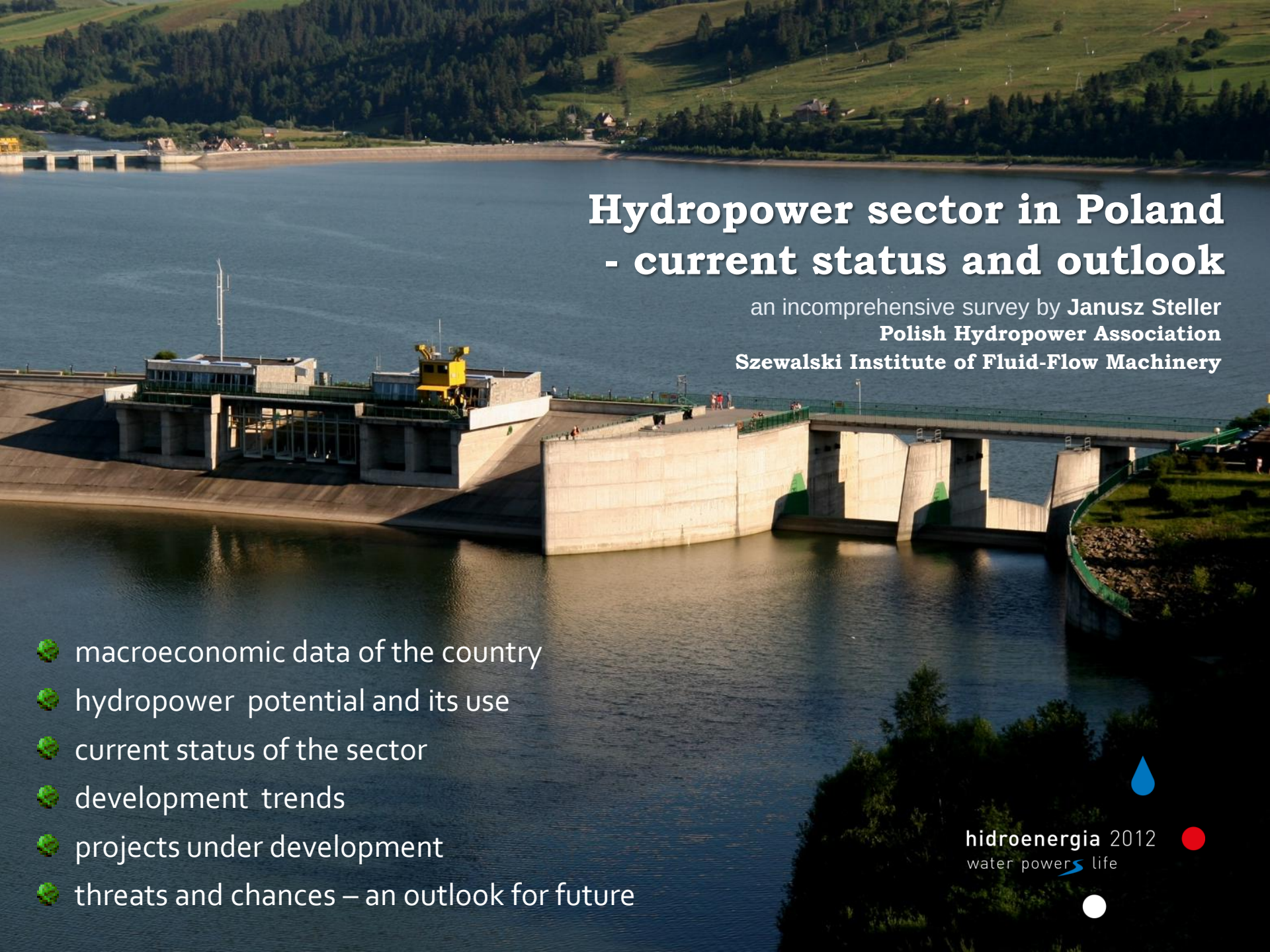


Hydropower sector in Poland - current status and outlook

an incomprehensive survey by **Janusz Steller**
Polish Hydropower Association
Szewalski Institute of Fluid-Flow Machinery

- macroeconomic data of the country
- hydropower potential and its use
- current status of the sector
- development trends
- projects under development
- threats and chances – an outlook for future

hidroenergia 2012
water powers life

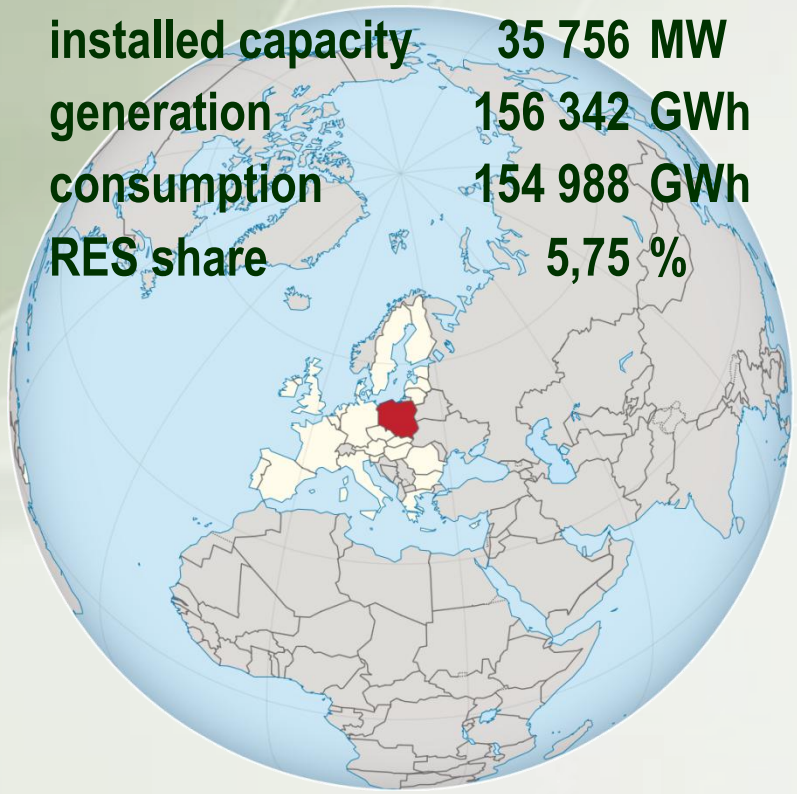
POLAND:

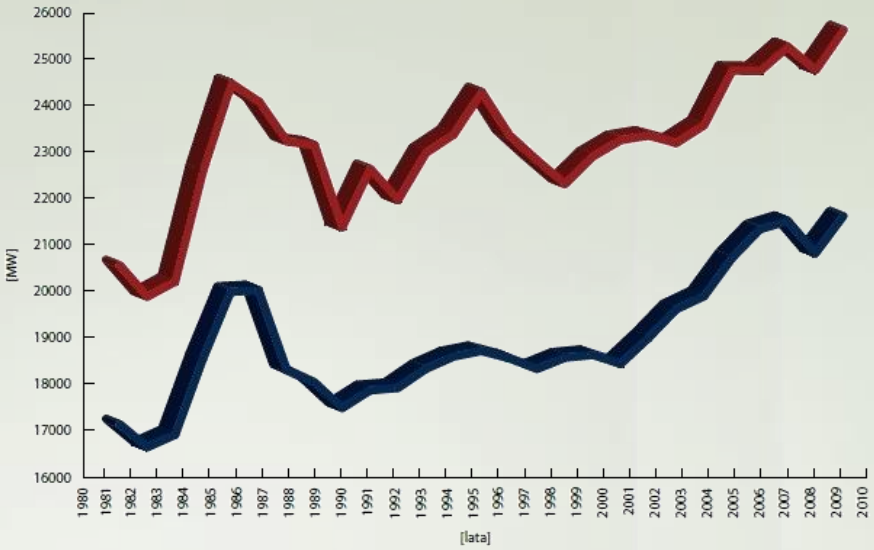
Essential macroeconomic data

Area	**312 500**	**km²**
Population (2010)	**38,2**	**mln**
GDP (2009)	**320 000**	**mln EUR**
Unemployment (2011)	**11,6**	**%**

