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HYDROELECTRIC POWER PLANTS of PPC S.A. in GREECE

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A

GENERAL INFORMATION FOR HPP's of PPC SA

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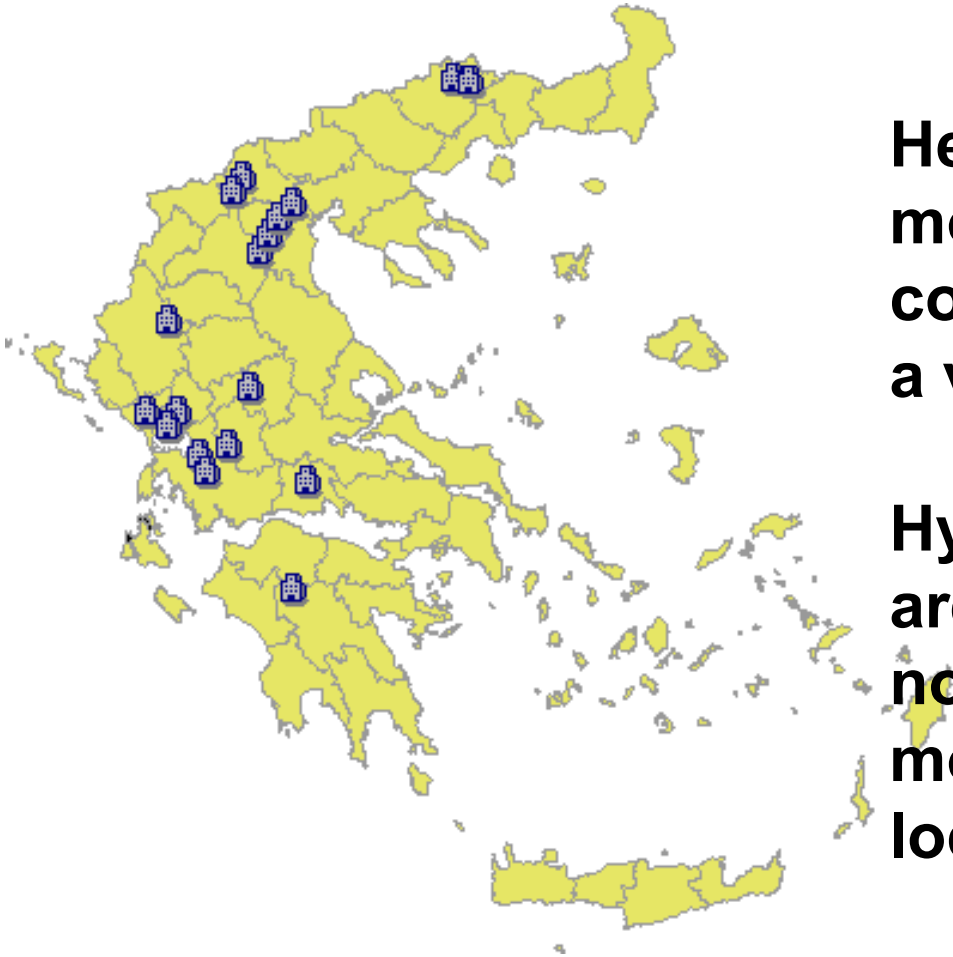
HPPs location

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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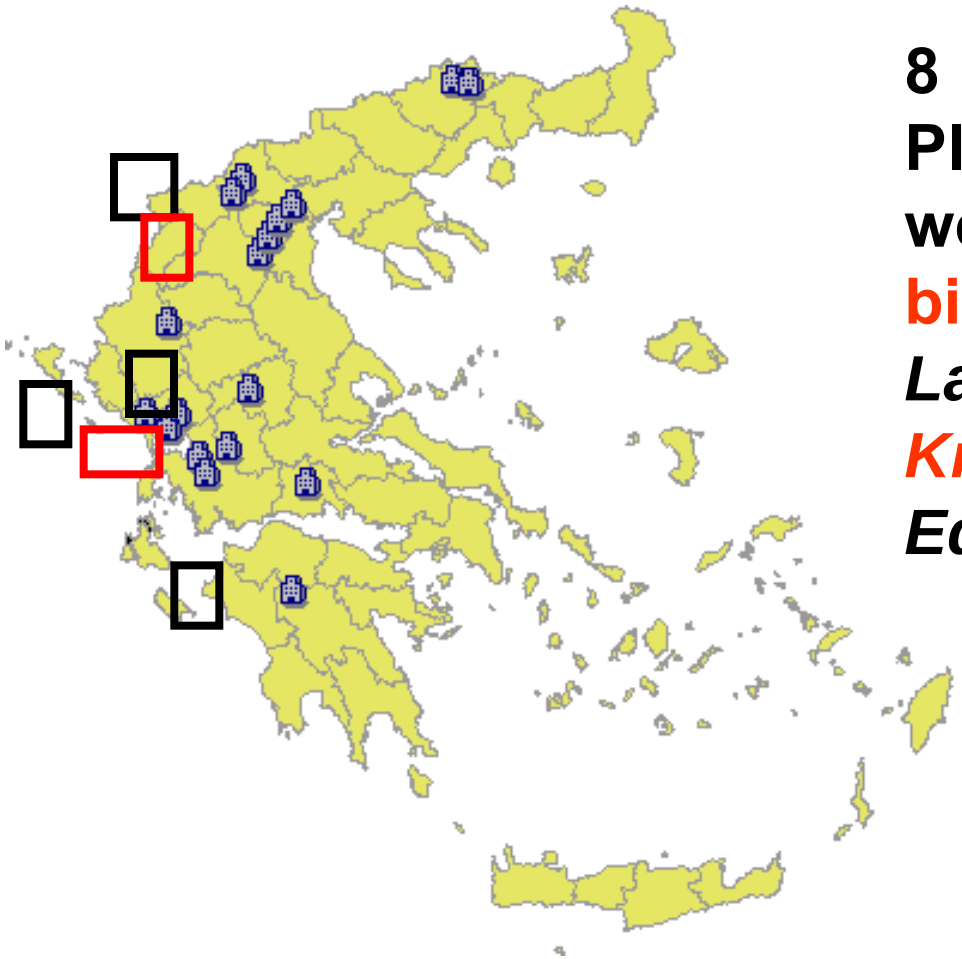
1950-1975



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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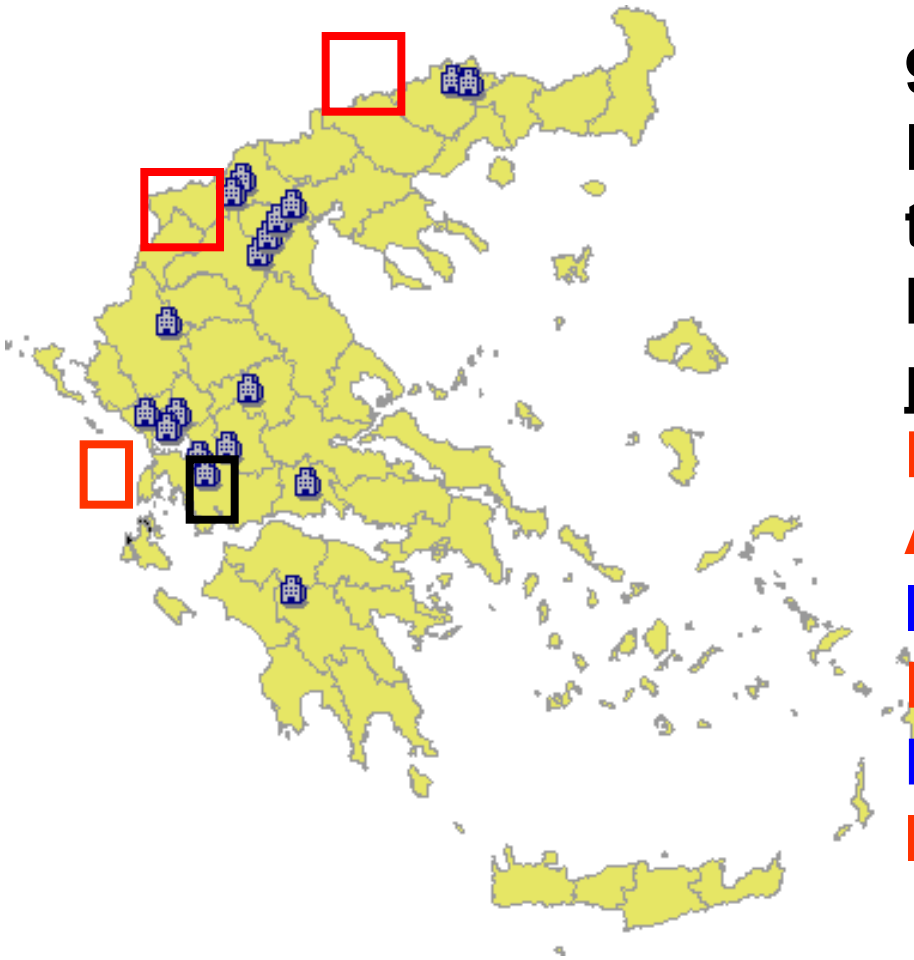
1976 up to date



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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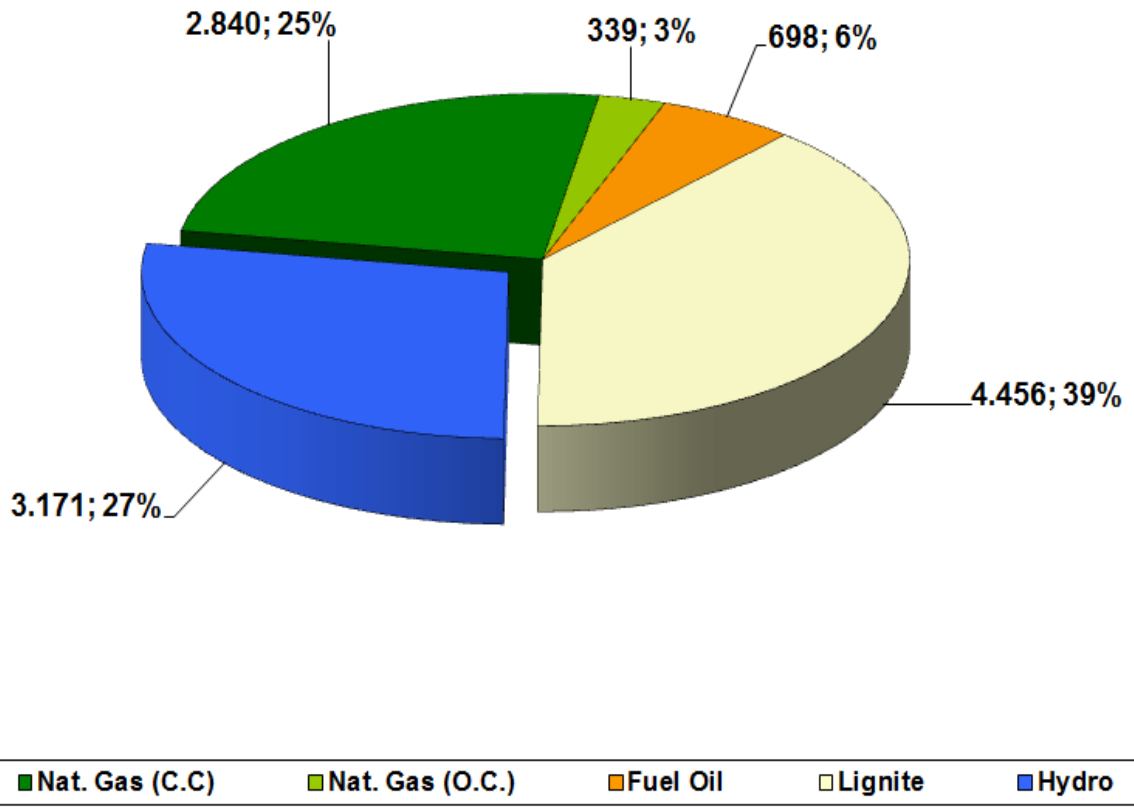
Installed Capacity by type of fuel

YEAR 2015: 11.216 MW [source: ADMIE]



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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

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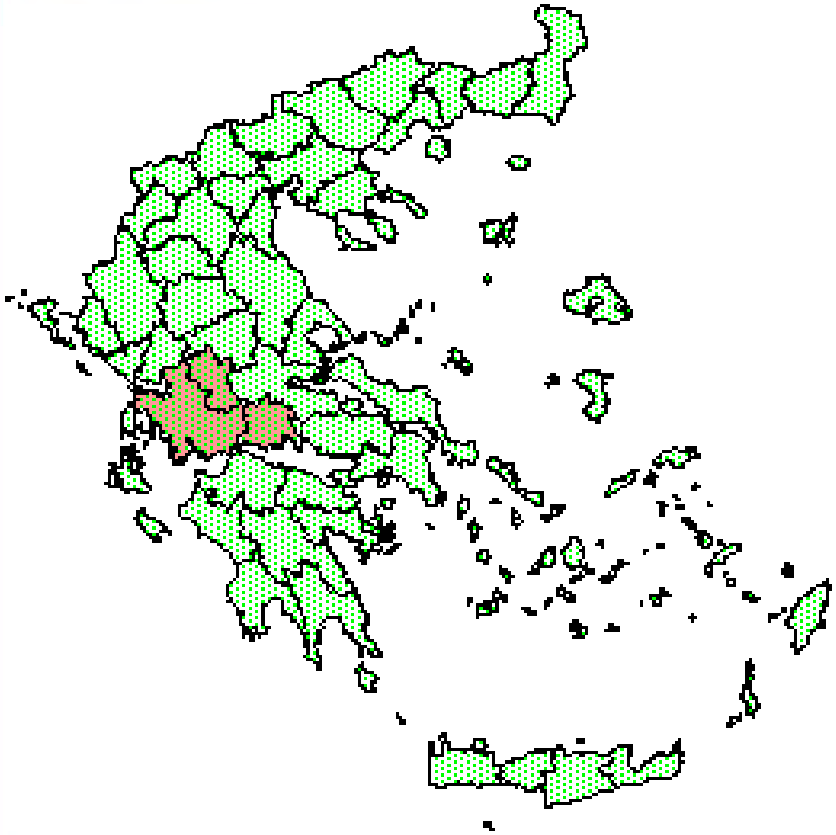

Acheloos r. Hydroelectric Scheme in Western Greece

[Western Continental territory]

