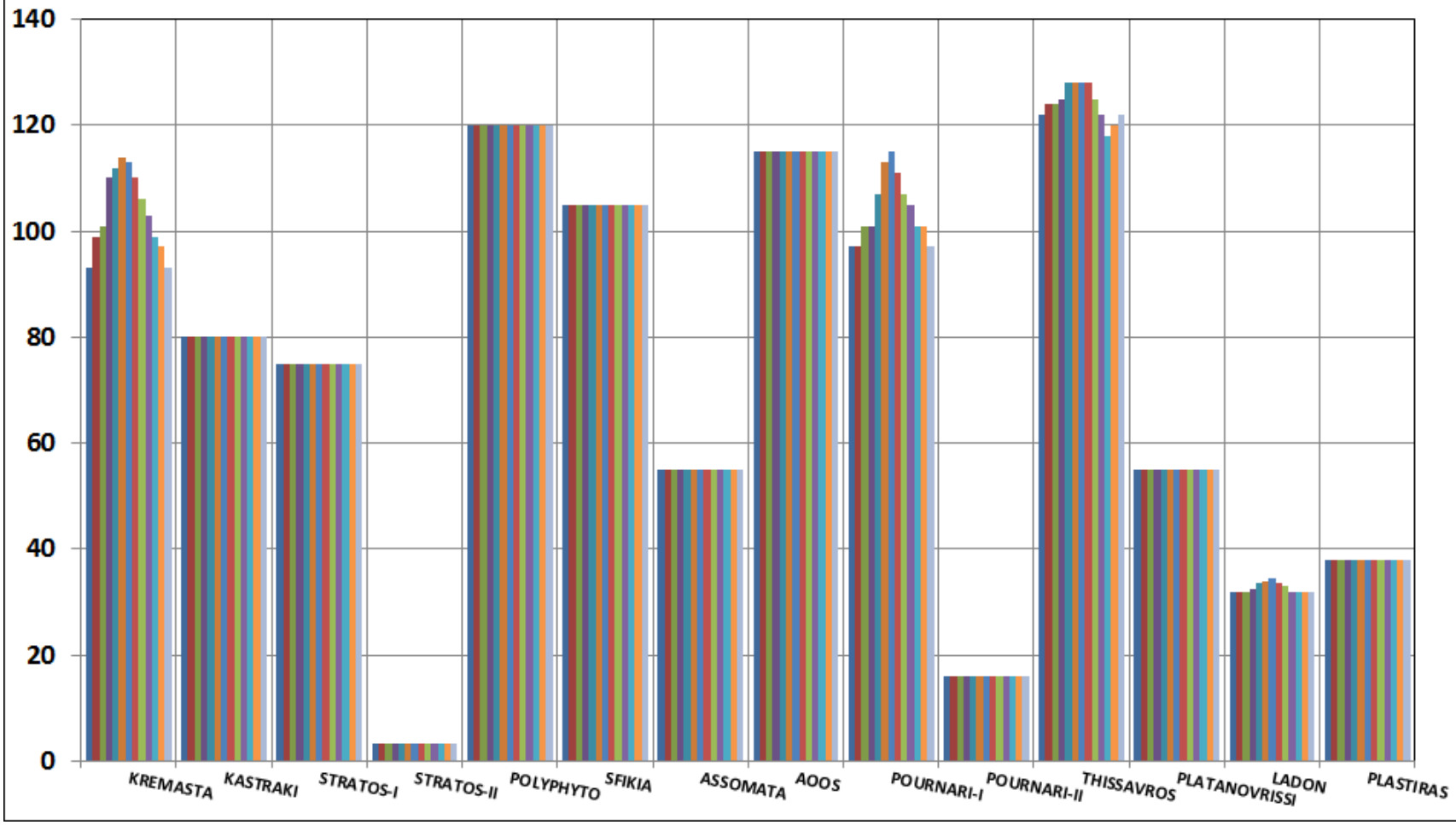

Annual Management of Water Reserves (GWH)
3300
3200
3100
3000
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Min.
Med.
Max.