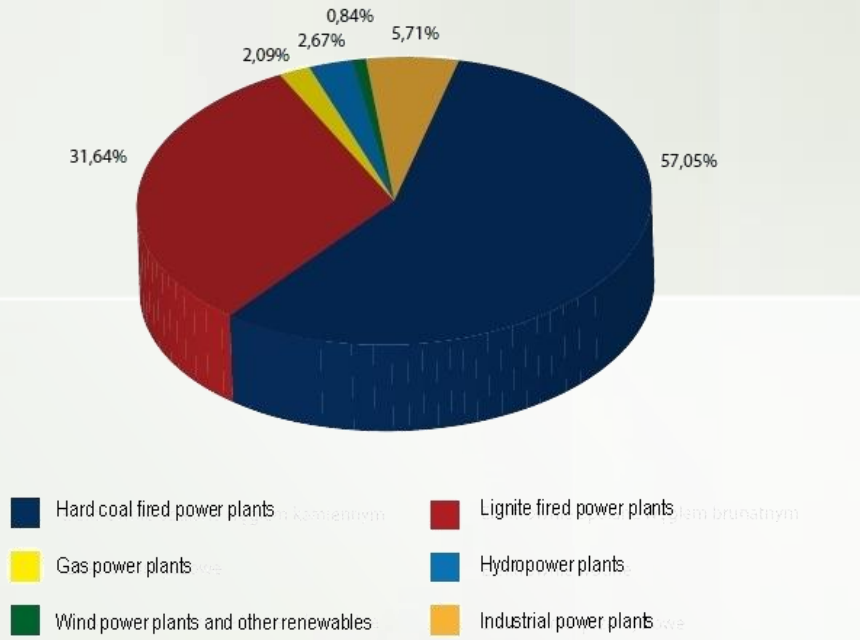
Electrical energy sector (2010)

installed capacity	**35 756**	**MW**
generation	**156 342**	**GWh**
consumption	**154 988**	**GWh**
RES share	**5,75**	**%**





Krajowe zapotrzebowanie maksymalne i średnie roczne w dniach roboczych w latach 1980 - 2010



Procentowy udział w krajowej produkcji energii elektrycznej poszczególnych grup elektrowni według rodzajów paliw w roku 2010

POLAND
– a lowland country with modest hydropower potential

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hydropower potential

gross/theoretical	25	TWh/annum
technical	12 (13,7)	TWh/annum
economic	8,5	TWh/annum (?)

small hydro

technical	5,1	TWh/annum
economic	2,5	TWh/annum

POLAND

– a lowland country with modest hydropower potential

No.	Water system	Potential, GWh
1	**Vistula + catchment basin**	**9 270**
2	**Vistula**	**6 177**
3	**Left bank tributaries**	**513**
4	Pilica	170
5	Brda	119
6	others	224
7	**Right bank tributaries**	**2 580**
8	Dunajec	814
9	Wisłoka	126
10	San	714
11	Bug	309
12	Narew	179
13	others	438
14	**Oder + catchment basin**	**2 400**
15	**Oder**	**1 273**
16	**Left bank tributaries**	**619**
17	Nysa Kłodzka	134
18	Bóbr	320
19	others	165
20	**Right bank tributaries**	**507**
21	Warta	351
22	others	156
23	**others (mainly small rivers in Pomerania)**	**280**
	Total (items 1+14+23)	**11 950**

Towarzystwo Elektrowni Wodnych

Hydro power potential and its use in Poland and EU

hidroenergia 2012

No.	Member State	Technical potential	Installed capacity (RES)	Normalised production (RES)	Utilisation of the technical potential	Specific investment costs	
						<10 MW	≥ 10 MW
		GWh/year	MW	GWh	%	k€/kW	k€/kW
1	Austria	73 000	8 380	38 746	53,1	4,5	no data
2	Belgium	400	119	370	92,5	2,5 ÷ 12	no data
3	Bulgaria[1]	4520	3 019	3693	92,5	1,4 ÷1,5	no data
4	Czech Rep.	4 880	1 531	2 253	46,2	6,8	3
5	Estonia	163	6,8	22	13,5	1,9	no data
6	Finland	16 916	3 049	14 000	82,8	3,5	no data
7	France	120 000	25 423	*61 650*	51,4	2,3 ÷ 4,5	2,0 ÷ 3,0
8	Germany	36 000	3 905	*19 503*	54,2	7,5	no data
9	Grecja	no data	3 200	5 239	b.d.	1,5	2
10	Ireland	847	241	788	93	3,0 ÷ 12	no data
11	Italy	160 000	17 721	*44 092*	27,6	4,5	b.d.
12	Latvia	5 360	1 553	2 963	55,3	2,6	no data
13	Lihuania	2 090	130	422	20,2	2,5	no data
14	**Poland**	**13 800**	**945**	**2 353**	**17,2**	**6,5**	**>10**
15	Portugal	19 440	5 039	11 380	58,5	2,5	no data
16	Romania	34 509	6 403	17 193	49,8	2,5÷ 3,5	4,0 ÷ 5,0
17	Slovakia	7 560	1 802	4 424	58,5	6,35	6,36
18	Slovenia	8 800	1 219	*5 241*	59,6	7	6
19	Spain	68 500	no data	*28 230*	41,2	1,5	no data
20	Sweden	130 000	16 934	68 071	52,4	3,1 ÷3,5	1,3
21	UK	27 203	1 542	4 965	18,1	3,0 ÷12	1,8

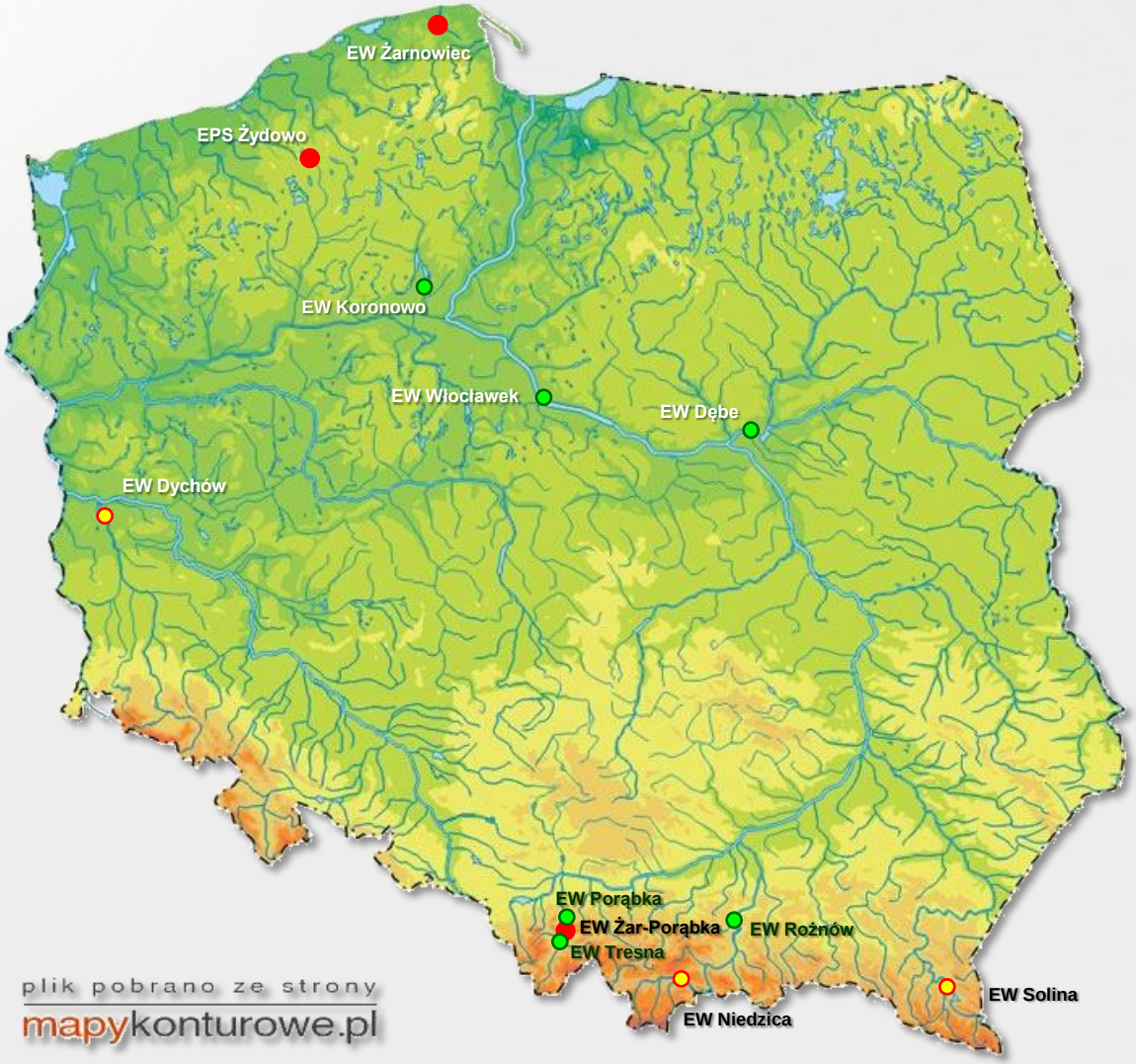
Data source:
HYDI, 2011

STREAM MAP

[1] Economic potential shown instead of the technical one.