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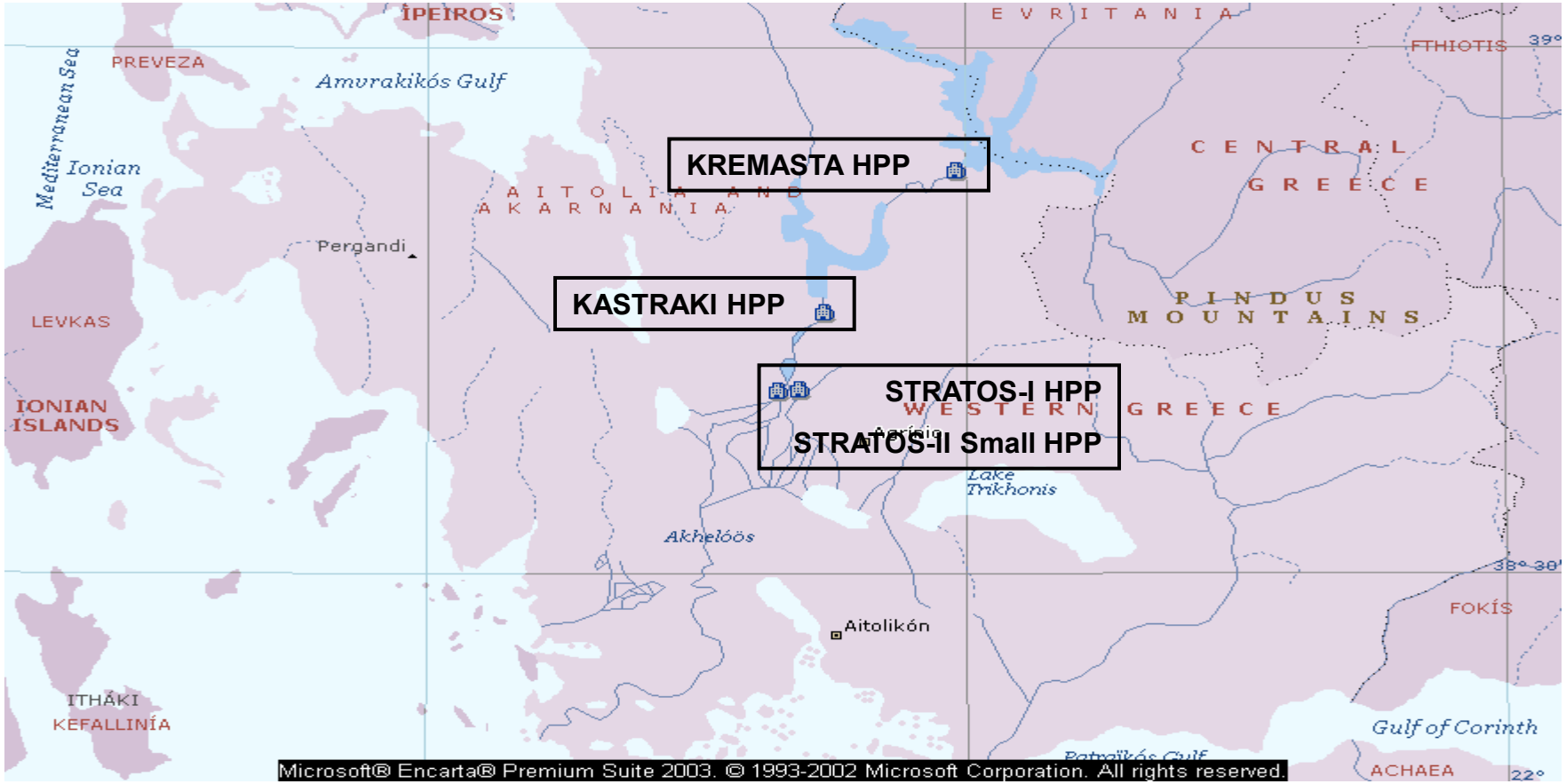
Acheloos Hydroelectric Scheme



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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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It is the largest Hellenic Hydroelectric Power Plant

Acheloos Hydroelectric Scheme
Kremasta HPP

Location: West. Cont. Greece, Aetoloakarnania prefecture
Purpose: hydropower, flood control
Commercial operat.: 1966
Installed power: 437,2 MW (4x109,3)
Francis type turbines
Mean an. Product.: 848 GWH
Dam: earthfill, 165 m height
Reserv. net cap.: 3300 m.c.m.

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Acheloos Hydroelectric Scheme
Kastraki HPP

Location: West. Cont. Greece,
Aetoloakarnania
prefecture
Purpose: hydropower,
irrigation,
water supply
Commercial operat.: 1969
Installed power: 320 MW
(4x80)
Francis type turbines
Mean an. Product.: 598 GWH
Dam: earthfill, 96 m height
Reserv. net cap.: 53 m.c.m.

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Acheloos Hydroelectric Scheme
Stratos-I HPP &
Stratos-II small HPP

Location: West. Cont. Greece,
Aetoloakarnania pref.
Purpose: hydropower,
irrigation
Commercial operat.: 1989
Installed power: 150 MW
Francis type turb.
6,2 MW
Tube-S type turb.
Mean an. Product.: 237 GWH
Dam: earthfill, 26 m height
Reserv. net cap.: 11 m.c.m.

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Acheloos Hydroelectric Scheme
Glafkos small HPP

Location: Northwest Peloponnese,
Achaea prefecture
Purpose: hydropower,
irrigation,
water supply
Commercial operat.: 1926
Installed power: 3,7 MW
(2x1,4) Pelton &
(1x2,29) Francis type turb.
Mean an. Product.: 11,4 GWH

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Acheloos Hydroelectric Scheme
Ghiona small HPP

Location: East Continental Greece,
Fokis prefecture
Purpose: hydropower,
water supply
Commercial operat.: 1988
Installed power: 8,5 MW
(1x8,5) Francis type turbines
Mean an. Product.: 40 GWH

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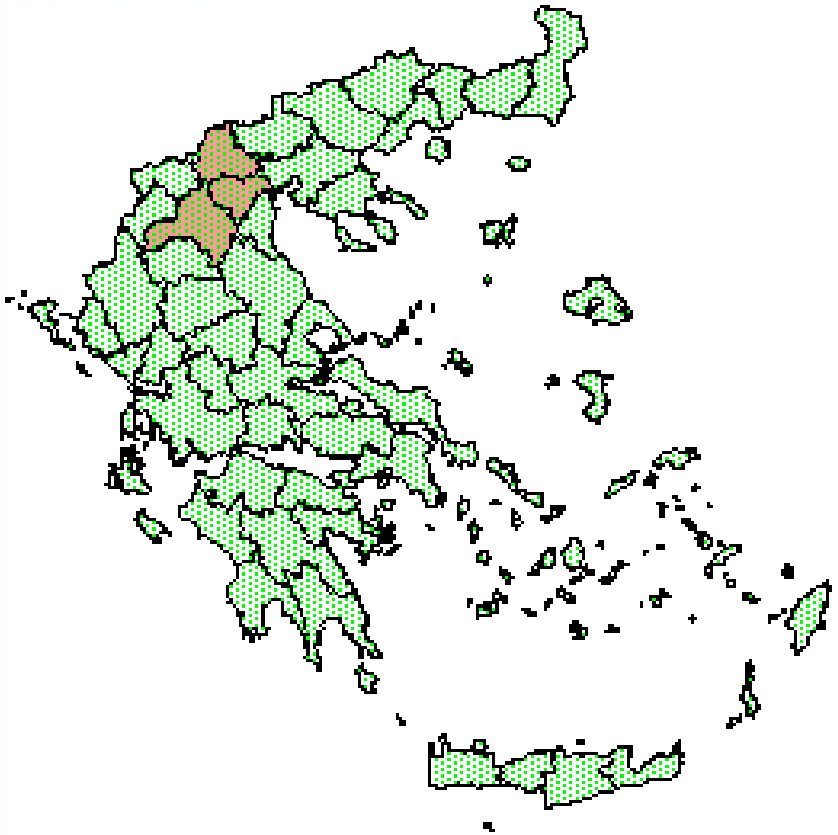

Aliakmon r. Hydroelectric Scheme in Northern Greece

[Western/Central Macedonia territory]

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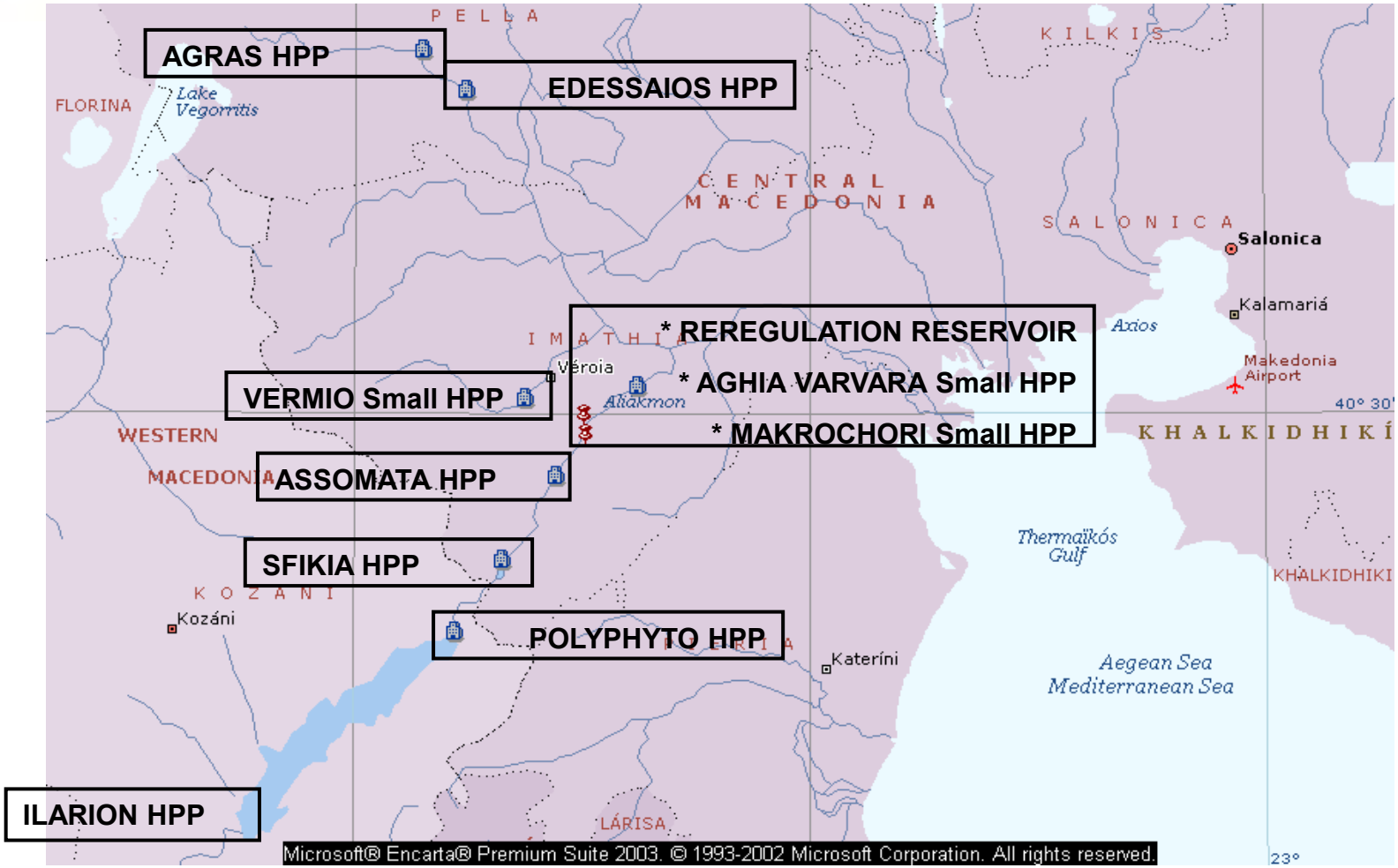
Aliakmon Hydroelectric Scheme



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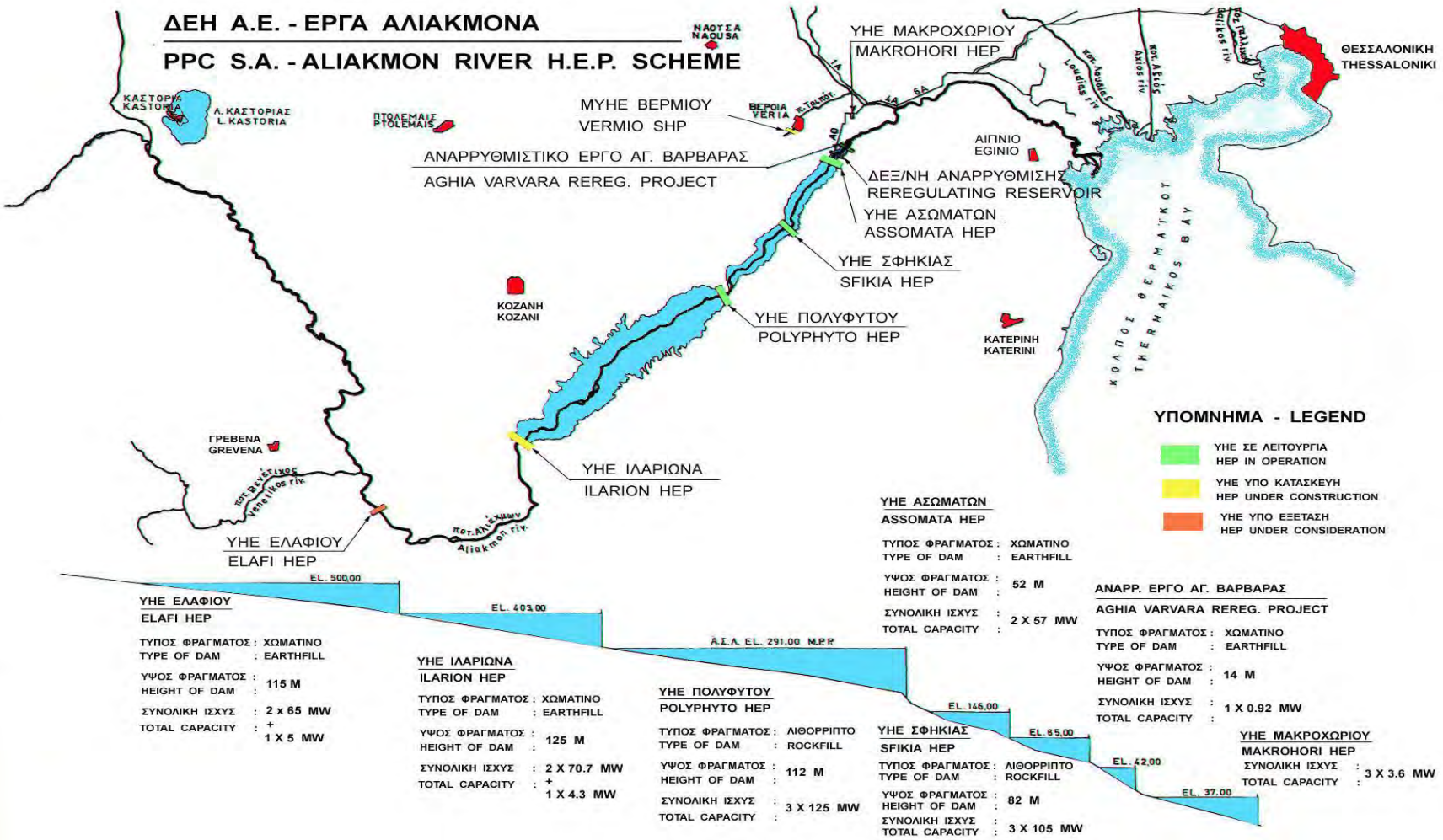
HPP in Aliakmon river (General Layout)