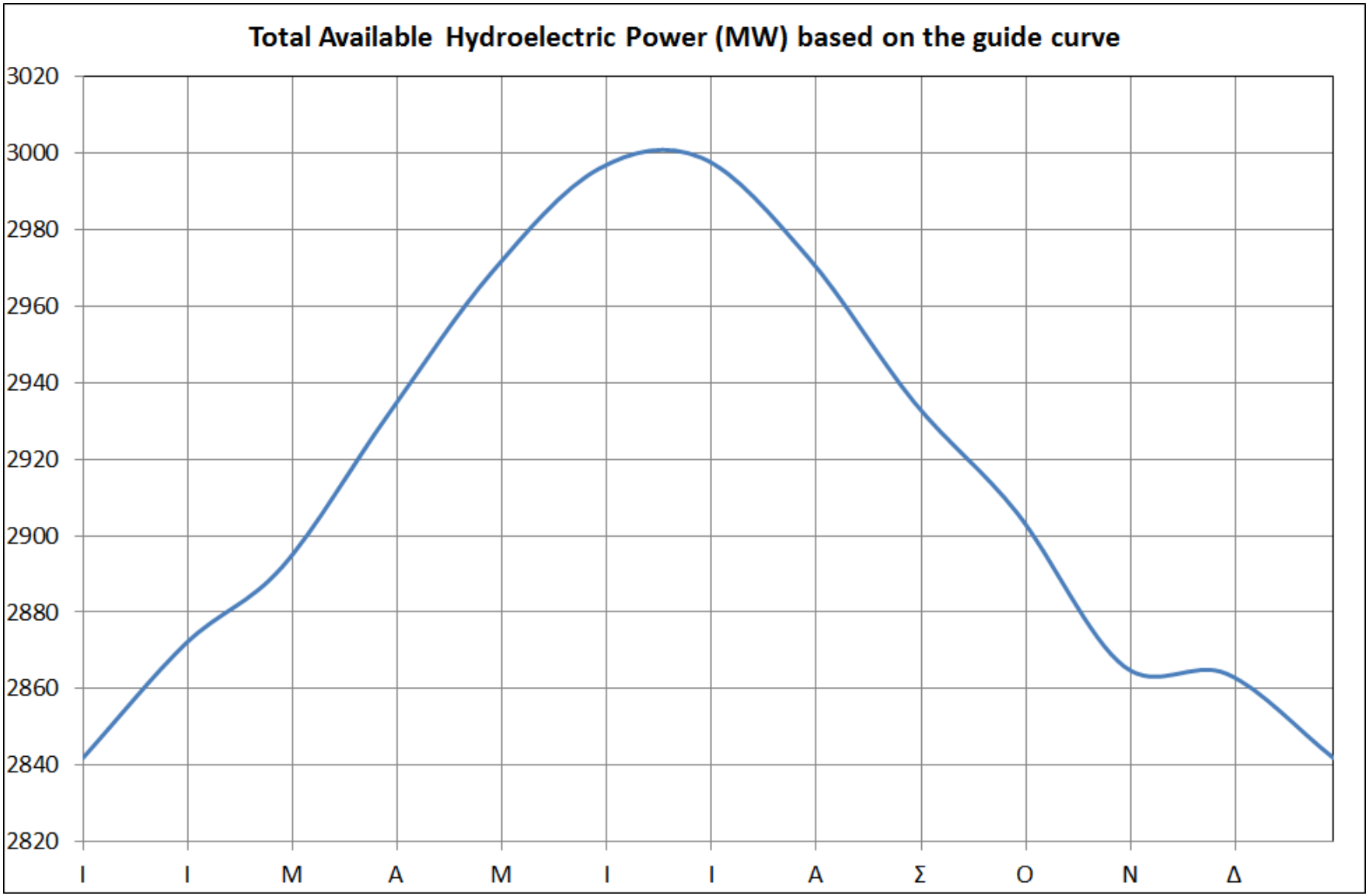
AVAILABILITY FOR HYDROELECTRIC POWER PLANTS [MW]