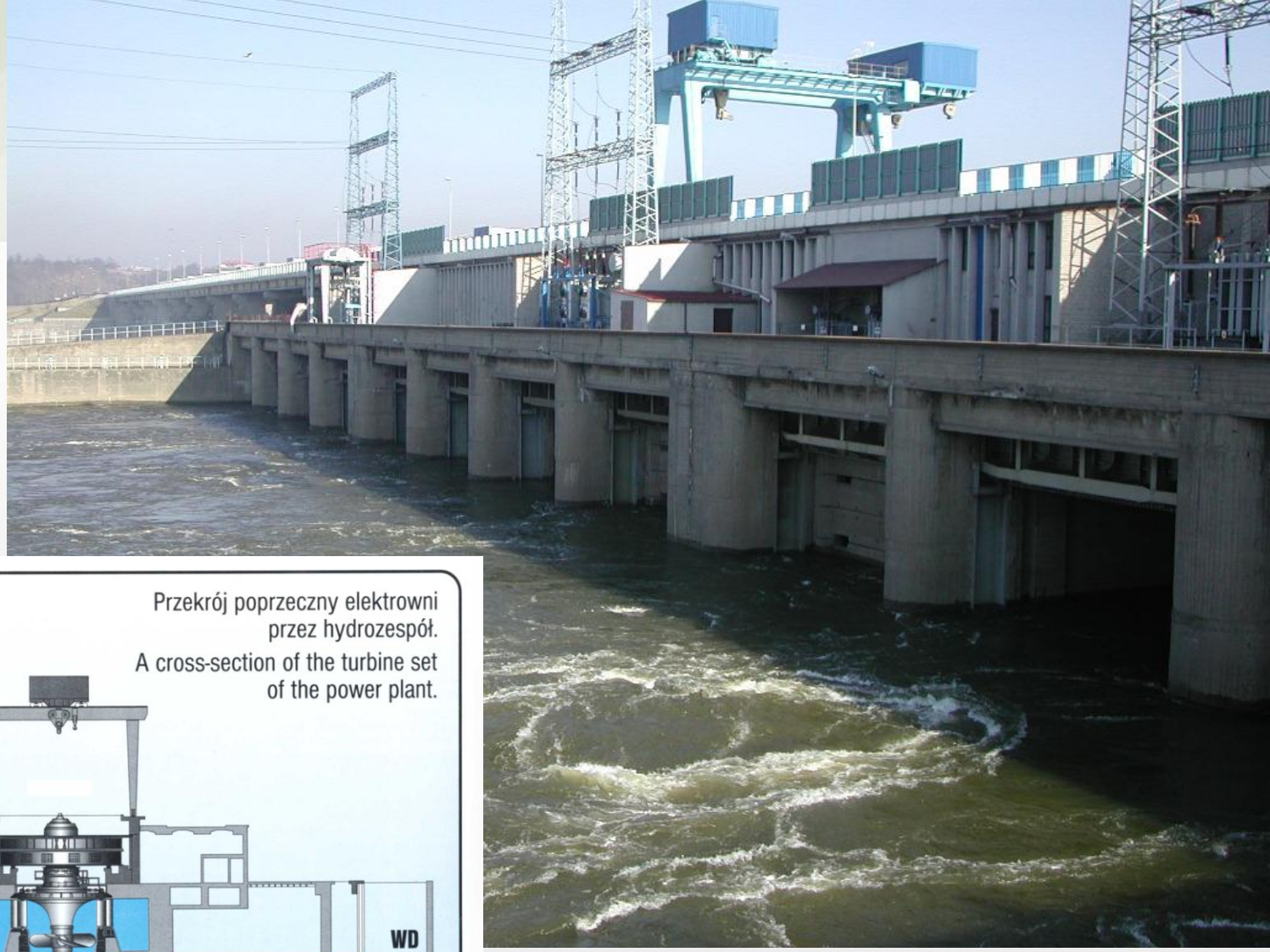
Current status: Large hydro in Poland

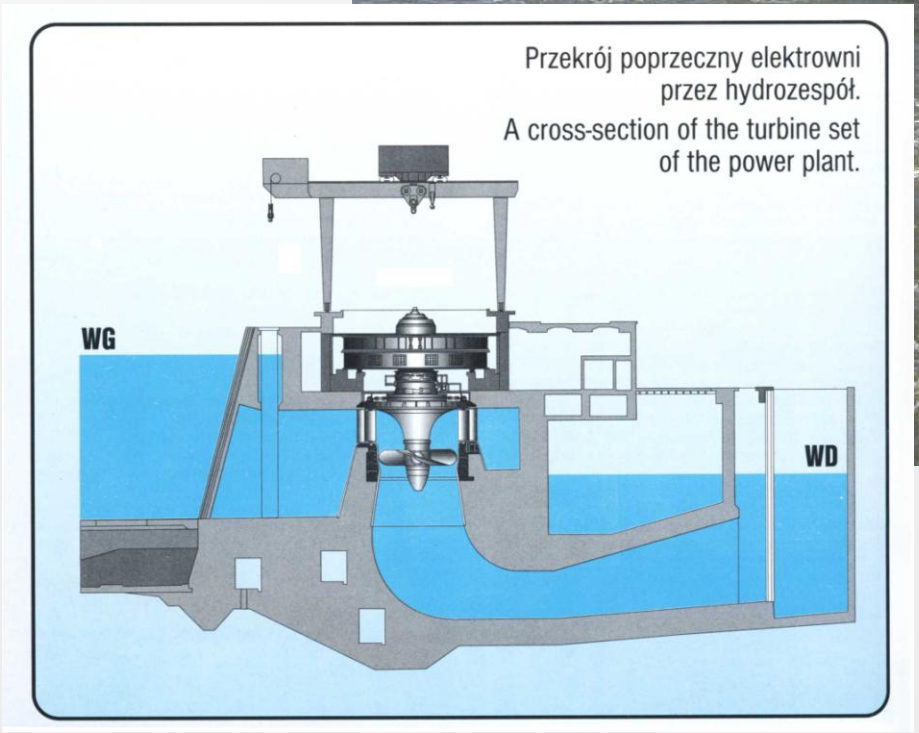
Power plant	Capacity, MW
Włocławek	162
Rożnów	50
Koronowo	26
Tresna	21
Debe	20
Porąbka	11
Solina	200
Dychów	91,5
Niedzica	91,5
mixed pumping total	383
renewable total	674
Porąbka-Żar	540
Żarnowiec	716
Żydowo	152
pumped storage total	1408
large hydro total	2082