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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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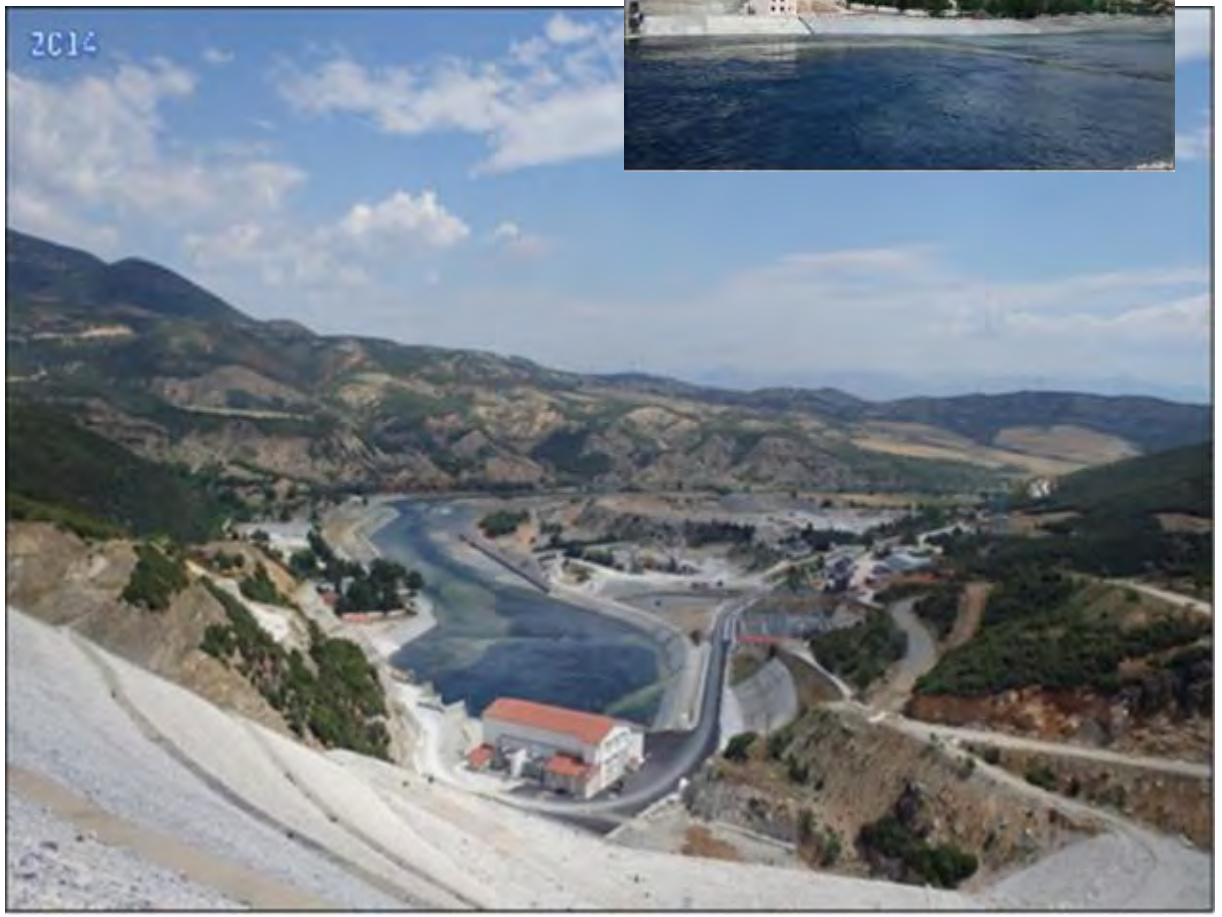
Aliakmon r. Hydroelectric Scheme
Ilarion HPP

Location: Western Macedonia,
Kozani prefecture
Purpose: hydropower,
irrigation,
water supply
Commercial operat.: 2014
Installed power: 153 MW
(2x76,5)
Francis type turbines
Mean an. Product.: 320 GWH
Dam: rockfill, 130 m height
Reserv. net cap.: 270 m.c.m.

Energy for everyone

Aliakmon r. Hydroelectric Scheme
Ilarion Small HPP

Location: Western Macedonia,
Kozani prefecture
Purpose: hydropower
Commercial operat.: 2015
Installed power: 4,2 MW
Francis type turbines
Mean an. Product.: 9 GWH



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Aliakmon Hydroelectric Scheme
Polyphyto HPP

Location: Western Macedonia,
Kozani prefecture
Purpose: hydropower,
irrigation,
water supply,
flood control
Commercial operat.: 1974/75
Installed power: 375 MW
(3x125)
Francis type turbines
Mean an. Product.: 420 GWH
Dam: rockfill, 112 m height
Reserv. net cap.: 1220 m.c.m.

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Aliakmon Hydroelectric Scheme
Sfikia HPP (pump-storage)

Location: Central Macedonia, Imathia prefecture
Purpose: hydropower
Commercial operat.: 1985/86
Installed power: 315 MW (3x105)
Francis type pumb turbines
Mean an. Product.: 380 GWH (incl. 200 GWH due to pumping)
Dam: earthfill, 82 m height
Reserv. net cap.: 18 m.c.m.

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Aliakmon Hydroelectric Scheme
Assomata HPP

Location: Central Macedonia, Imathia prefecture
Purpose: hydropower, irrigation
Commercial operat.: 1985
Installed power: 108 MW (2x54)
Francis type turbines
Mean an. Product.: 130 GWH
Dam: earthfill, 52 m height
Reserv. net cap.: 10 m.c.m.

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Aliakmon Hydroelectric Scheme

Reregulation Reservoir & New Reregulation Aghia Varvara Small HPP

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Aliakmon Hydroelectric Scheme
Makrochori small HPP

Location: Central Macedonia,
Imathia prefecture
Purpose: hydropower,
irrigation,
water supply
Commercial operat.: 1992
Installed power: 10,8 MW
(3x3,6)
Caplan tubular S type turb.
Mean an. Product.: 30 GWH

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Aliakmon Hydroelectric Scheme
Vermio small HPP

Location: Central Macedonia,
Imathia prefecture
Purpose: hydropower,
water supply
Commercial operat.: 1936
Installed power: 1,5 MW
(2x0,75)
Francis type turb.
Mean an. Product.: 6 GWH

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Aliakmon Hydroelectric Scheme
Agras HPP

Location: Central Macedonia,
Pella prefecture
Purpose: hydropower,
irrigation,
water supply
Commercial operat.: 1954
Installed power: 50 MW
(2x25)
Francis type turb.
Mean an. Product.: 35 GWH

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Aliakmon Hydroelectric Scheme
Edessaios HPP

Location: Central Macedonia,
Pella prefecture
Purpose: hydropower,
irrigation,
water supply
Commercial operat.: 1970
Installed power: 19 MW
(1x19)
Francis type turb.
Mean an. Product.: 25 GWH

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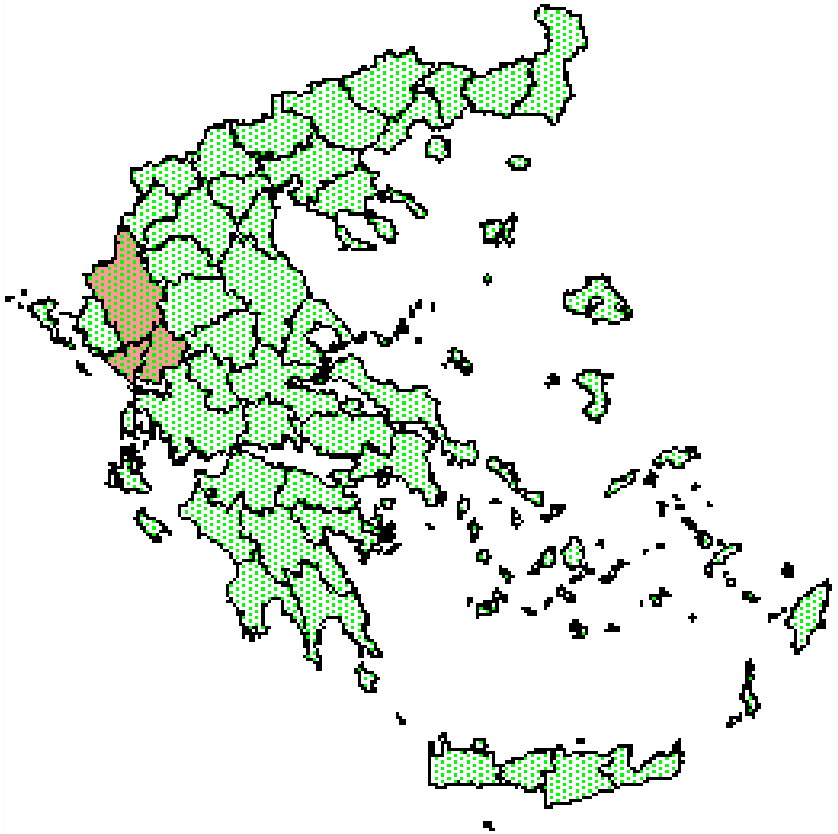

Arachthos r. Hydroelectric Scheme in Northwestern Greece

[Epirus territory]

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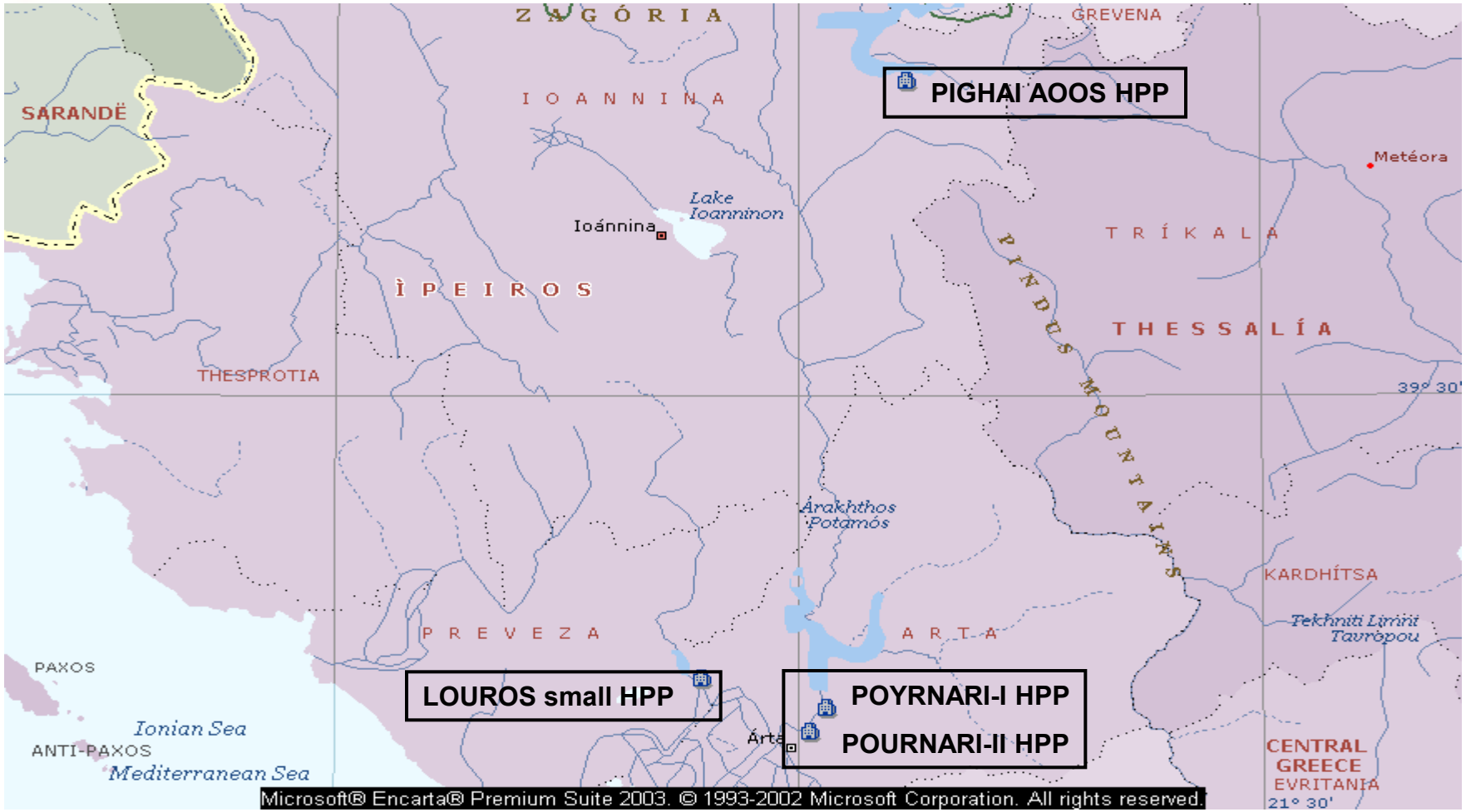
Arachthos Hydroelectric Scheme



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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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Arachthos Hydroelectric Scheme
Pigai Aoos HPP

Location: Epirus,
loannina prefecture
Purpose: hydropower
Commercial operat.: 1990/1
Installed power: 210 MW
(2x105)
Pelton type turbines
Mean an. Product.: 165 GWH
Dam: earthfill, 78 m height
Reserv. net cap.: 144,3 m.c.m.

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It is the first hydro project fully planned & designed by the PPC's local staff

Arachthos Hydroelectric Scheme
Pournari-I HPP

Location: Epirus,
Arta prefecture
Purpose: hydropower,
irrigation,
flood control
Commercial operat.: 1981
Installed power: 300 MW
(3x100)
Francis type turbines
Mean an. Product.: 235 GWH
Dam: earthfill, 87 m height
Reserv. net cap.: 303 m.c.m.

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Arachthos Hydroelectric Scheme
Pournari-II HPP

Location: Epirus,
Arta prefecture
Purpose: hydropower,
irrigation
Commercial operat.: 1998/9
Installed power: 33,6 MW
(2x16) bulb &
(1x1,6) S units
Mean an. Product.: 45 GWH
Dam: earthfill, 15 m height
Reserv. net cap.: 4 m.c.m.

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Arachthos Hydroelectric Scheme
Louros small HPP

Location: Epirus,
Preveza prefecture
Purpose: hydropower,
irrigation
Commercial operat.: 1954
Installed power: 10,3 MW
(2x2,5) & (1x5,3)
Francis type turbines
Mean an. Product.: 50 GWH
Dam: concrete grav. arch, 22 m height
Reserv. net cap.: 0,37 m.c.m.