based on the guide operation curve of reservoirs

number of units	4	4	2	2	3	3	2	2	3	2+1	3	2	2	3	
Date / STATION	KREMASTA	KASTRAKI	STRATOS-I	STRATOS-II	POLYPHYTO	SFIKIA	ASSOMATA	AOOS	POURNARI-I	POURNARI-II	THISSAVROS	PLATANOVRISSI	LADON	PLASTIRAS	**Total Available Hydroelectric Power**
1/1/2015	93	80	75	3,15	120	105	55	115	97	16	122	55	32	38	**2842**
31/1/2015	99	80	75	3,15	120	105	55	115	97	16	124	55	32	38	**2872**
28/2/2015	101	80	75	3,15	120	105	55	115	101	16	124	55	32	38	**2892**
31/3/2015	110	80	75	3,15	120	105	55	115	101	16	125	55	32,5	38	**2932**
30/4/2015	112	80	75	3,15	120	105	55	115	107	16	128	55	33,5	38	**2969**
31/5/2015	114	80	75	3,15	120	105	55	115	113	16	128	55	34	38	**2996**
30/6/2015	113	80	75	3,15	120	105	55	115	115	16	128	55	34,5	38	**2999**
31/7/2015	110	80	75	3,15	120	105	55	115	111	16	128	55	33,5	38	**2973**
31/8/2015	106	80	75	3,15	120	105	55	115	107	16	125	55	33	38	**2935**
30/9/2015	103	80	75	3,15	120	105	55	115	105	16	122	55	32	38	**2906**
31/10/2015	99	80	75	3,15	120	105	55	115	101	16	118	55	32	38	**2866**
30/11/2015	97	80	75	3,15	120	105	55	115	101	16	120	55	32	38	**2864**
31/12/2015	93	80	75	3,15	120	105	55	115	97	16	122	55	32	38	**2842**

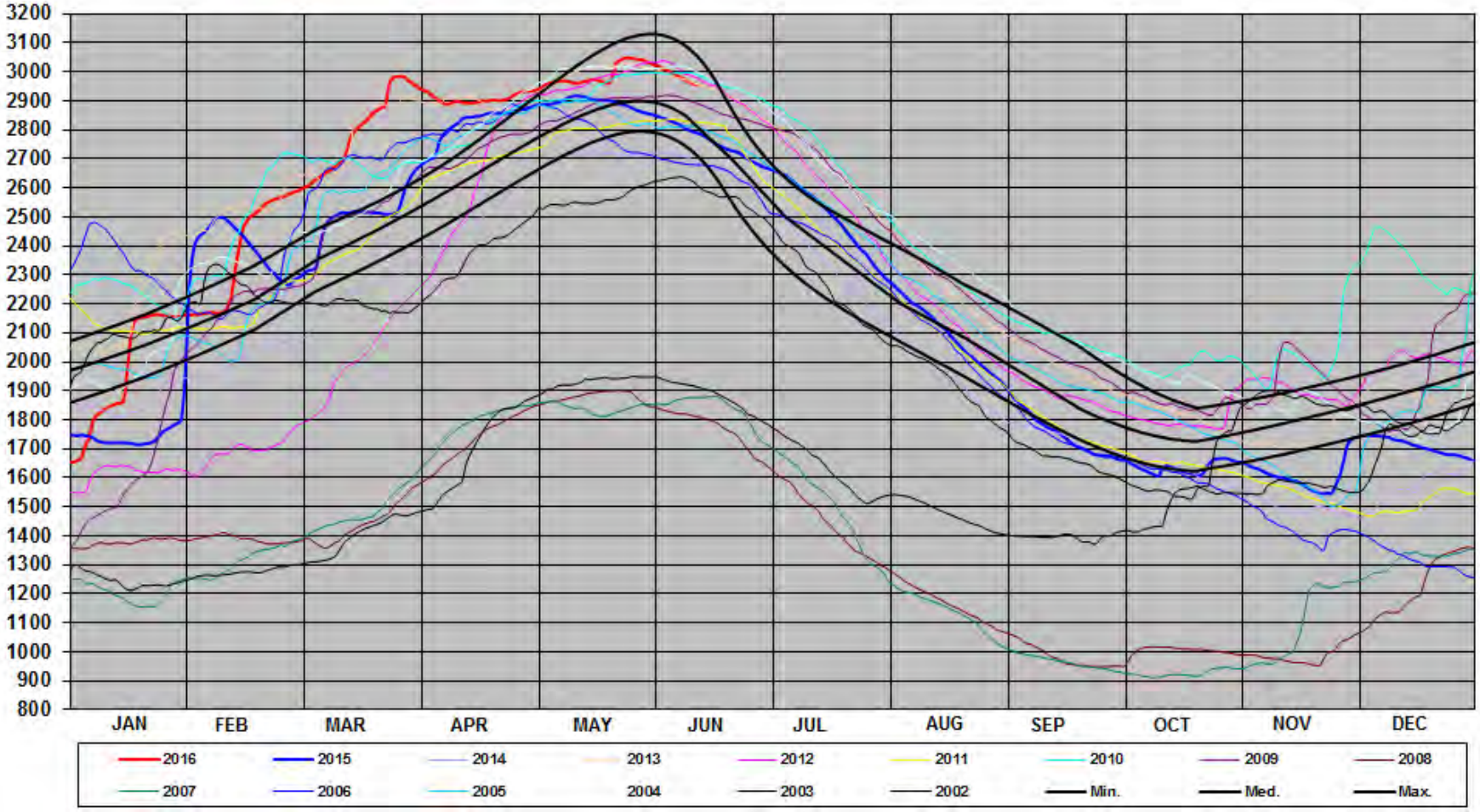
Availability Power Hydroelectric Power Plants [MW] actual data [2012-2015]