Towarzystwo Elektrowni Wodnych


Włocławek Hydropower Plant
6 × 26,7 MW





EW Włocławek, 162 MW

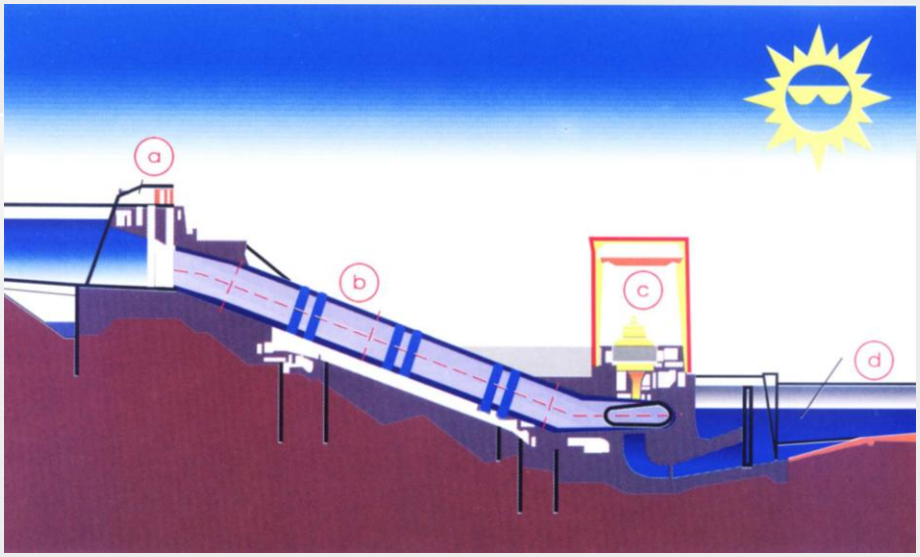
Current status: Large hydro

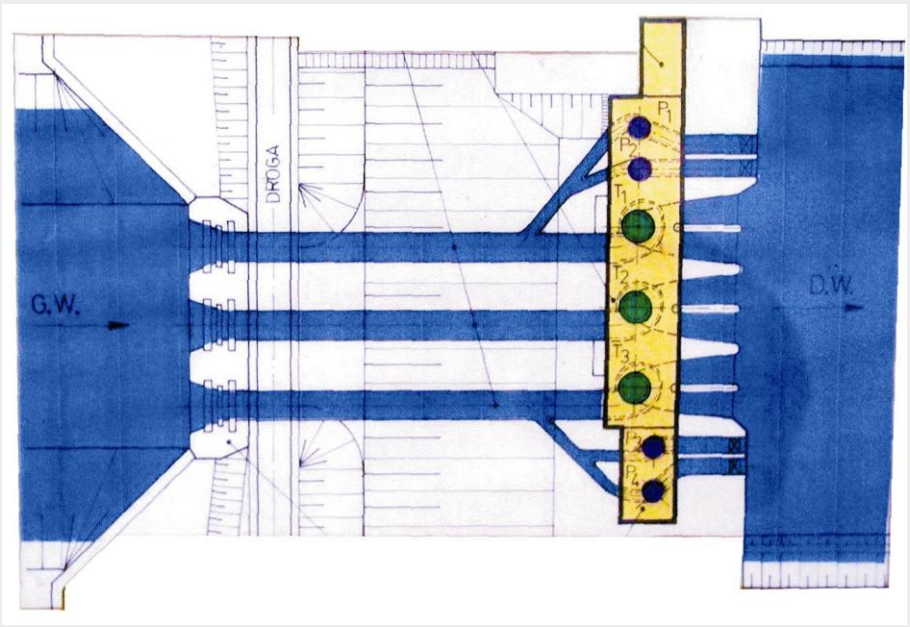
EW Rożnów, 50 MW
commissioning: 1941

Dychów Hydropower Plant

turbine mode
3 × 30 MW

pumping mode
4 × 5 MW





PGE Energia Odnawialna SA

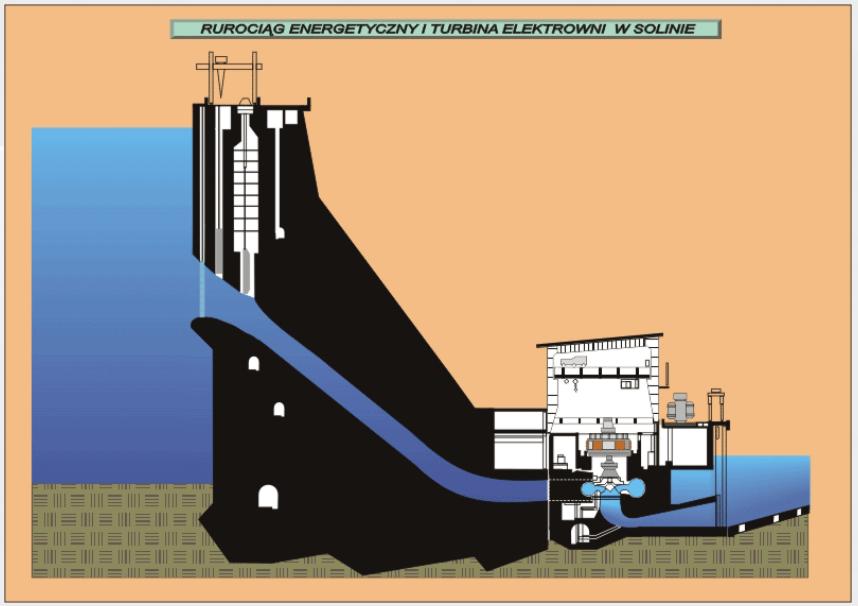
PGE Energia Odnawialna SA

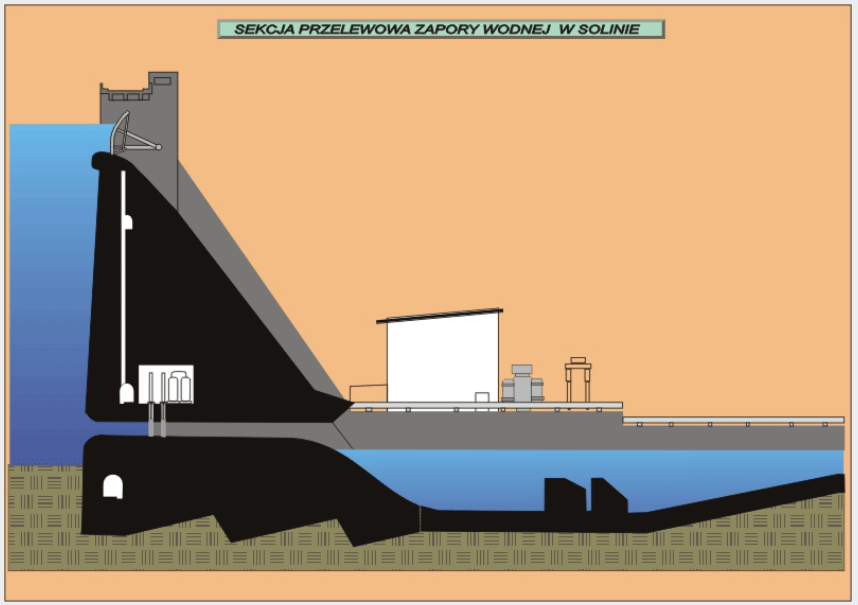
Current status: Large hydro

Solina Hydropower Plant

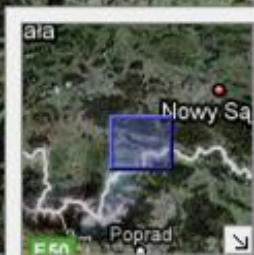
2 Francis units (70 MW each)
2 reversible units (30 MW each)