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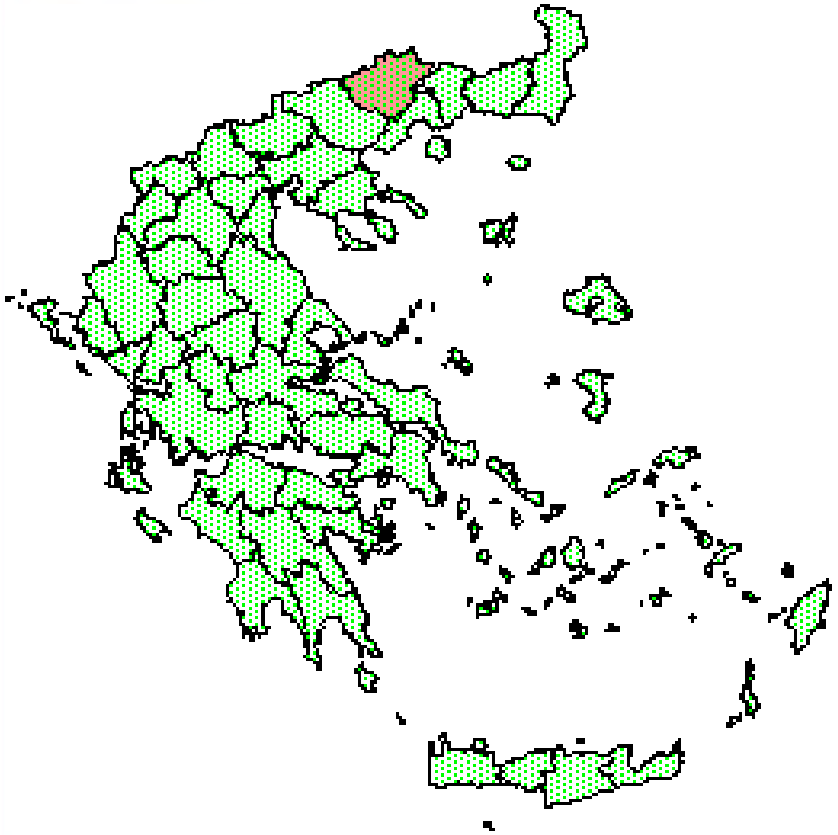

Nestos r. Hydroelectric Scheme in Northern Greece

(Eastern Macedonia territory)

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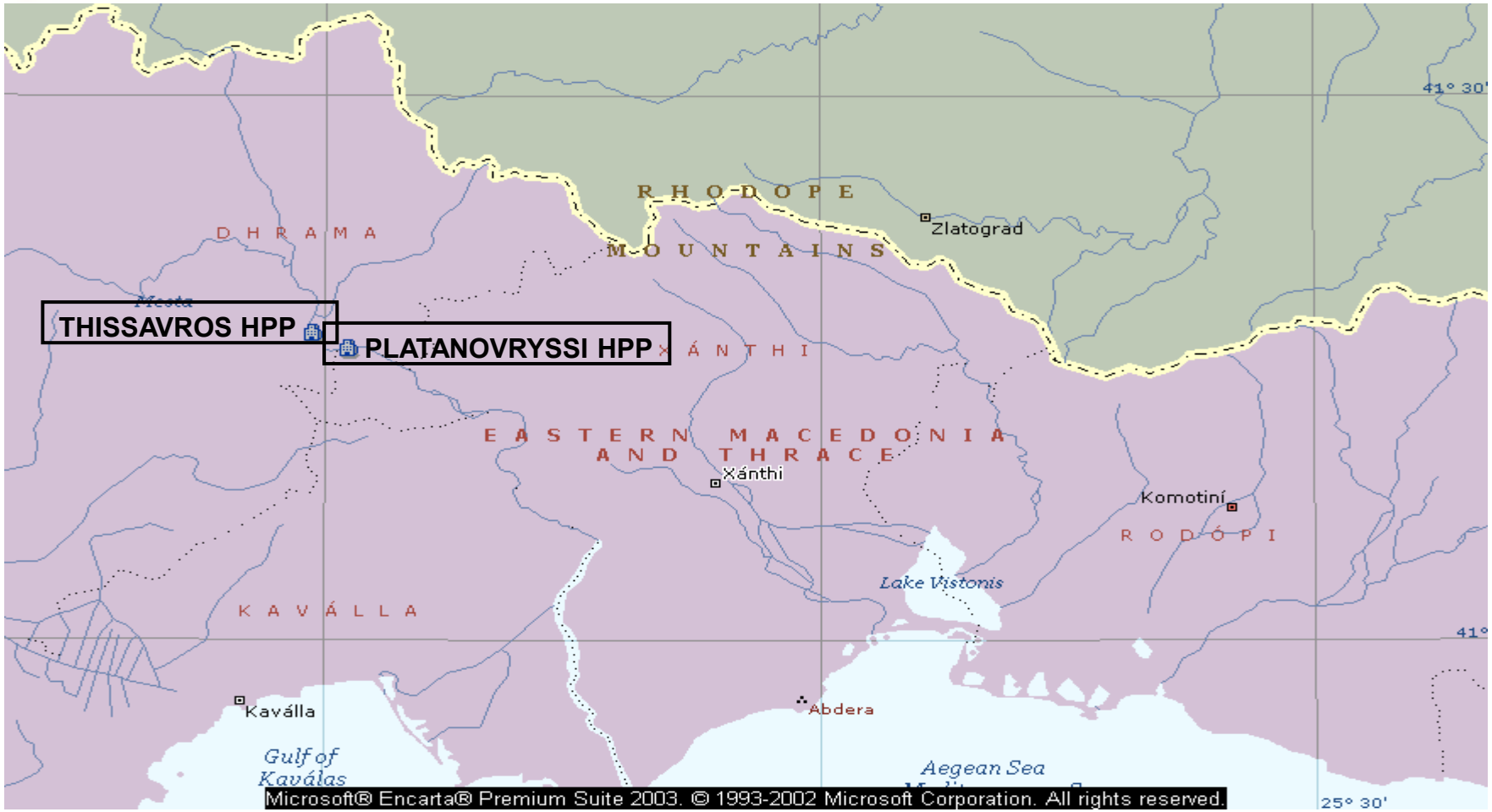
Nestos Hydroelectric Scheme



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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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Nestos Hydroelectric Scheme
Thissavros HPP (pump-storage)

Location: Eastern Macedonia, Drama prefecture
Purpose: hydropower, irrigation, flood control
Commercial operat.: 1998
Installed power: 384 MW (3x128)
Francis type pump turbines
Mean an. Product.: 440 GWH (incl. GWH due to pumping)
Dam: rockfill, 172 m height
Reserv. net cap.: 565 m.c.m.

Energy for everyone

It is the first RCC dam in the construction of which the fly ash of the Ptolemais thermal plant was utilized as basic cement, achieving thus big financial benefits & reducing the construction expenses

Nestos Hydroelectric Scheme
Platanovryssi HPP

Location: Eastern Macedonia, Drama prefecture
Purpose: hydropower, irrigation
Commercial operat.: 1999
Installed power: 116 MW (2x58)
Francis type turbines
Mean an. Product.: 240 GWH
Dam: Roller Compacted Concrete, 95 m height
Reserv. net cap.: 57 m.c.m.

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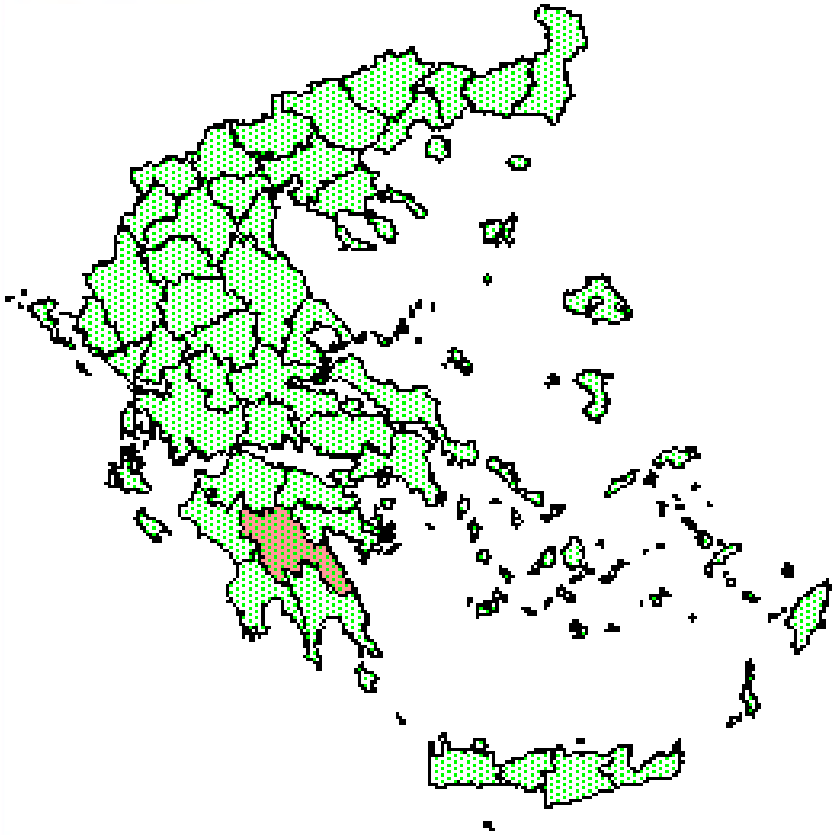

Ladon hydroelectric power plant in Southern Greece

[Peloponnese territory]

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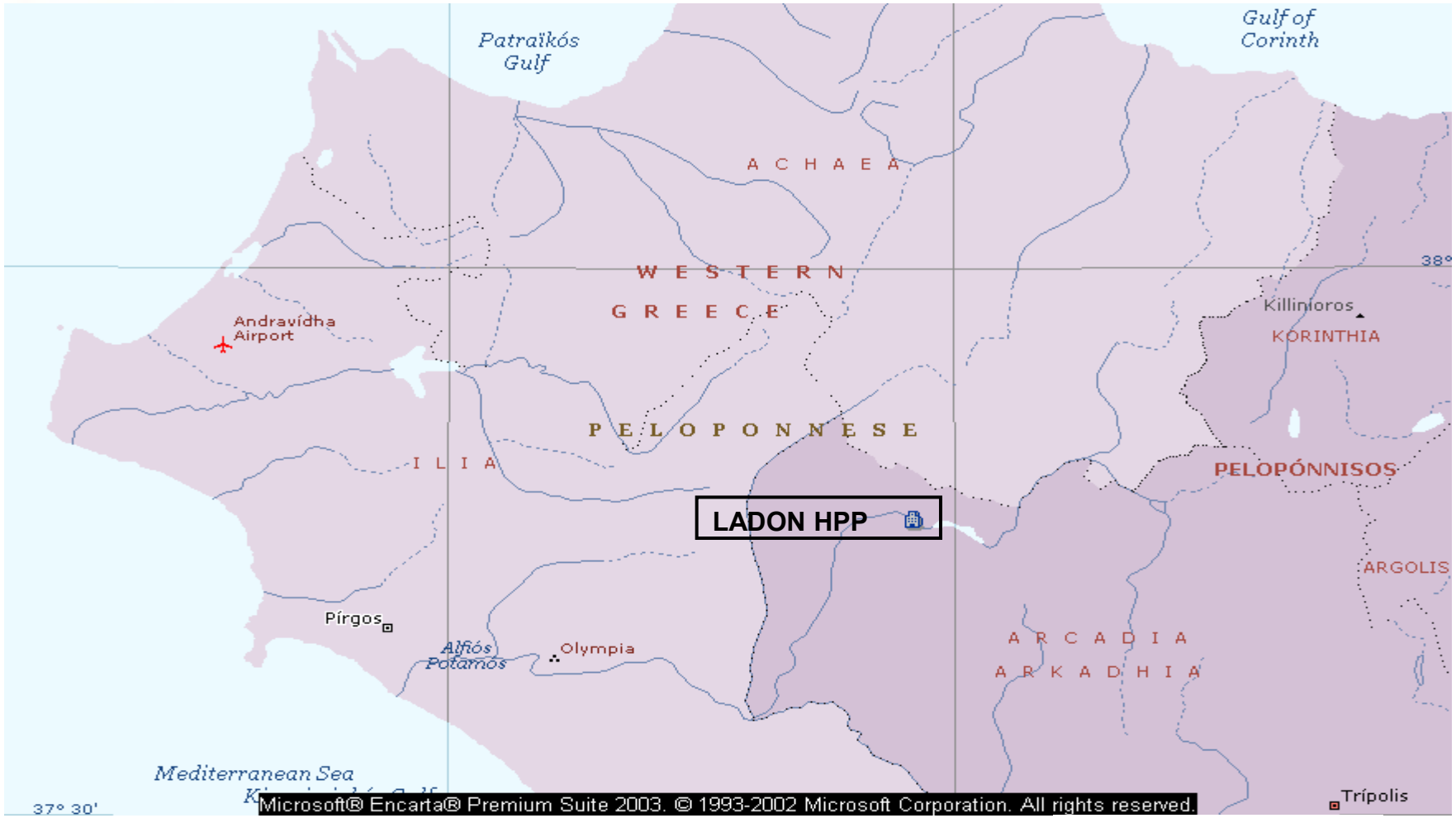
Ladon Hydroelectric Power Plant



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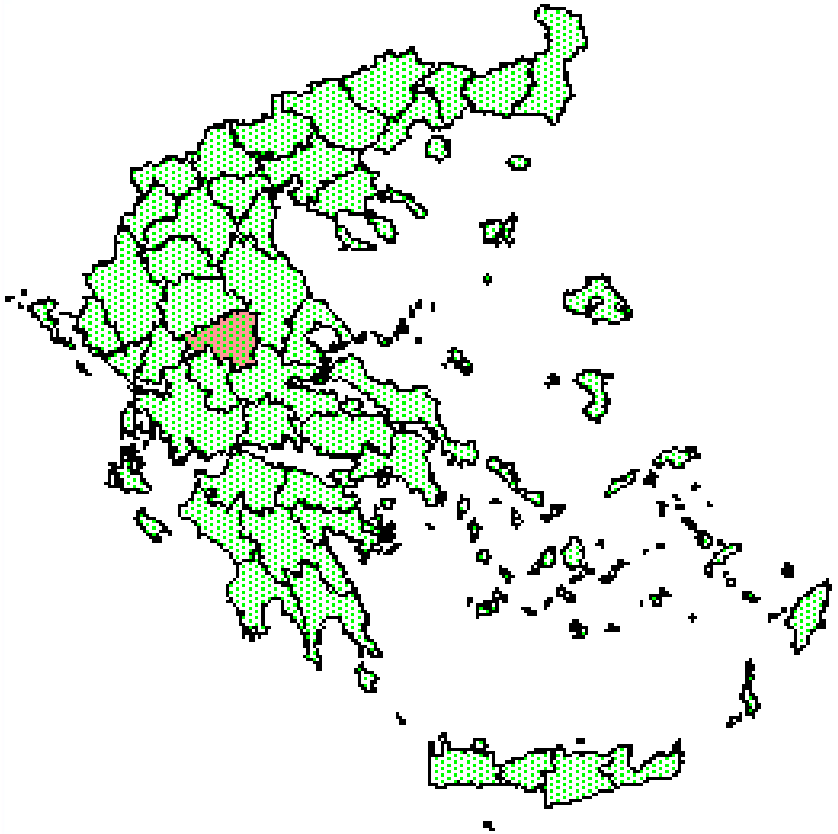
Ladon Hydroelectric Power Plant
(Ladon river)

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.