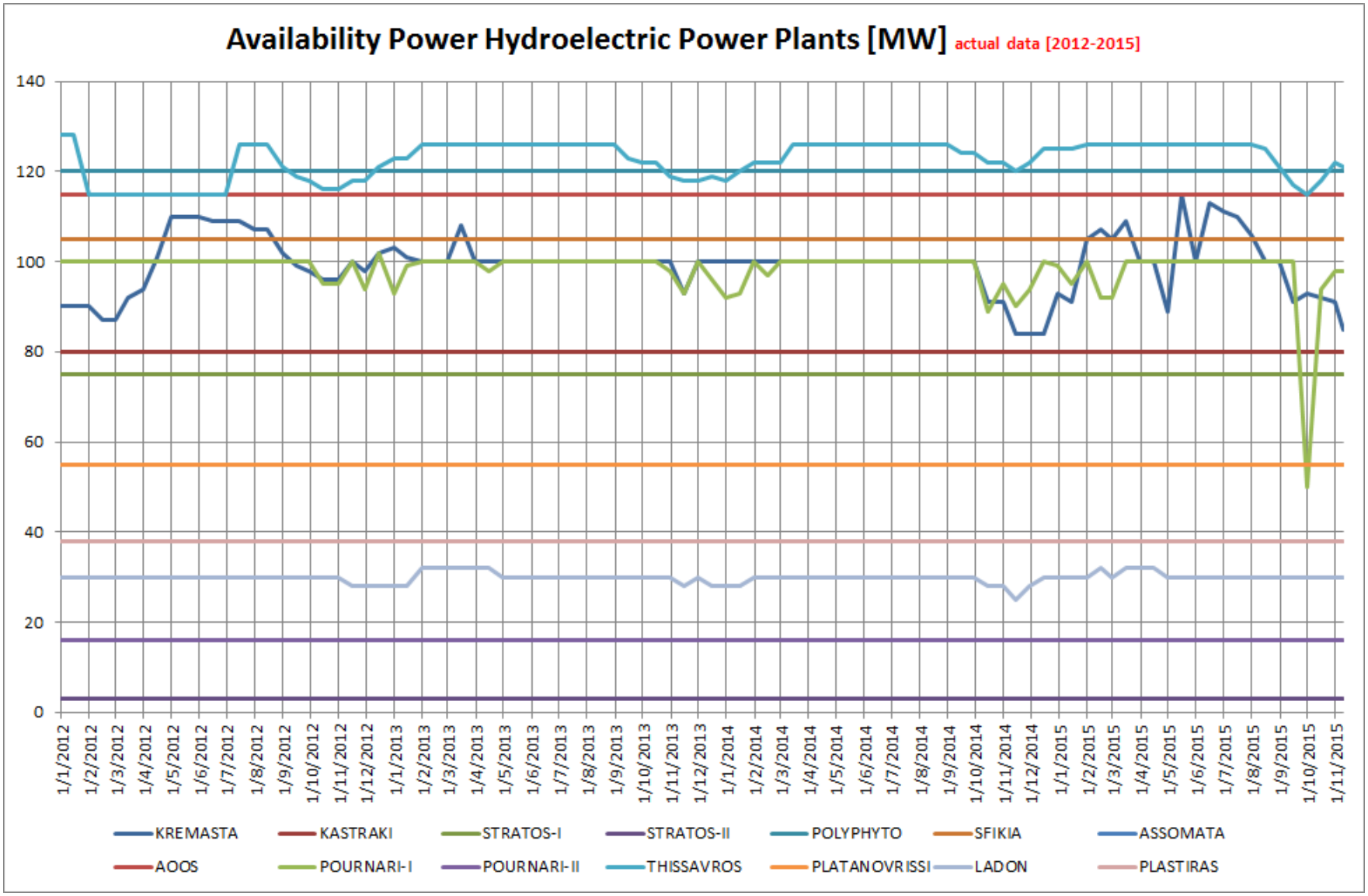

Total Available Hydroelectric Power (MW) based on the guide curve
3020
3000
2980
2960
2940
2920
2900
2880
2860
2840
2820
Ι
Ι
Μ
Α
Μ
Ι
Ι
Α
Σ
Ο
Ν
Δ