total capacity: 200 MW



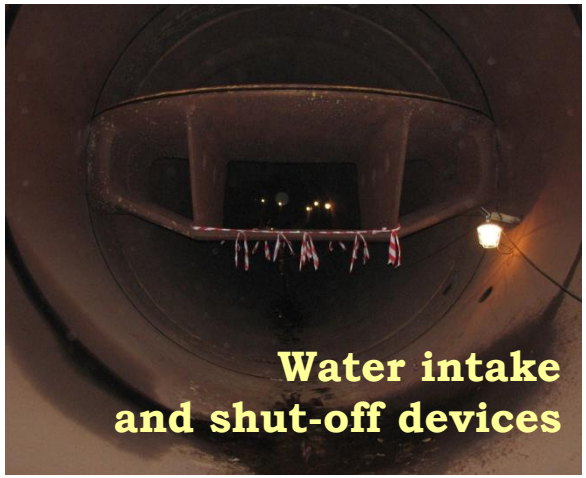


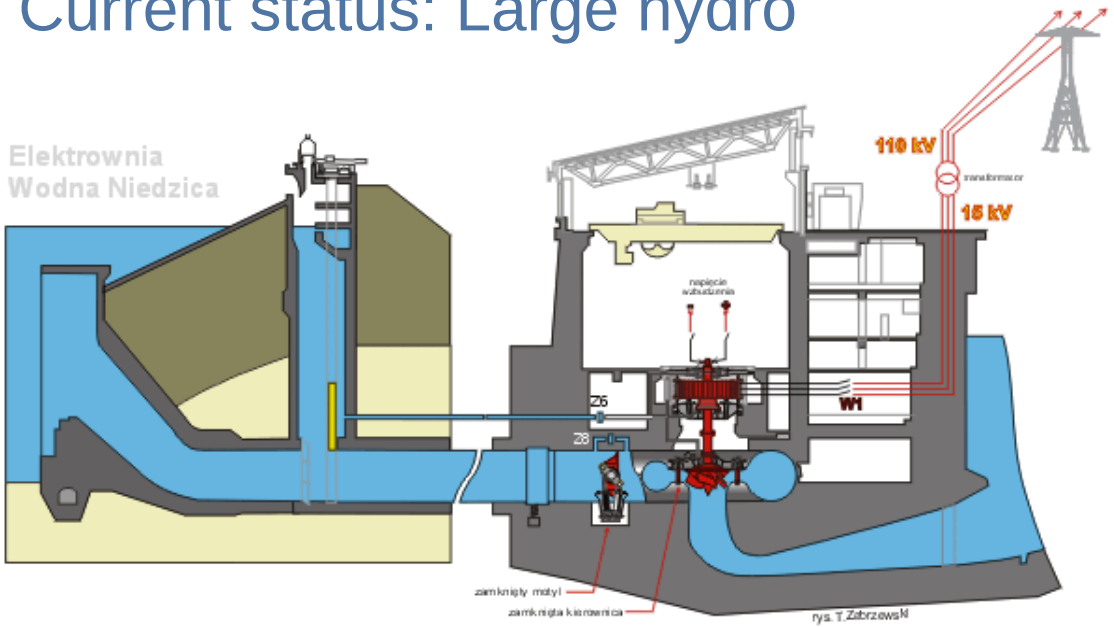
Niedzica Group of HPPs at Dunajec river



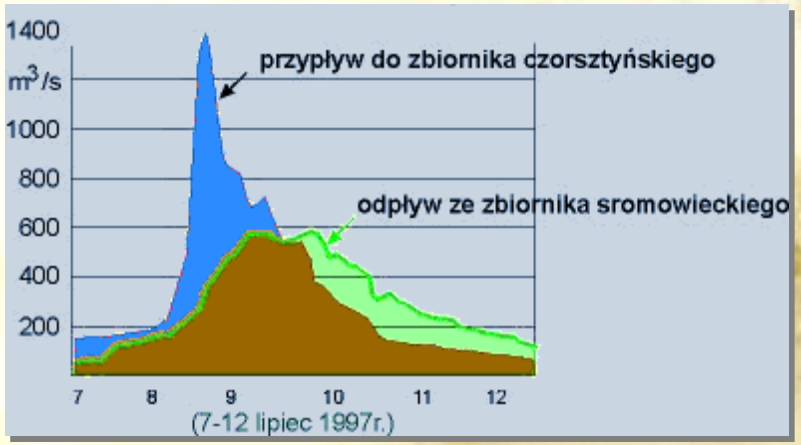
1 mi
2 km

Current status: Large hydro



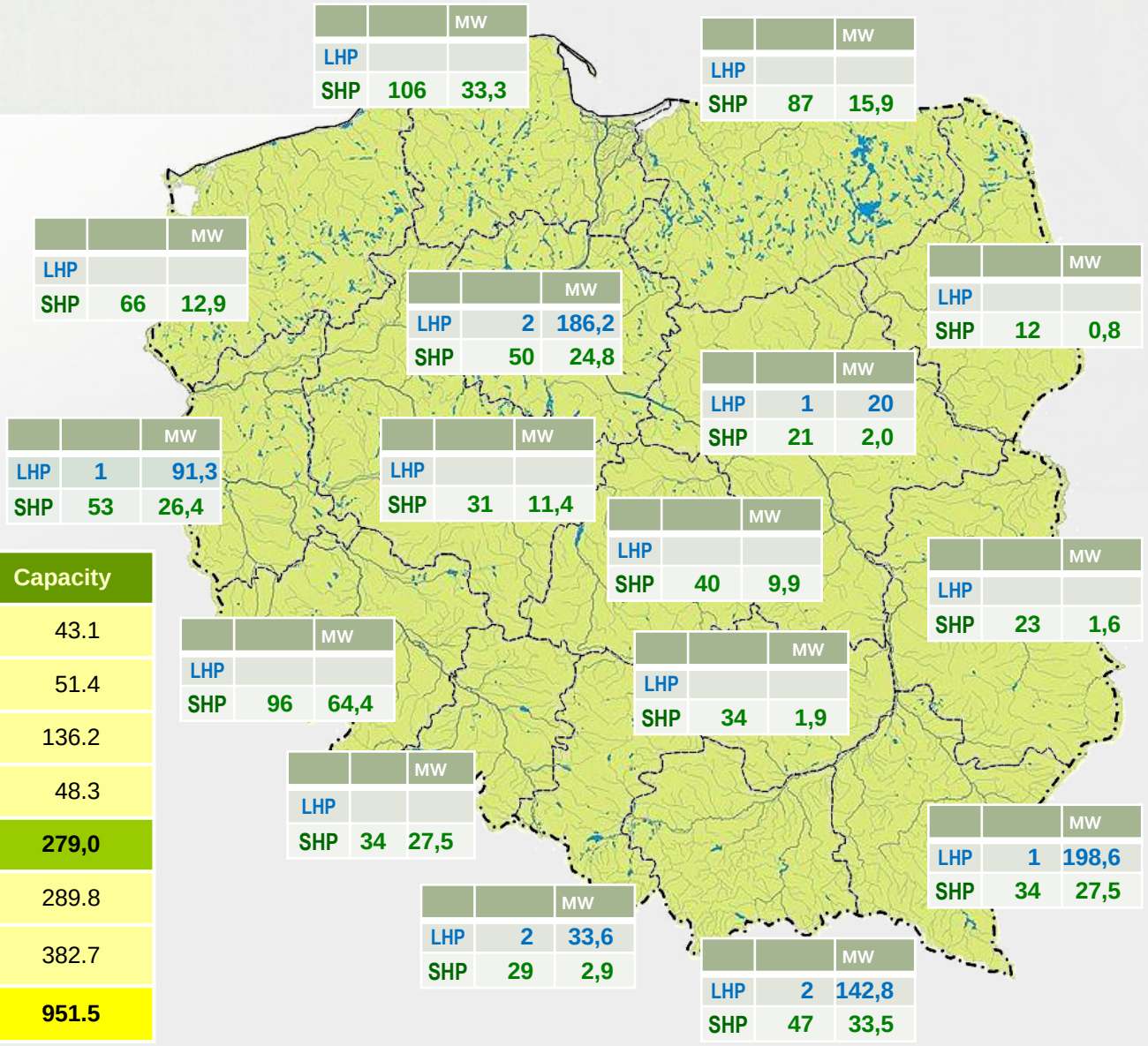


EW Niedzica - „Millennium water” in July 1997
Flattening of the flood wave by the Czorsztyn Dam



Current status: Renewable hydro in Poland

Urząd Regulacji Energetyki



category	No of plants	Capacity
P ≤ 0,3 MW	590	43.1
0,3 MW < P ≤ 1 MW	85	51.4
1 MW < P ≤ 5 MW	60	136.2
5 MW < P ≤ 10 MW	6	48.3
small hydro total	**741**	**279,0**
classic large hydro	6	289.8
pumped storage with natural inflow	3	382.7
renewable hydro total	**750**	**951.5**


EW Pilchowice I
Capacity: 7,5 MW
Commissioning: 1913
Small hydro in Poland: Heritage