Energy for everyone

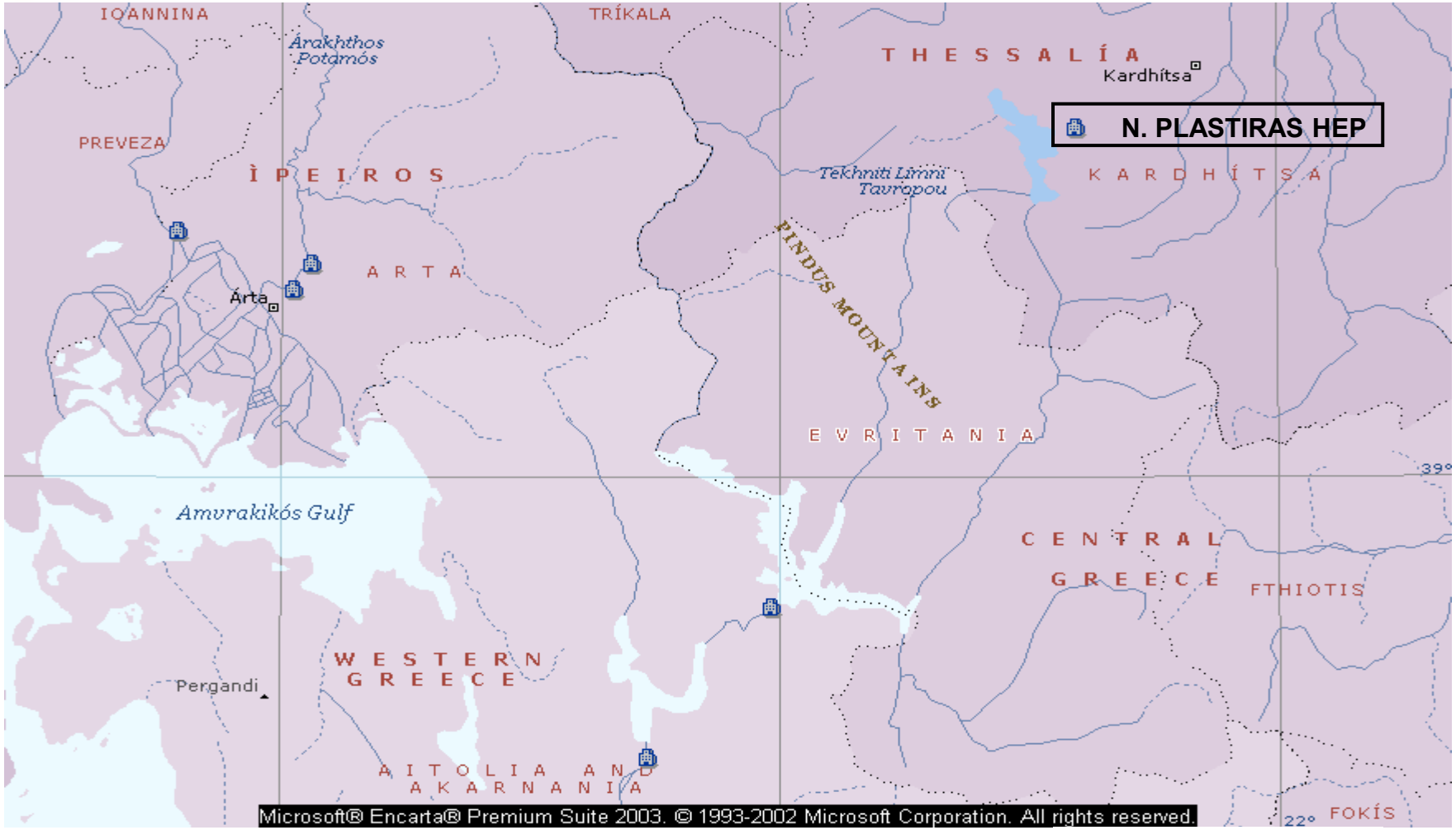


N. Plastiras hydroelectric plant in Central Greece

[Thessalia territory]

Energy for everyone

N. Plastiras Hydroelectric Power Plant



Energy for everyone

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.

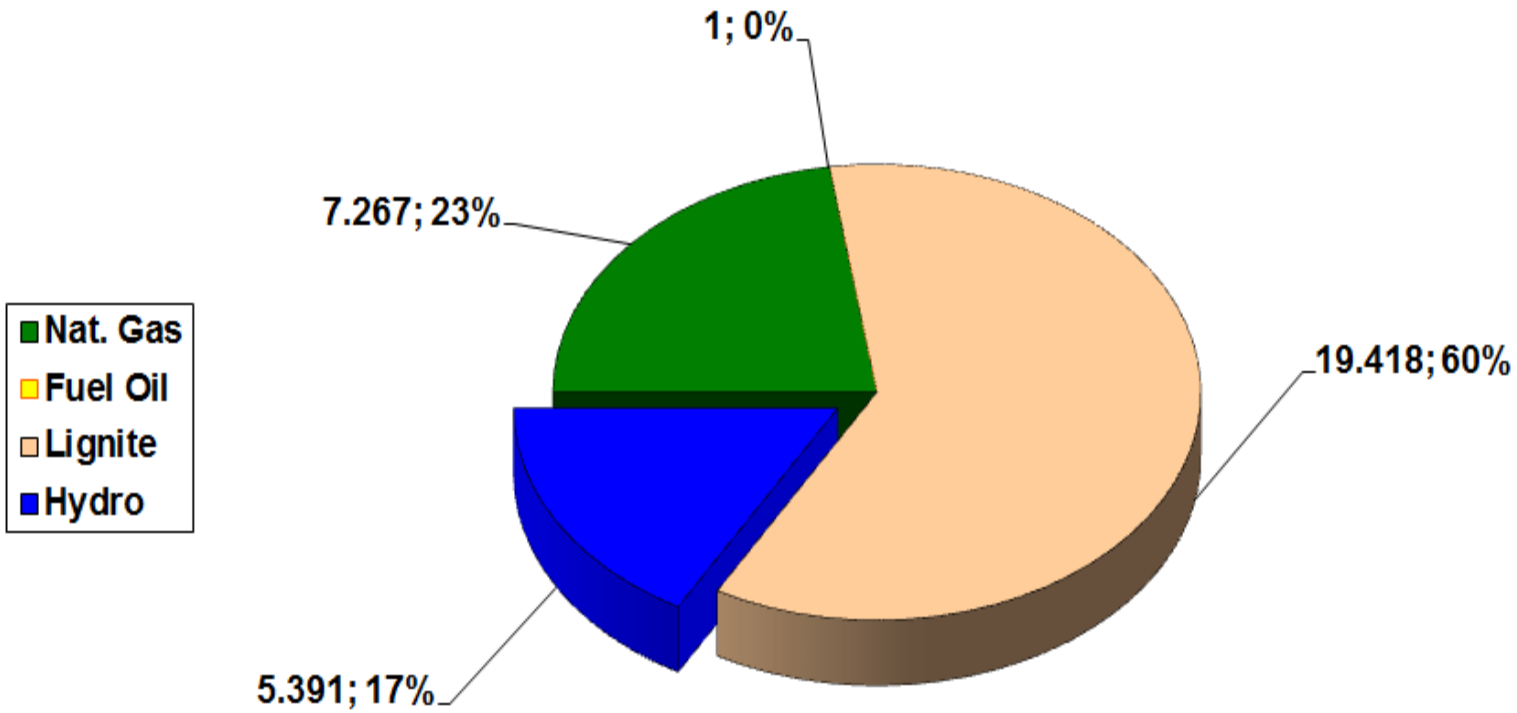
Energy for everyone

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

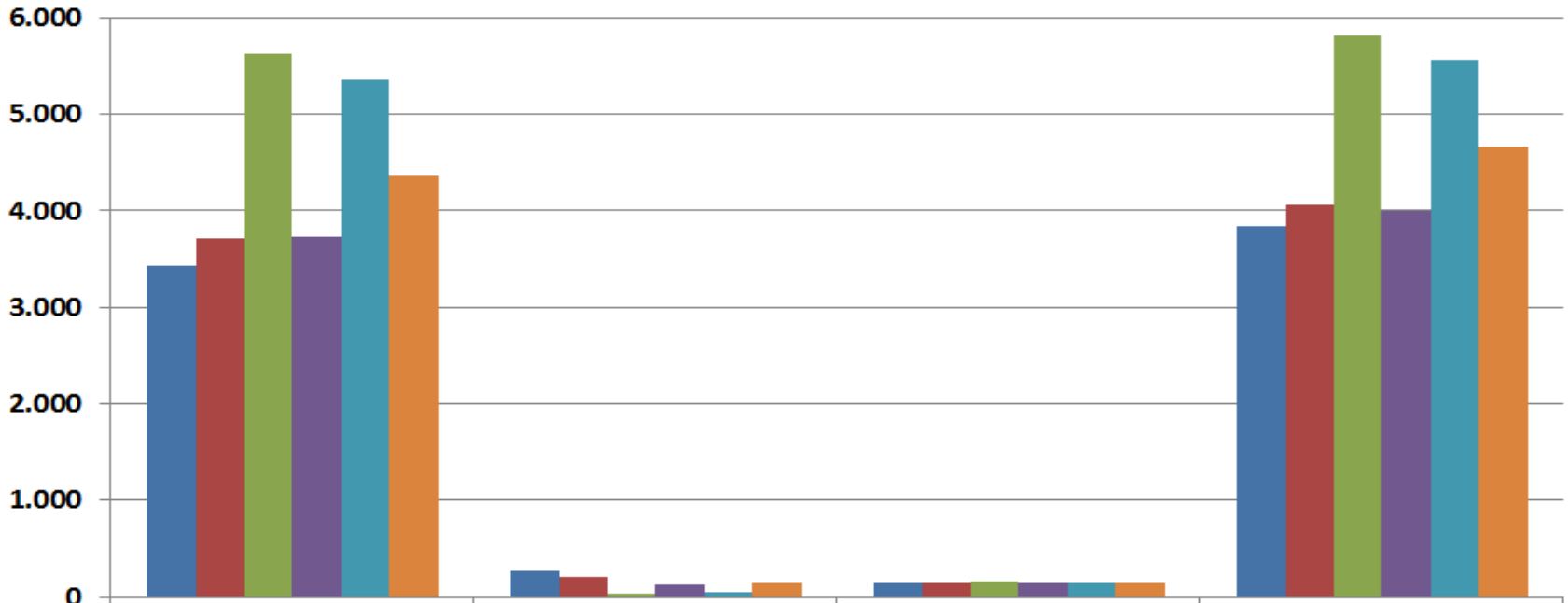
Energy for everyone

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



Energy for everyone

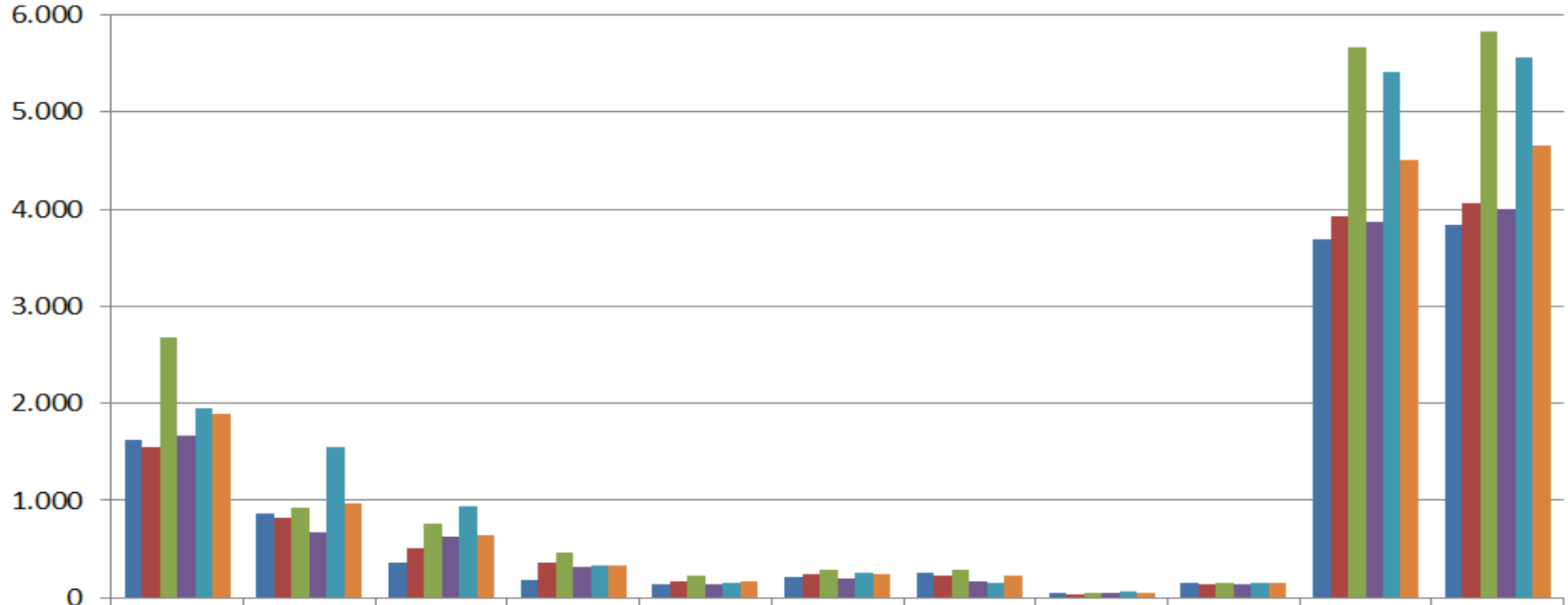
Annual Hydroelecric Energy Production (GWH)



	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

Energy for everyone

Annual Energy Production by River Hydroelectric Scheme (GWH)



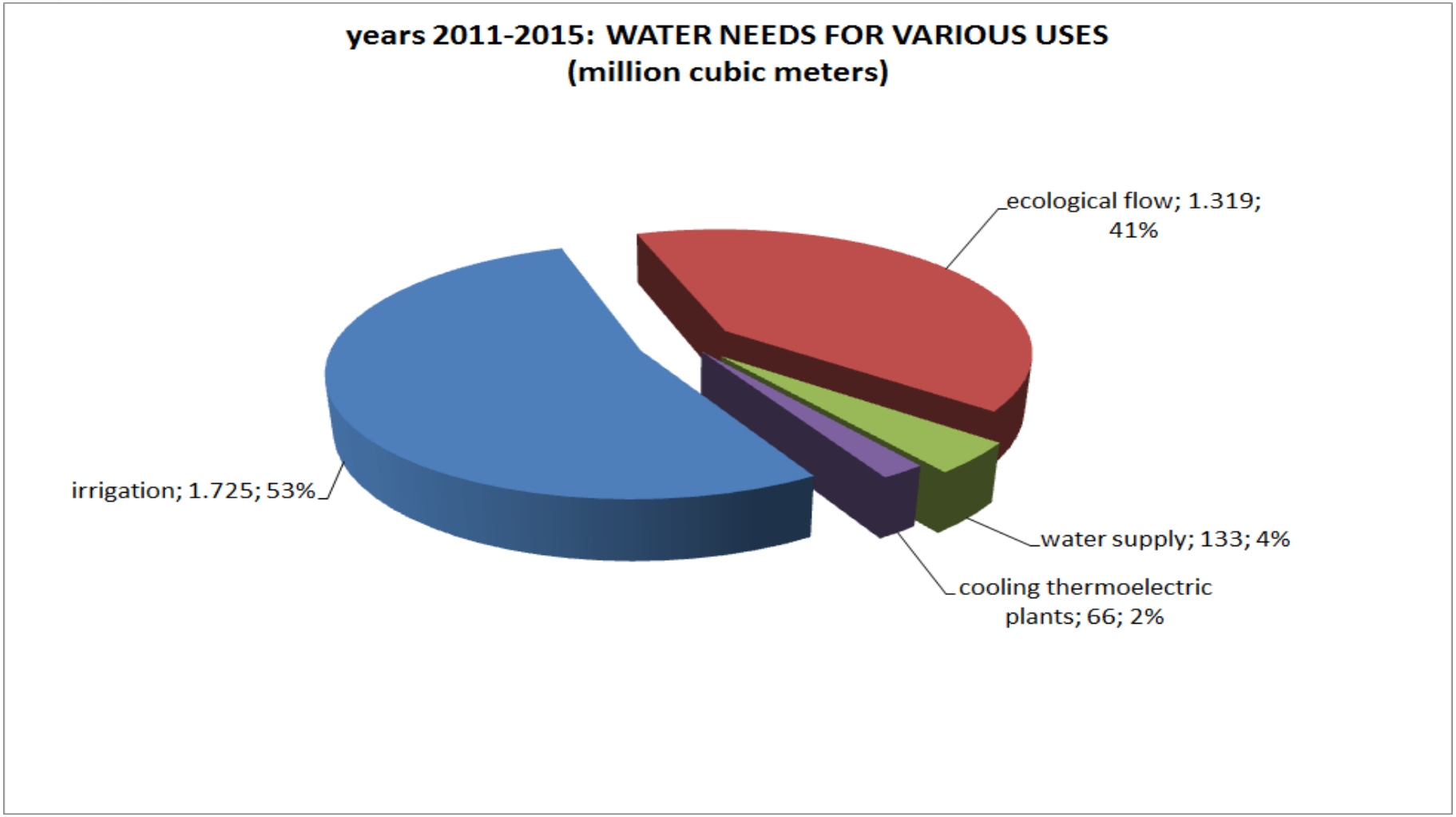
	Acheloos	Aliakmon	Nestos	Arachthos	Aoos	Ladon	Tavropos	Vodas	Small HPP	HPP	HPP+SHPP
2011	1.625	863	356	185	145	209	262	48	147	3.694	3.841
2012	1.551	816	514	360	170	240	231	40	144	3.921	4.065
2013	2.671	919	758	465	228	292	280	51	159	5.664	5.823
2014	1.673	676	628	311	145	203	175	49	138	3.860	3.998
2015	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