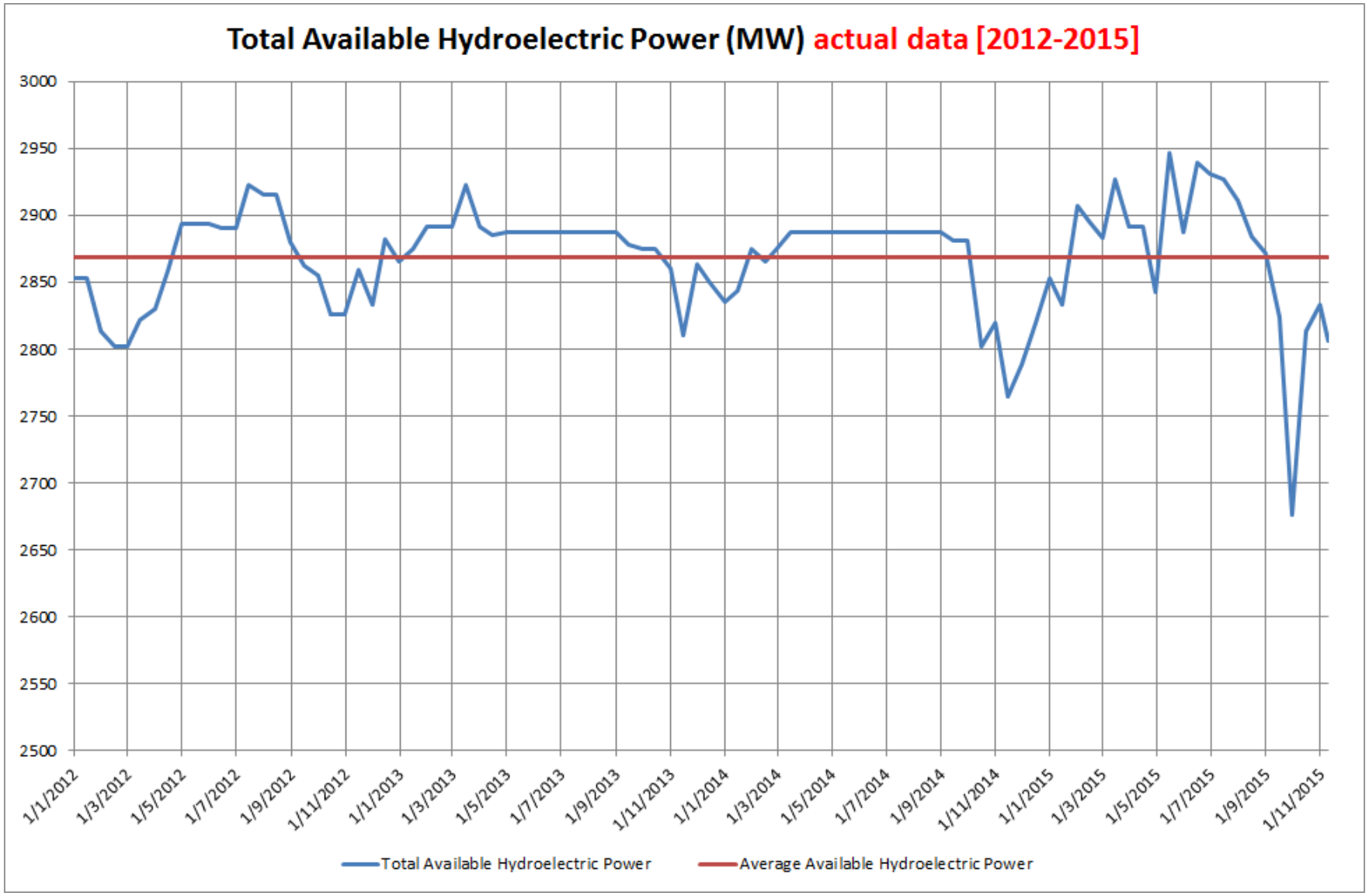
2. ACTUAL RESULTS

2002-2016: WATER/ENERGY RESERVES than the Min., Med., Max. goal (GWH)



Since actual data for the years 2000 ~ 2014 demonstrated that the desired storage area not only maintained but increased risk taking and certain times of year, the storage is maintained at higher levels. (This corresponds to the maximum of the individual curved guides). Declared availabilities per HPP unit also obtained and the total declared availability of HPP.


Availability Power Hydroelectric Power Plants [MW] actual data [2012-2015]
140
120
100
80
60
40
20
0
1/1/2012
1/2/2012
1/3/2012
1/4/2012
1/5/2012
1/6/2012
1/7/2012
1/8/2012
1/9/2012
1/10/2012
1/11/2012
1/12/2012
1/1/2013
1/2/2013
1/3/2013
1/4/2013
1/5/2013
1/6/2013
1/7/2013
1/8/2013
1/9/2013