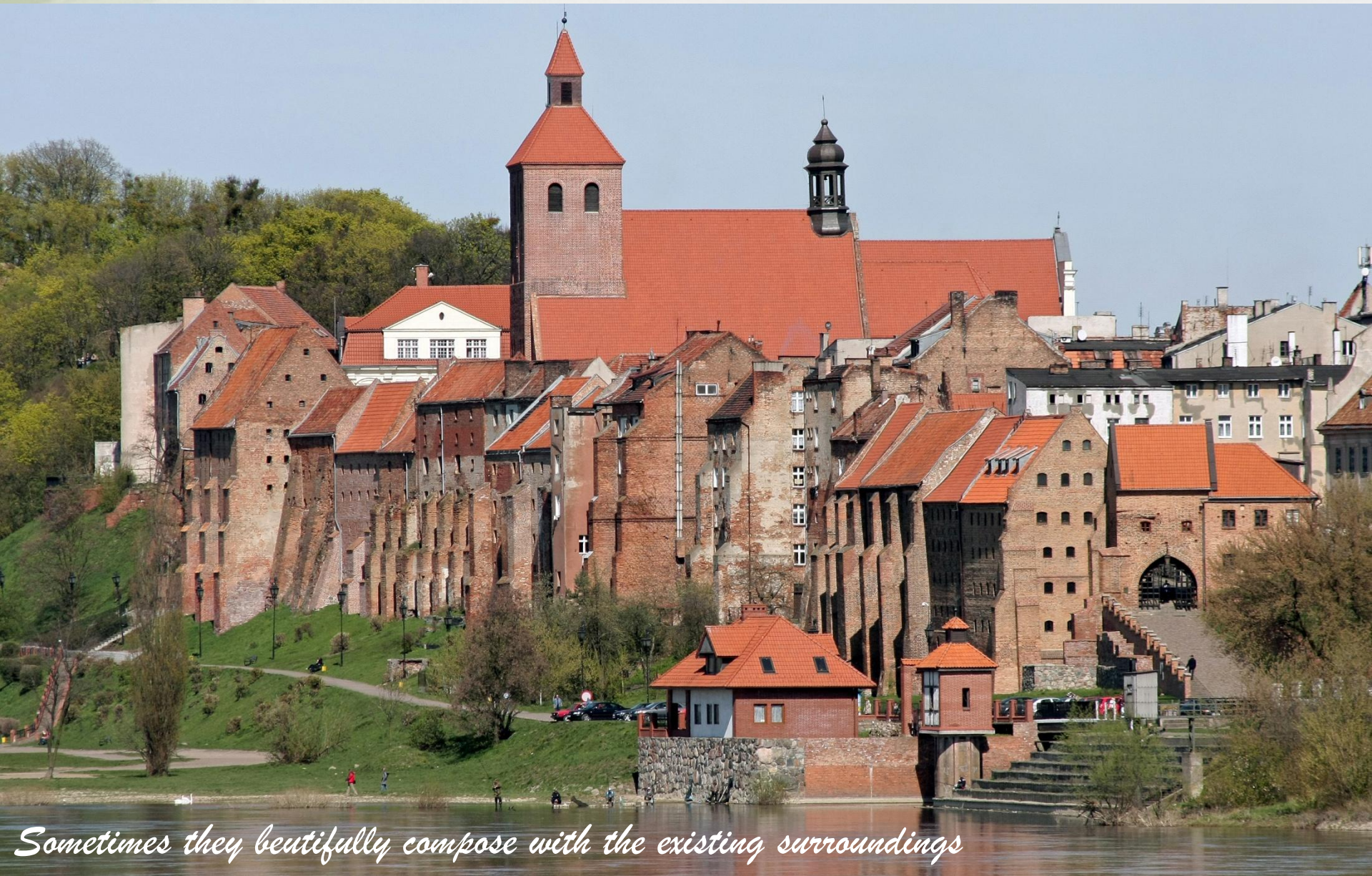
Water intake of Żur HPP, 8 MW
commissioning 1929

Small hydro in Poland: Heritage


Small hydro in Poland.
This is also the heritage


Small hydro in Poland.
A lot is still to be done

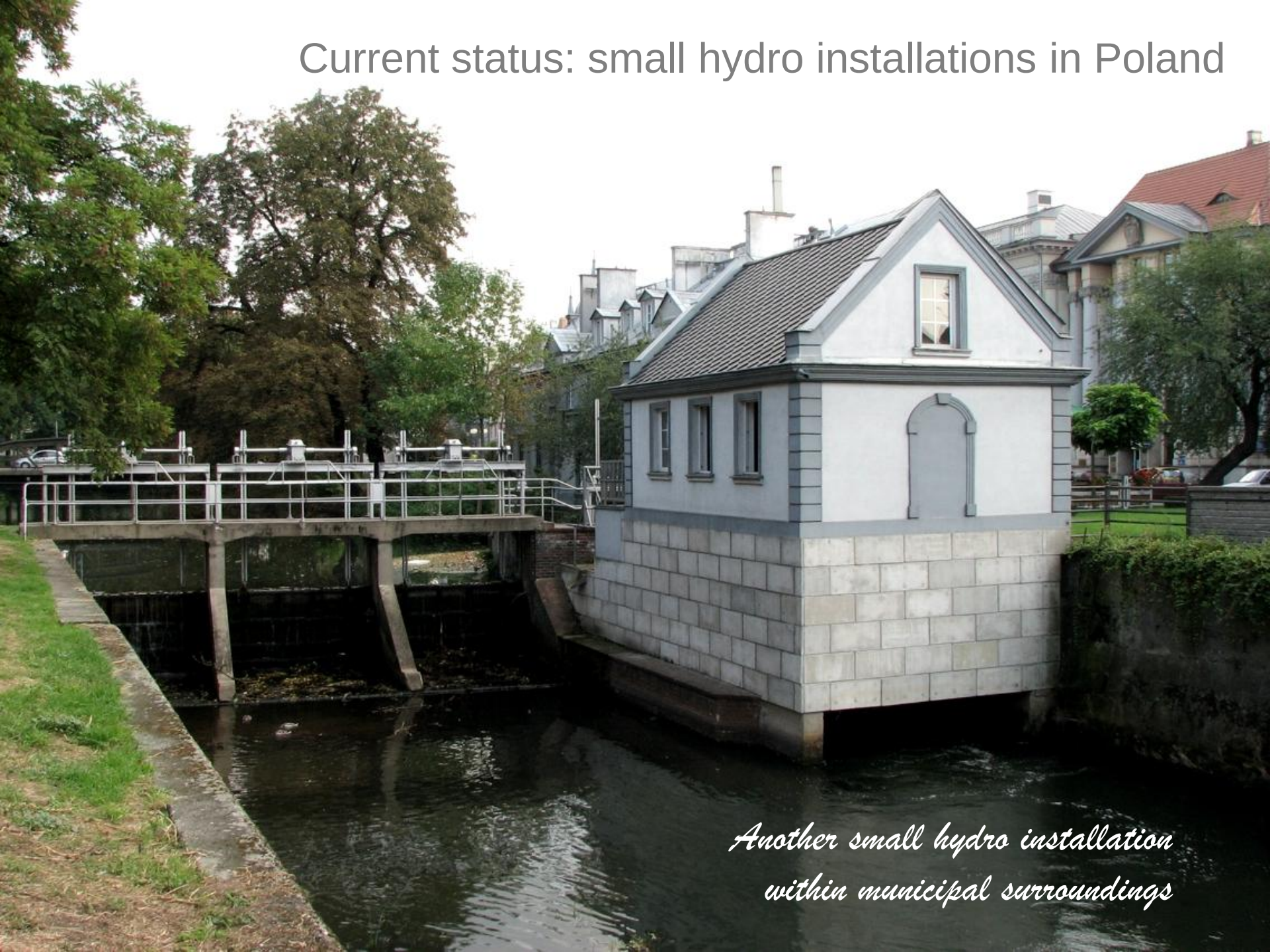
Current status: small hydro installations in Poland



Sometimes they beutifully compose with the existing surroundings

Current status: small hydro installations in Poland

Current status: small hydro installations in Poland



Another small hydro installation within municipal surroundings


Composing with natural environment

Most new SHPs are erected at the existing weirs.

Weirs in administration of Water Management Authorities (RZGW) provide raw capacity of up to 3 MW.