Energy for everyone

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, Arta, Agrinio, Karditsa, etc.)	133
Cooling PPC's Thermoelectric Plants	66
Ecological flow into the river beds	1.319
TOTAL	3.243

Energy for everyone



Energy for everyone

Snapshots of the PPC reservoirs

- Fishing lake
- Maritime sports, entertainment & sport facilities
- Lakeside livestock
- Scientific observation
- Recreation, refreshment, relaxation, pleasure

Energy for everyone

Acheloos Hydroelectric Scheme

Stratos HPP, maritime sports

Energy for everyone

Acheloos Hydroelectric Scheme

Stratos HPP, maritime sports

Energy for everyone

Aliakmon Hydroelectric Scheme

Polyphyto HPP, fishing lake

Energy for everyone

Aliakmon Hydroelectric Scheme

Polyphyto HPP, Entertainment & Sport facilities

Energy for everyone

Aliakmon Hydroelectric Scheme

Polyphyto HPP, entertainment & sport facilities

Energy for everyone

Aliakmon Hydroelectric Scheme

Agras-Edessaios HPP, fishing Nission Lake

Energy for everyone

Aliakmon Hydroelectric Scheme

Polyphyto HPP, lakeside livestock

Energy for everyone

PPC's NEW HYDROELECTRIC PROJECTS

Energy for everyone

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

Energy for everyone

B

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

Energy for everyone

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)

Energy for everyone

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

Energy for everyone

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**

Energy for everyone

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**

Energy for everyone

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

Energy for everyone

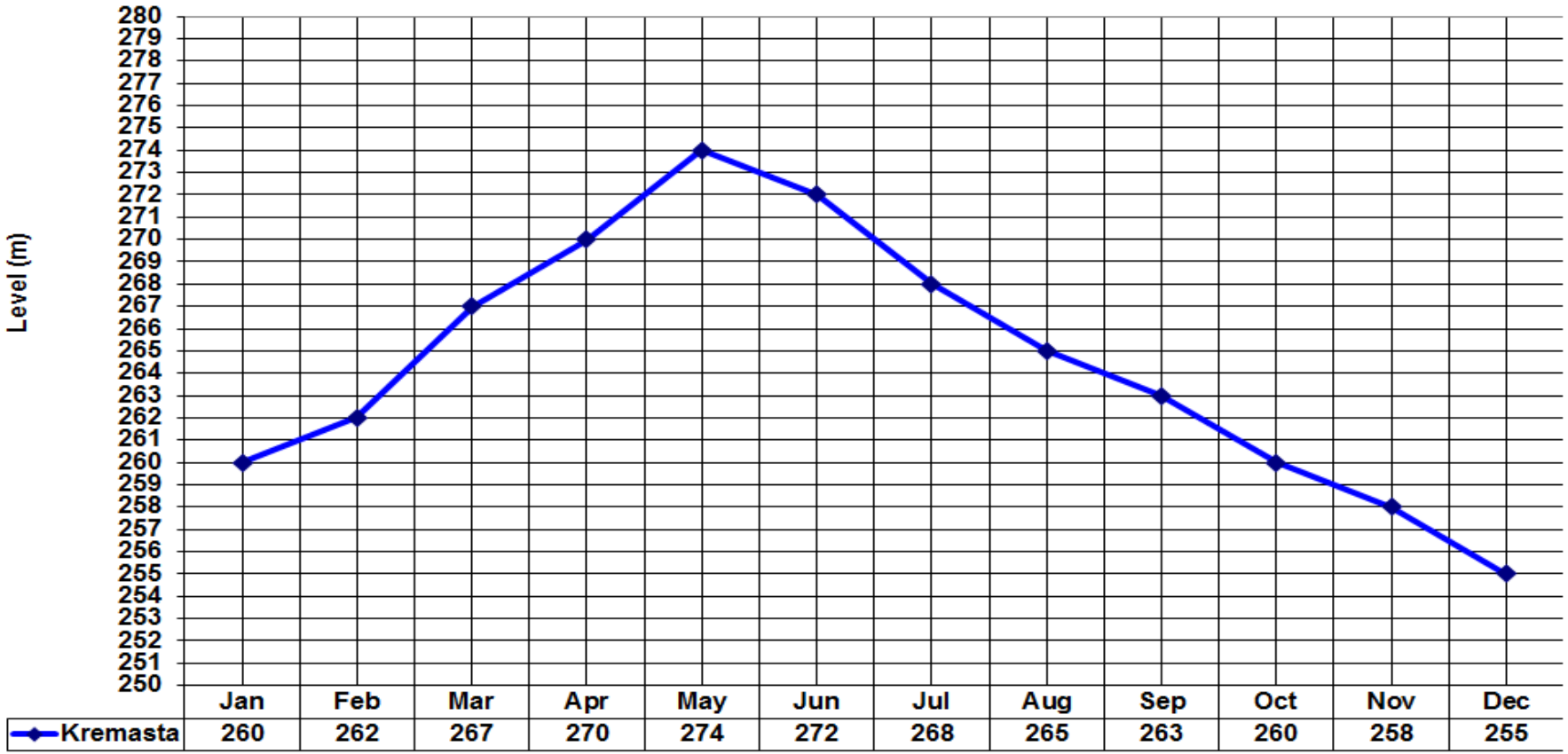
5. WATER MANAGEMENT

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**

Energy for everyone

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

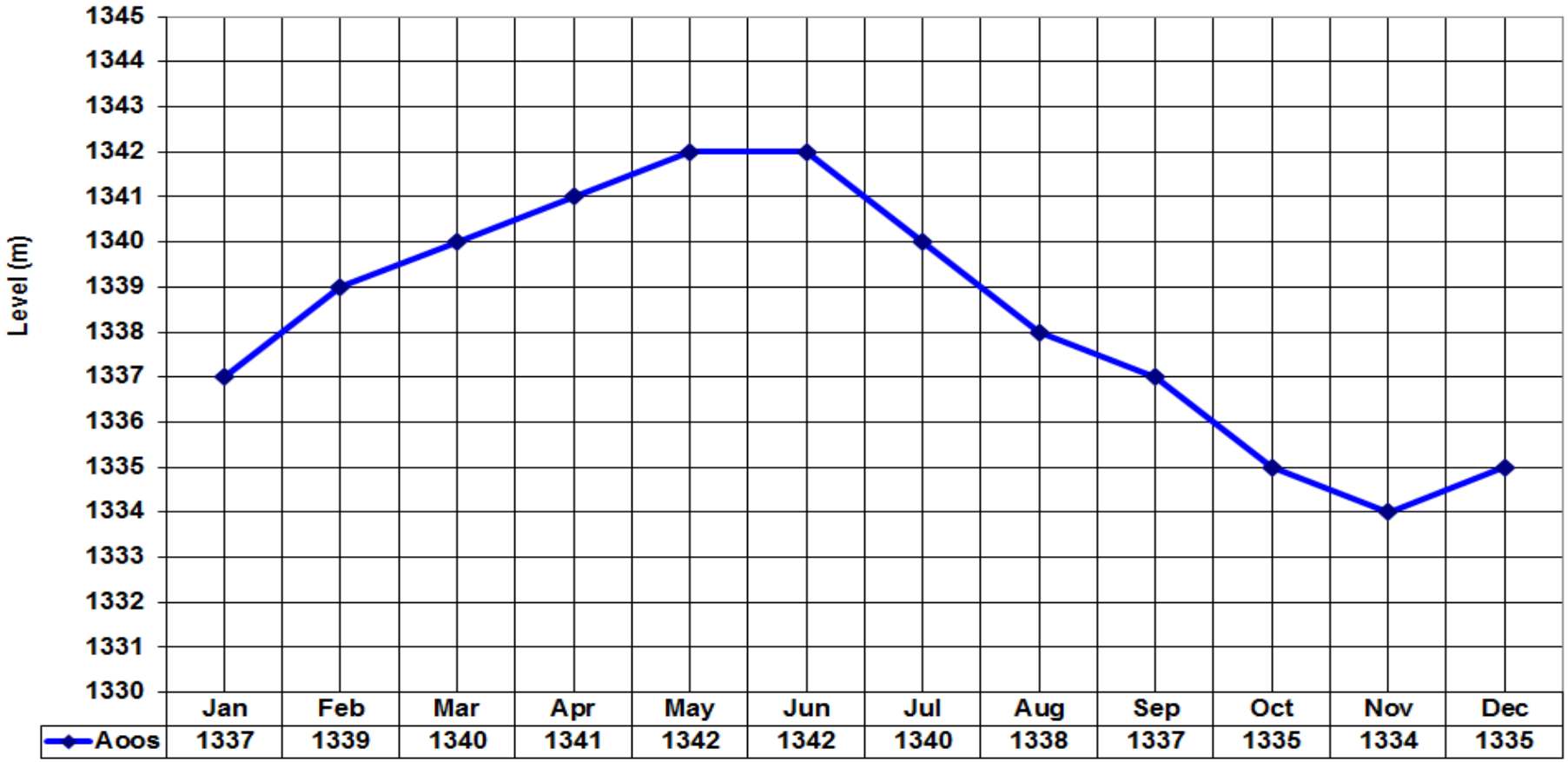
Energy for everyone

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

Energy for everyone

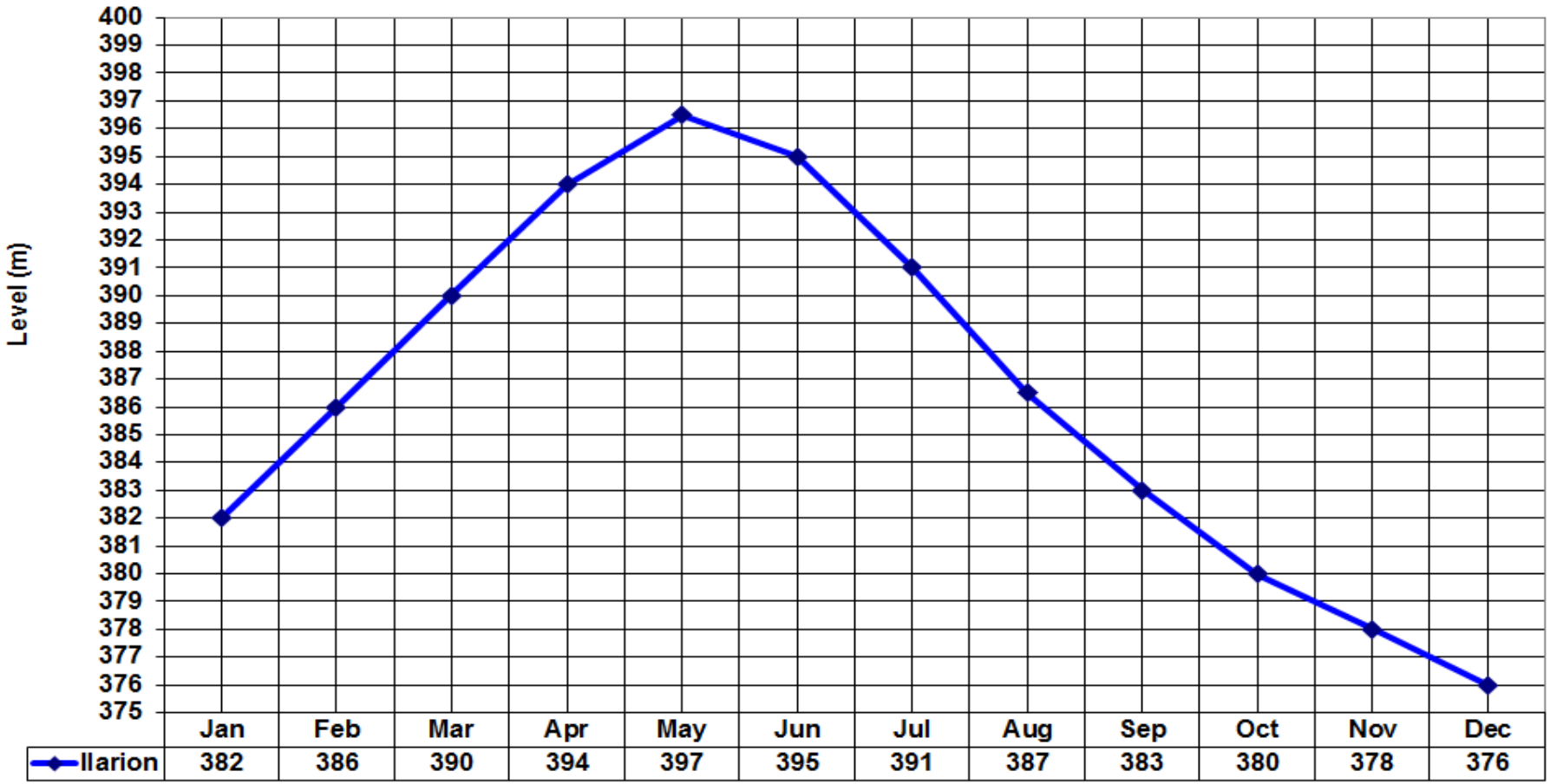
AOOS: Reservoir Level at the end of the month