1/10/2013
1/11/2013
1/12/2013
1/1/2014
1/2/2014
1/3/2014
1/4/2014
1/5/2014
1/6/2014
1/7/2014
1/8/2014
1/9/2014
1/10/2014
1/11/2014
1/12/2014
1/1/2015
1/2/2015
1/3/2015
1/4/2015
1/5/2015
1/6/2015
1/7/2015
1/8/2015
1/9/2015
1/10/2015
1/11/2015
KREMASTA
KASTRAKI
STRATOS-I
STRATOS-II
POLYPHYTO
SFIKIA
ASSOMATA
AOOS
POURNARI-I
POURNARI-II
THISSAVROS
PLATANOVRISSI
LADON
PLASTIRAS


Total Available Hydroelectric Power (MW) actual data [2012-2015]
3000
2950
2900
2850
2800
2750
2700
2650
2600
2550
2500
1/1/2012
1/3/2012
1/5/2012
1/7/2012
1/9/2012
1/11/2012
1/1/2013
1/3/2013
1/5/2013
1/7/2013
1/9/2013
1/11/2013
1/1/2014
1/3/2014
1/5/2014
1/7/2014
1/9/2014
1/11/2014
1/1/2015
1/3/2015
1/5/2015
1/7/2015
1/9/2015
1/11/2015
Total Available Hydroelectric Power
Average Available Hydroelectric Power