Current status: New small hydro installations

Inlet channel to Januszkowice SHP
at Upper Oder
H = 2.3 m, P = 1400 kW, Q_{max} = 30 m^3/s

Current status: New small hydro installations

Zawada low head SHP at Upper Oder

P = 1500 kW, Q_{max} = 43 m^3/s

Current status: New small hydro installations

Luboszyce SHP at Upper Oder

P = 55 kW, Q_{max} = 4 m^3/s

Current status: economic parameters

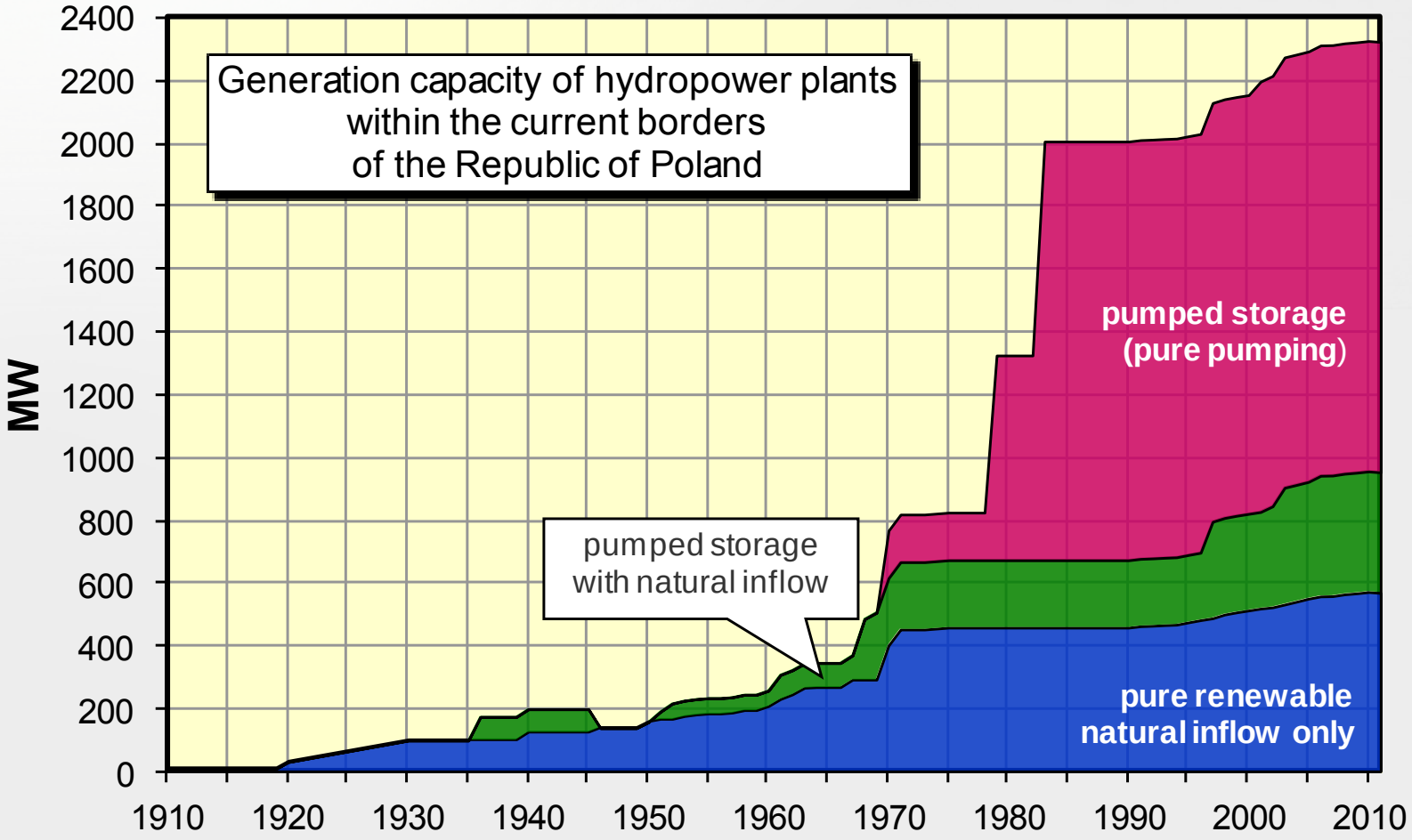
Investment costs, EUR/kW

Country	Small hydro		Large hydro	
	low head	high head	classic	pumped storage
Poland	6 400		6 000 (>13 000)	800
Czech Republic	6 450	800	3 000	
Slovakia	5 500		6 360	1 280

Companies

	Total	Small hydro
No. of companies	**380**	
Employment	**2810**	**2060**
Civil engineering	330	215
Equipment supply	240	210
Engineering activity	155	105
Maintenance	165	80
Plant operation & others	1920	1450

Looking backwards – over 100 years of history (since 1896)



Current trends

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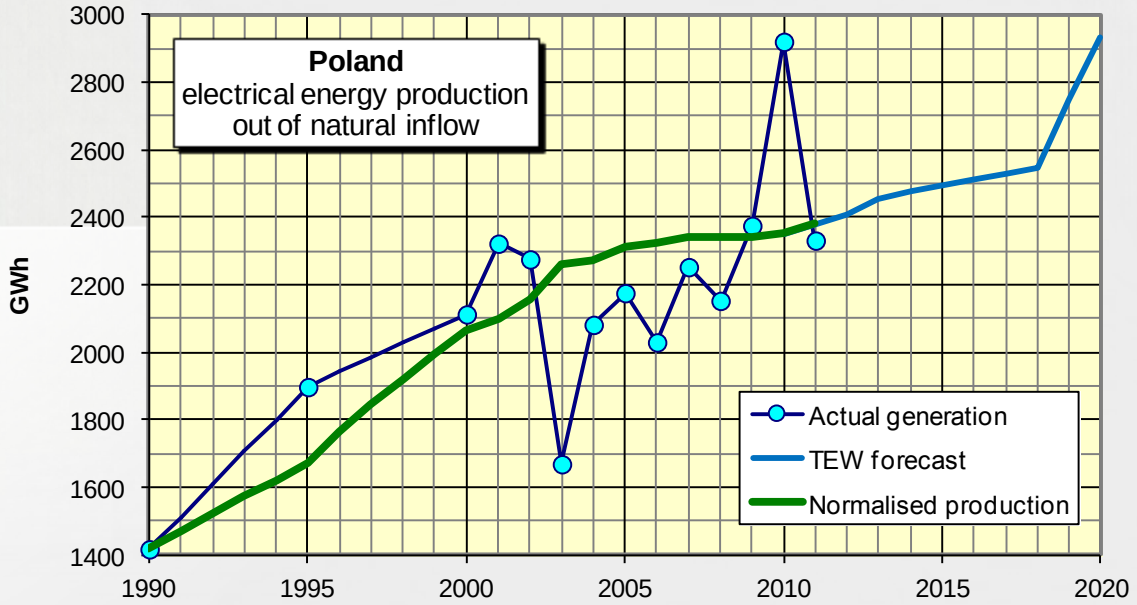
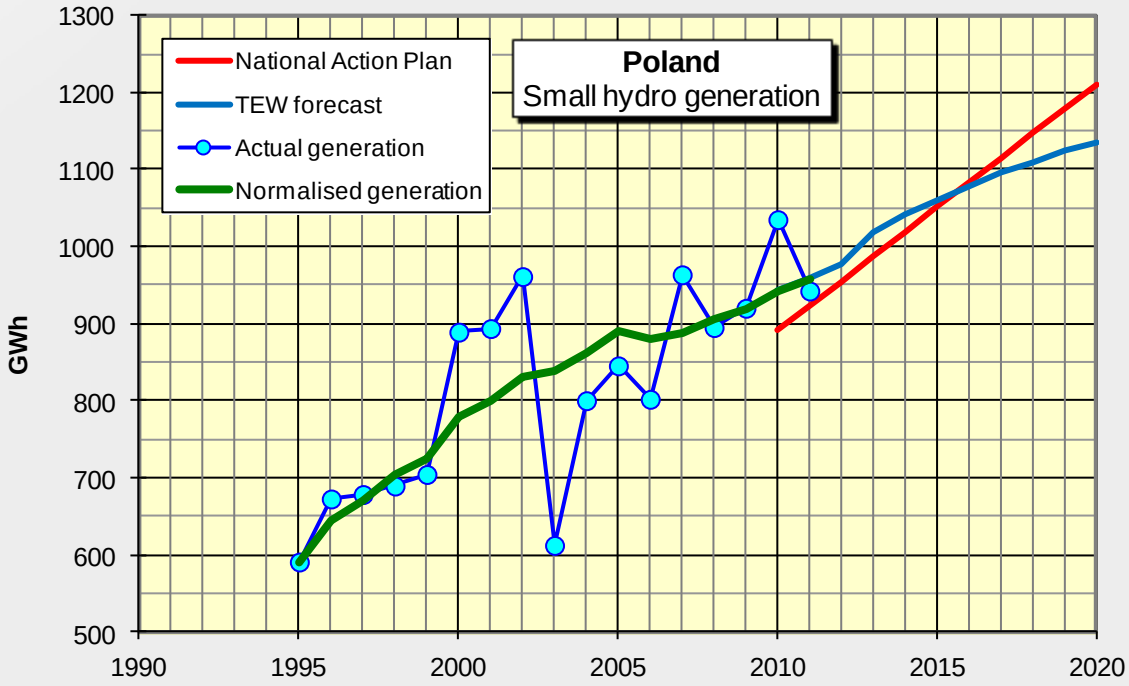
STREAM MAP