	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

Energy for everyone

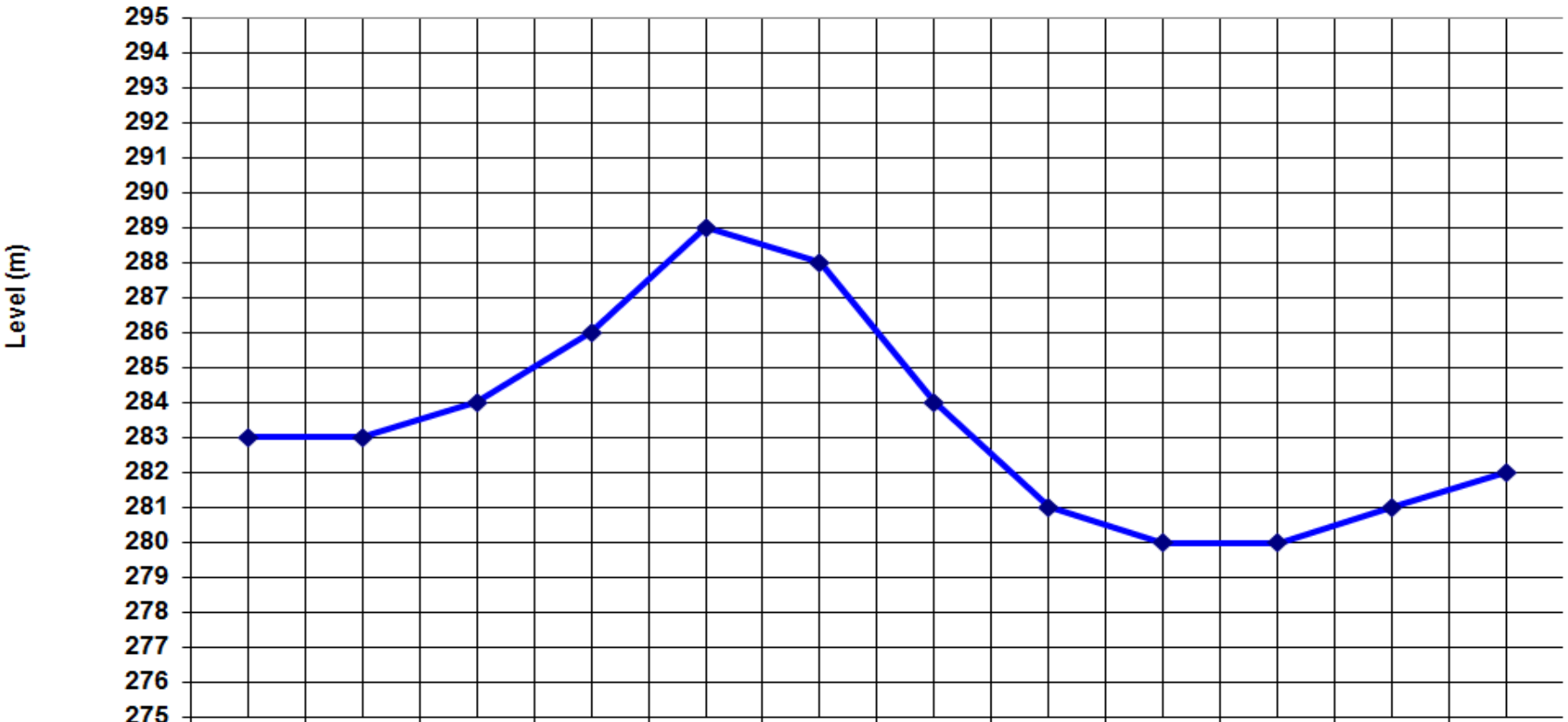
Ilarion: Reservoir Level at the end of the month



	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

Energy for everyone

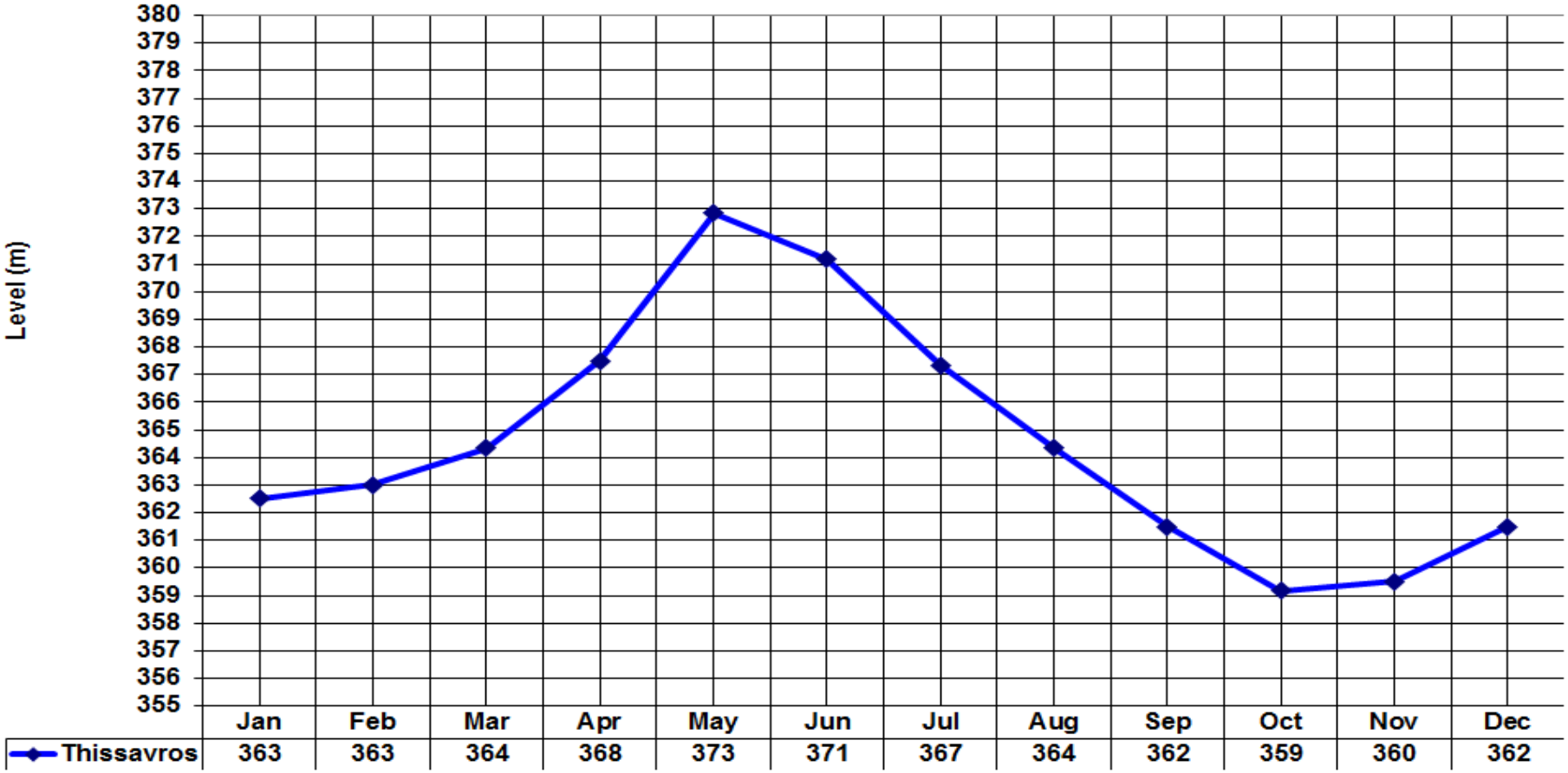
Polyphyto: Reservoir Level at the end of the month



	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

Energy for everyone

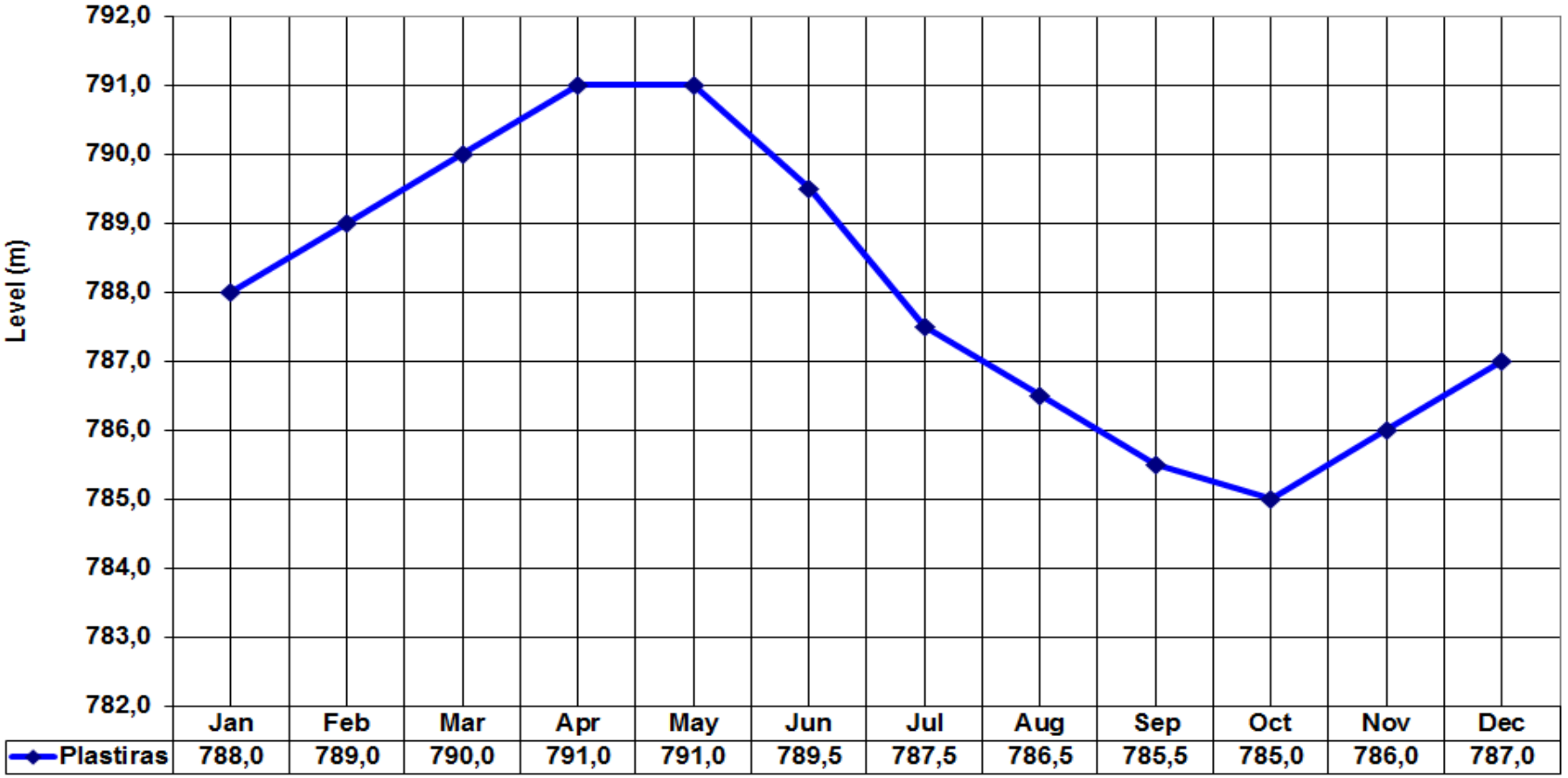
Thissavros: Reservoir Level at the end of the month



	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

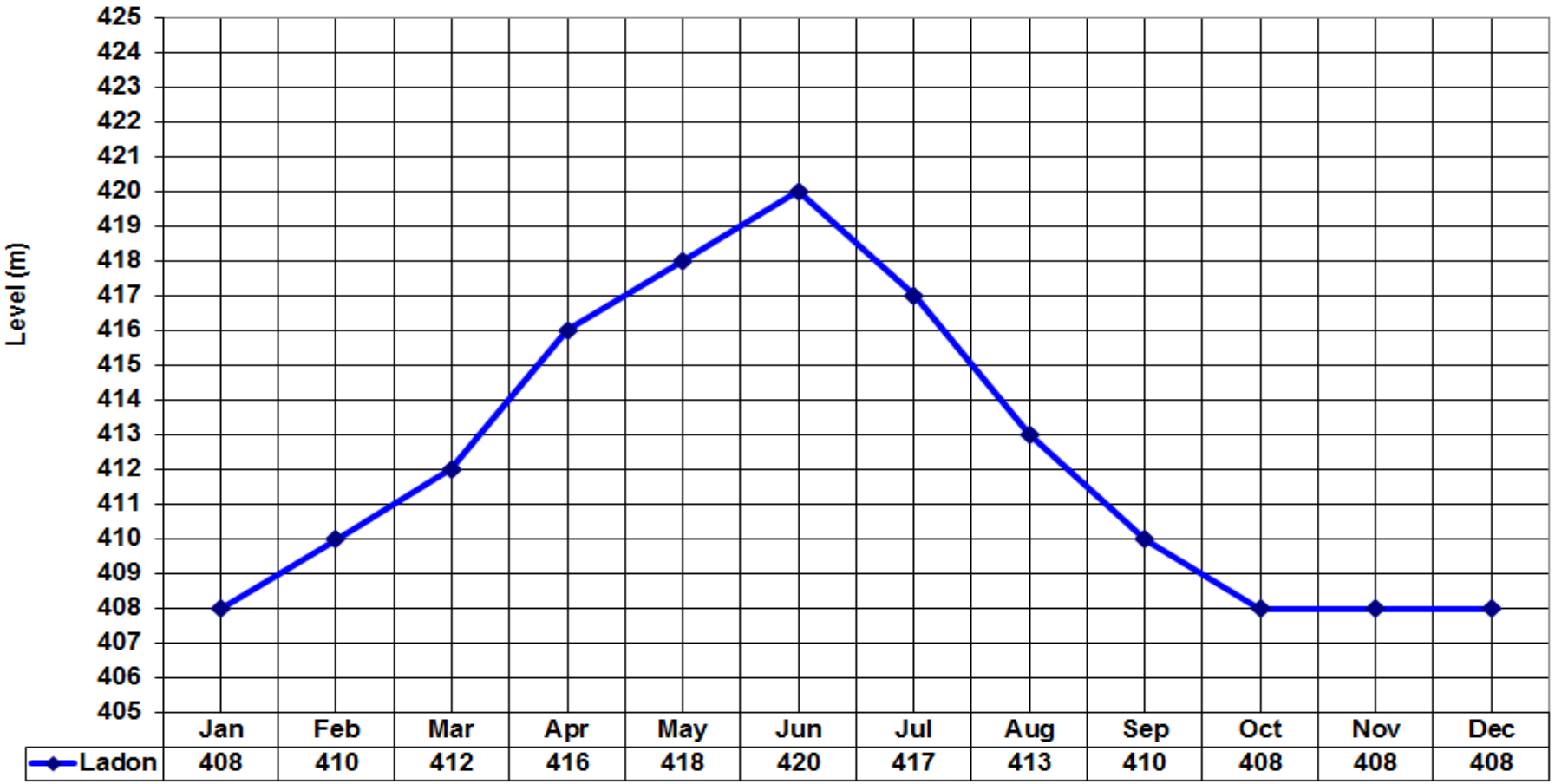
Plastiras: Reservoir Level at the end of the month