HYDROPOWER PLANT AVAILABILITY: YEAR 2015

HPP	installed capacity (MW)	Coefficient %		Plant shutdowns (hours)			Unavailability (%)			Availability (%)	
		in relation to the total installed capacity	in relation to the river group installed capacity	because maintenance	due to damage	third	maintenance	damages	third	Plant	Group
KREMASTA	437,2	0,14	0,48	213	28	65	2,43%	0,32%	0,75%	97,25%	
KASTRAKI	320	0,10	0,35	0	1884	11	0,00%	21,51%	0,13%	78,49%	
STRATOS-I	150	0,05	0,17	301	162	72	3,43%	1,85%	0,82%	94,72%	
r. ACHELOOS GROUP	**907,2**	**0,29**	**1,00**				**1,74%**	**8,05%**	**0,54%**		**90,22%**
POURNARI-I	300,0	0,09	0,55	489	320	558	5,58%	3,65%	6,37%	90,77%	
POURNARI-II units 1,2	32,0	0,01	0,06	121	20	372	1,38%	0,23%	4,25%		
POURNARI-II unit 3	1,6	0,00	0,00	0	39	186	0,00%	0,44%	2,12%		
	33,6	**0,01**	**0,06**				**1,31%**	**0,24%**	**4,15%**	98,45%	
AOOS	210,0	0,07	0,39	87	171	15	0,99%	1,95%	0,17%	97,06%	
r. ARACHTHOS GROUP	**543,6**	**0,17**	**1,00**				**3,55%**	**2,78%**	**3,83%**		**93,67%**
ILARION	153,0	0,05	0,15	313	84	53	3,57%	0,96%	0,61%	95,47%	
POLYPHYTO	375,0	0,12	0,37	502	512	27	5,74%	5,84%	0,31%	88,43%	
SFIKIA	315,0	0,10	0,31	231	71	0	2,63%	0,81%	0,00%	96,55%	
ASSOMATA	108,0	0,03	0,11	0	72	47	0,00%	0,82%	0,53%	99,18%	
AGRAS	50,0	0,02	0,05	129	8	8	1,47%	0,09%	0,09%	98,44%	
EDESSAIOS	19,0	0,01	0,02	0	33	0	0,00%	0,38%	0,00%	99,62%	
r. ALIAKMON GROUP	**1020,0**	**0,32**	**1,00**				**3,53%**	**2,64%**	**0,27%**		**93,83%**
THISSAVROS	384,0	0,12	0,77	122	373	0	1,39%	4,25%	0,00%	94,35%	
PLATANOVRISSI	116,0	0,04	0,23	339	0	0	3,87%	0,00%	0,00%	96,13%	
r. NESTOS GROUP	**500,0**	**0,16**	**1,00**				**1,97%**	**3,27%**	**0,00%**		**94,77%**
LADON	70,0	0,02		200	18	162	2,29%	0,20%	1,85%	**97,51%**	
PLASTIRAS	129,9	0,04		271	29	0	3,09%	0,33%	0,00%	**96,58%**	
TOTAL	**3170,7**	**1,00**					**2,73%**	**4,16%**	**0,94%**		**93,11%**

Reported actual data fully confirm the details of our programming (Cap. 1), namely:

1.The total declared availability of HPP (which we never had problems deviations), has never fallen below 2800 MW.

2.The maximum available power is around 2950MW, and almost as much as the installed capacity of large HPPs (Not including small HPPs).

3.The average power available for the period under examination amounts to 2868 MW.

4.The actual available power, declared for the indicated time at 61% of the time than the average volume of 2868MW and only 39% of the time just short ie just 2.3% of the average.

CONCLUSIONS – COMMENTARY

- **The above document effortlessly that the available power of HPPs is always more than 2800 MW, and the average annual power available is superior (2868 MW).**

- **The reliability of HPP on the availability of Hydro Units exceeds 93%.**

- **The Hydro Units have rapid response in order to take cargo and flexibility to meet the system requirements.**

- **For all these endeavors impairment capacity availability of HPPs of said technically unsubstantiated and unjust offset the contribution of HPPs in the National Interconnected System.**

Thank you!