	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

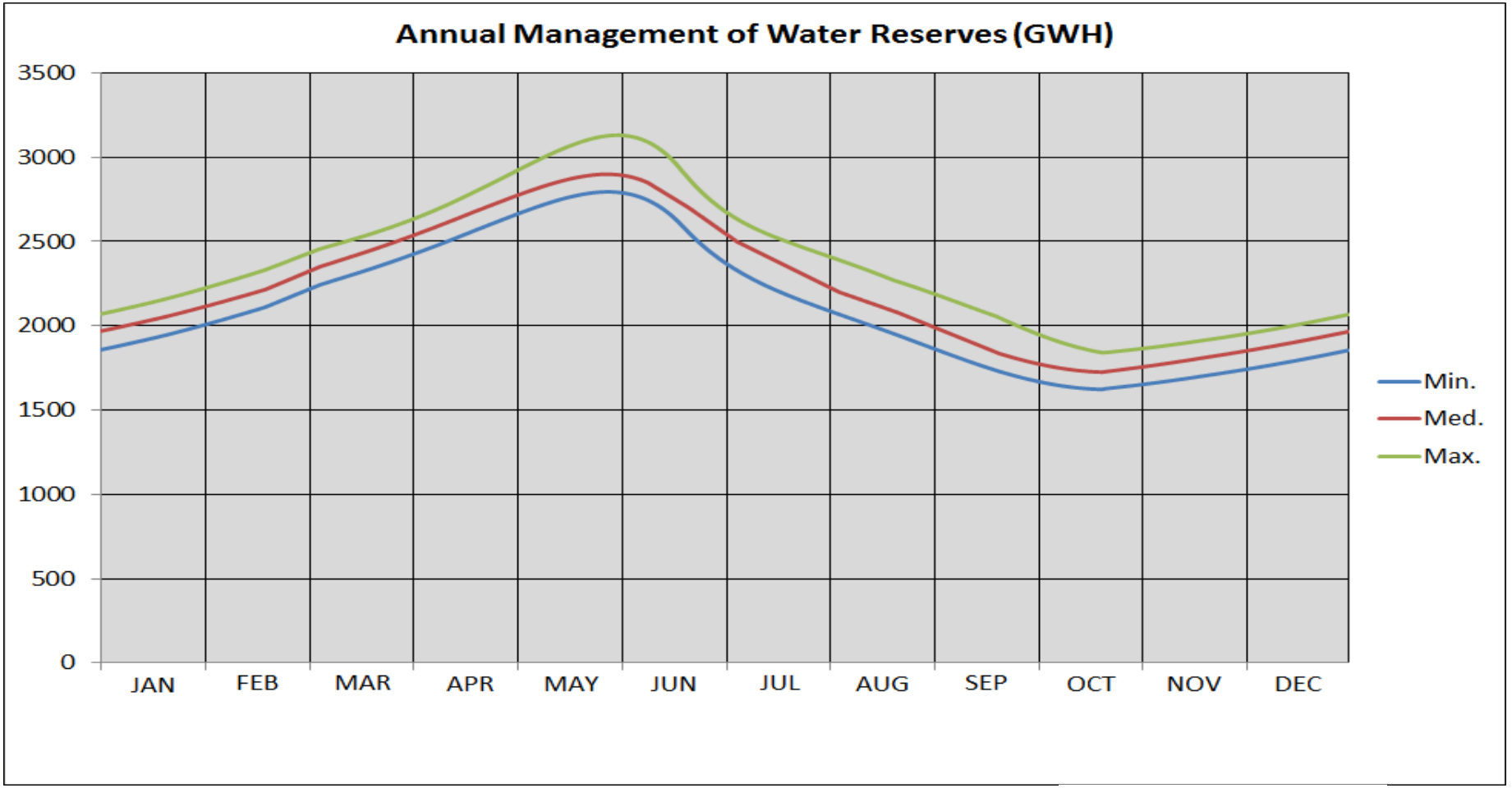
Ladon: Reservoir Level at the end of the month



	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

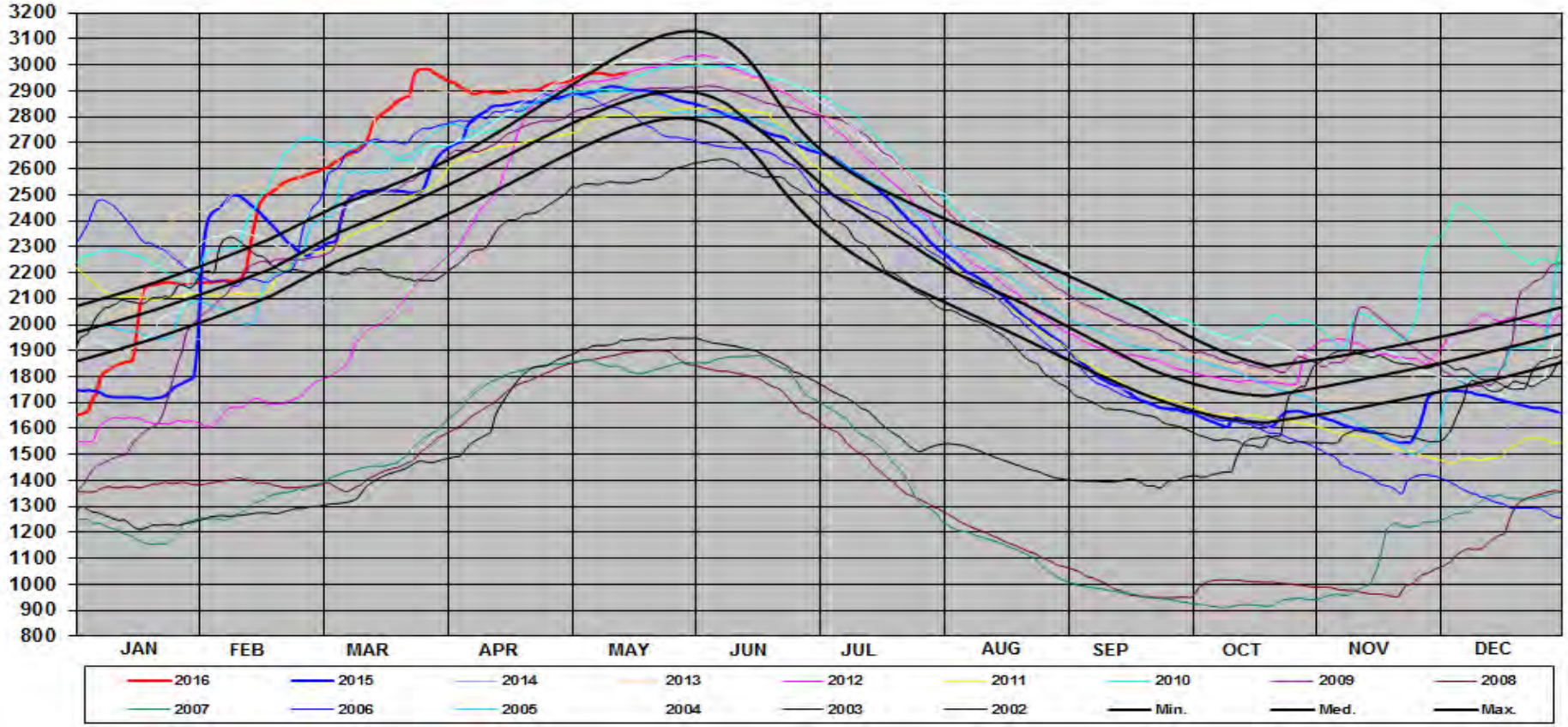
STATISTICAL CURVES FOR WATER RESERVES FOR EACH MONTH



Energy for everyone

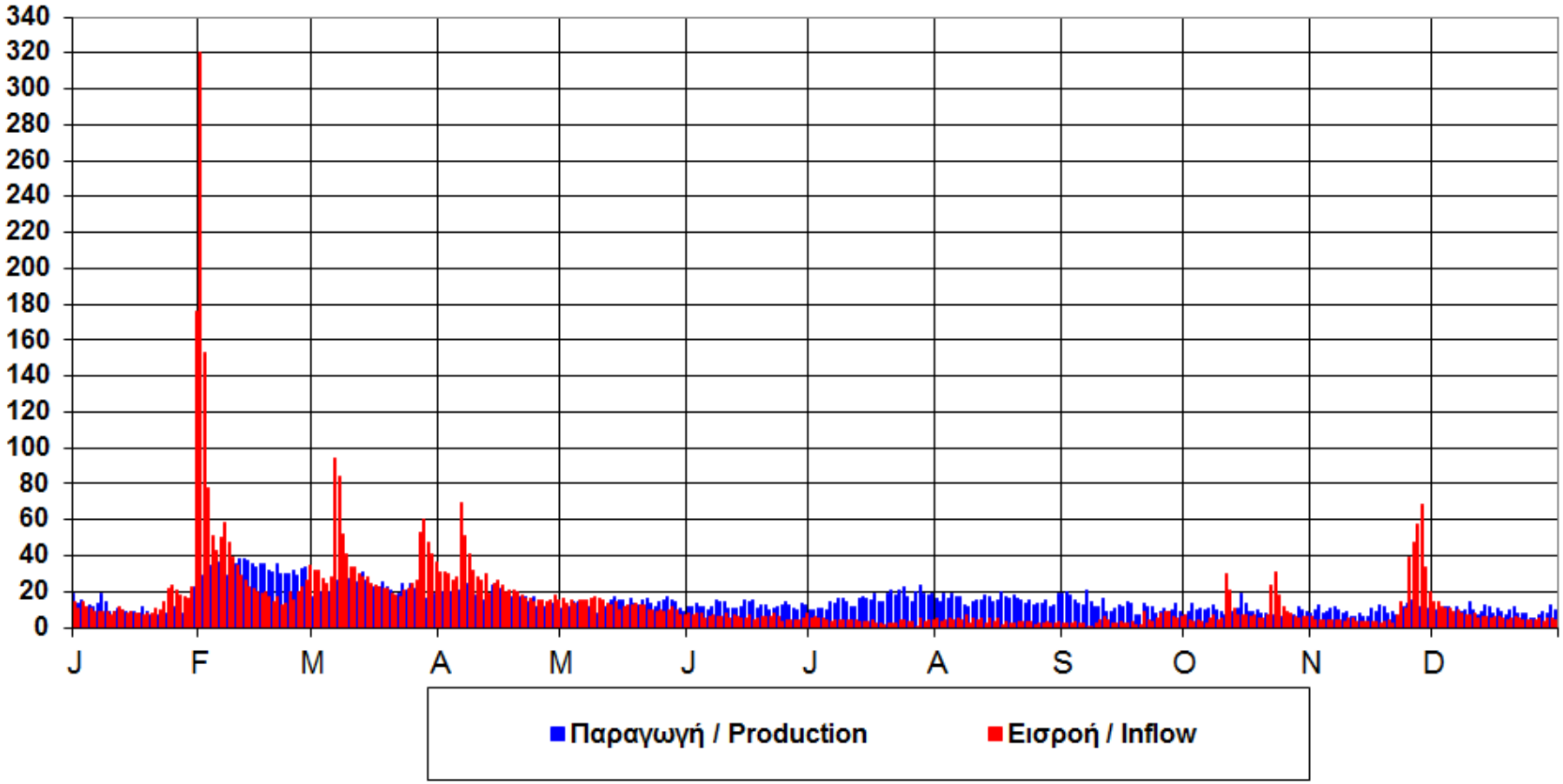
ACTUAL CURVES FOR WATER RESERVES FOR EACH MONTH

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



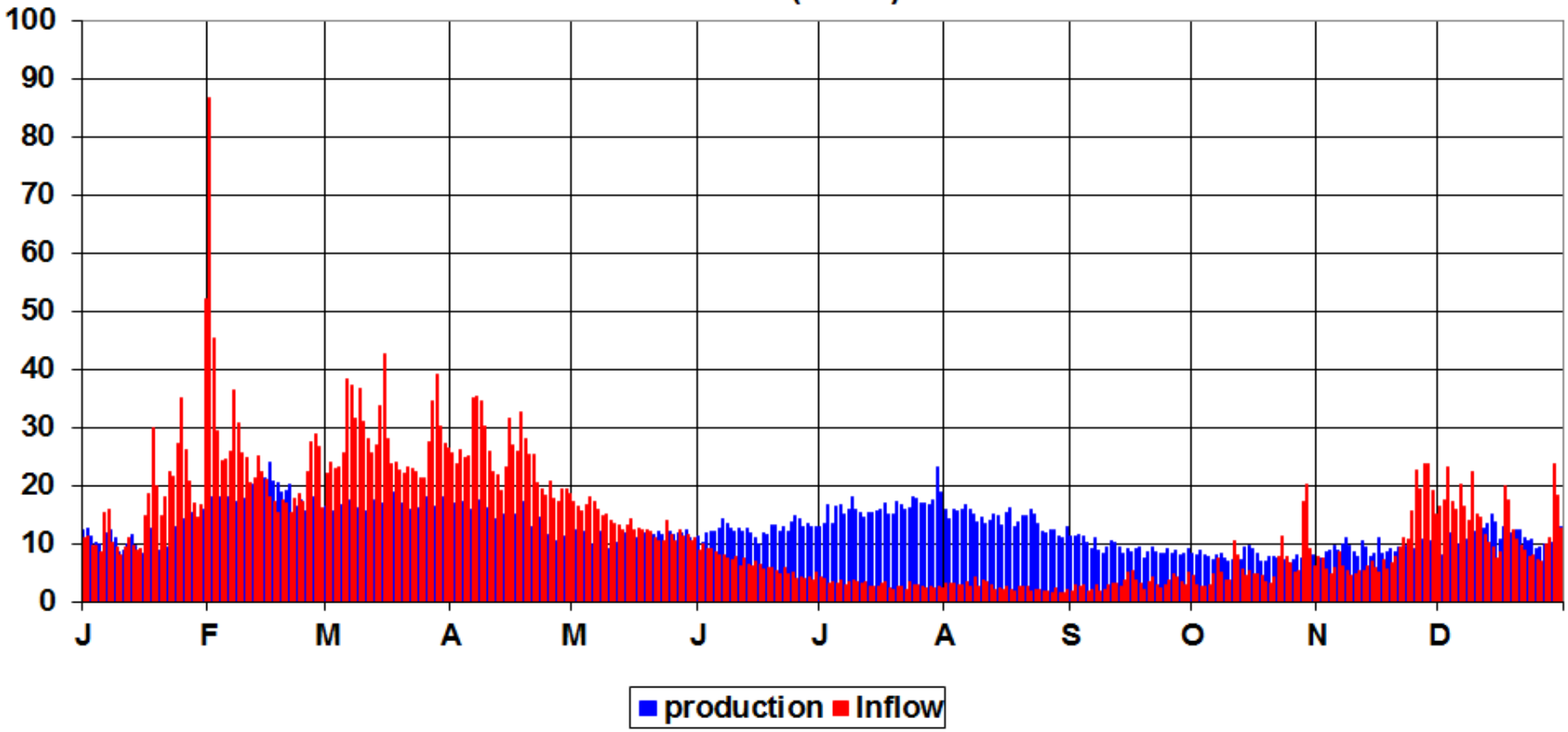
Energy for everyone

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



Energy for everyone

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



Thank you!