Towarzystwo Elektrowni Wodnych



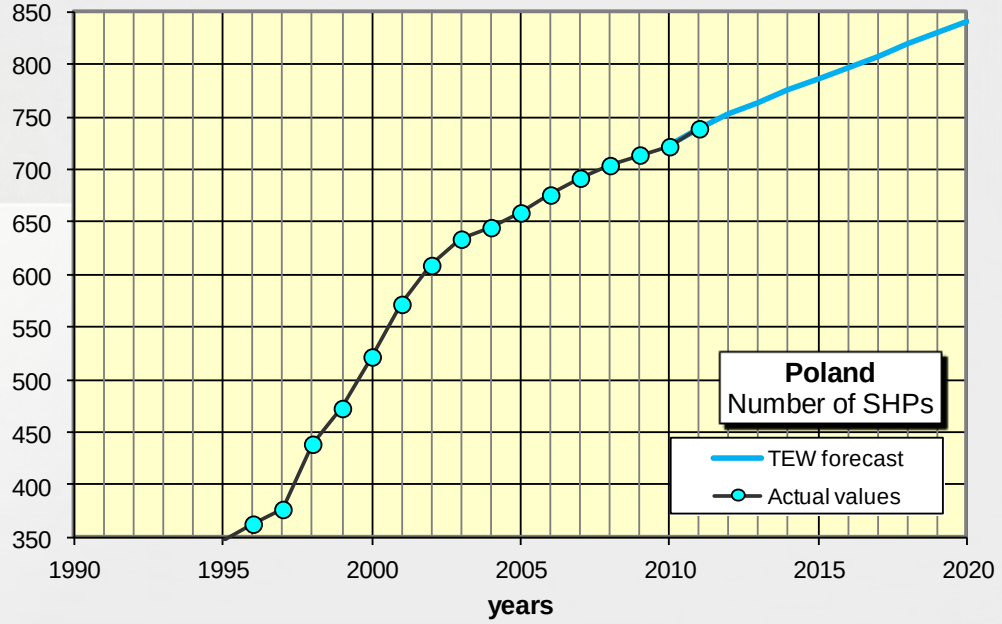


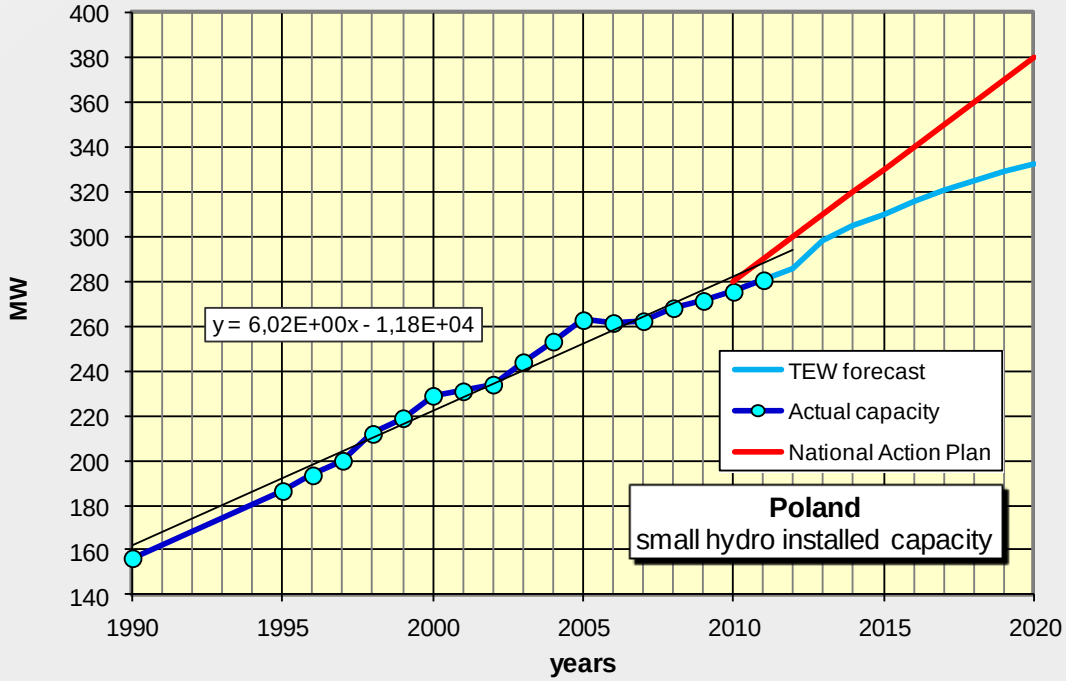
Current trends

hidroenergia 2012

STREAM MAP

Towarzystwo Elektrowni Wodnych

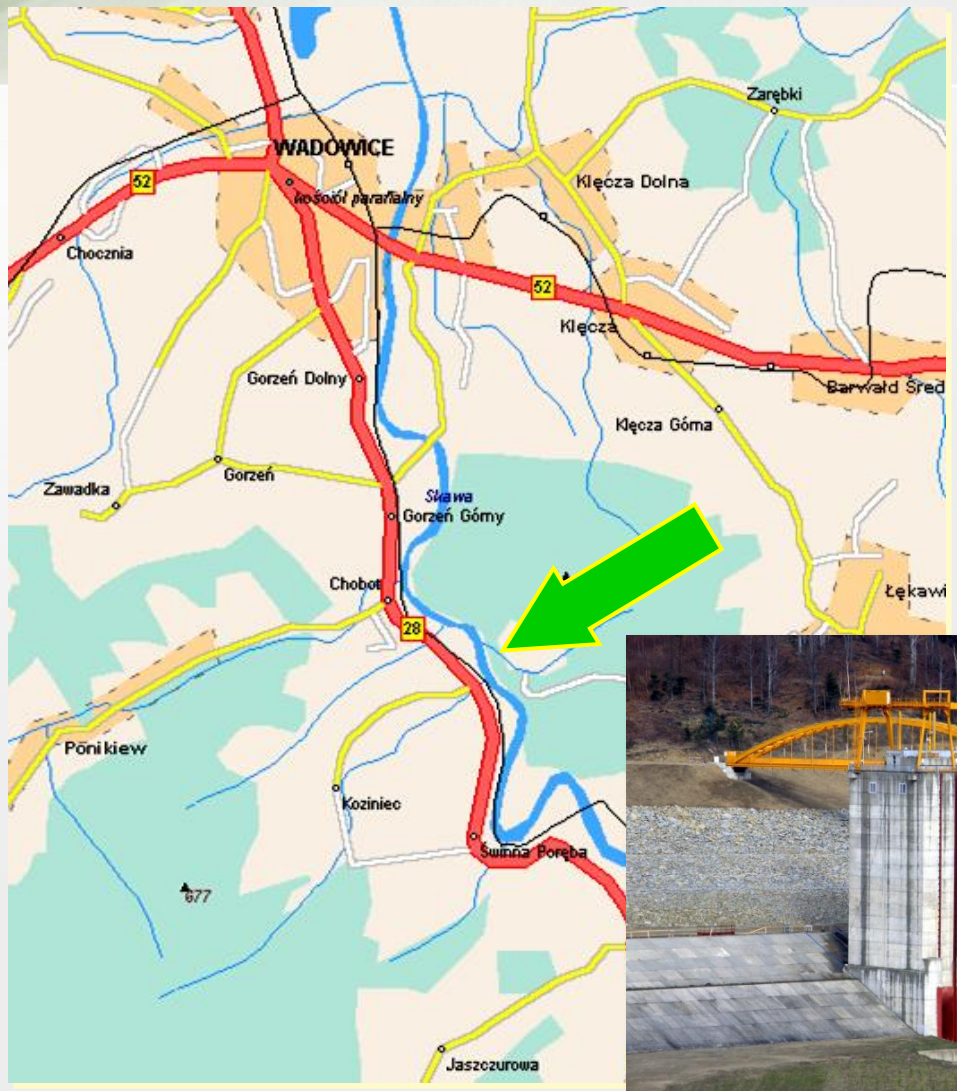


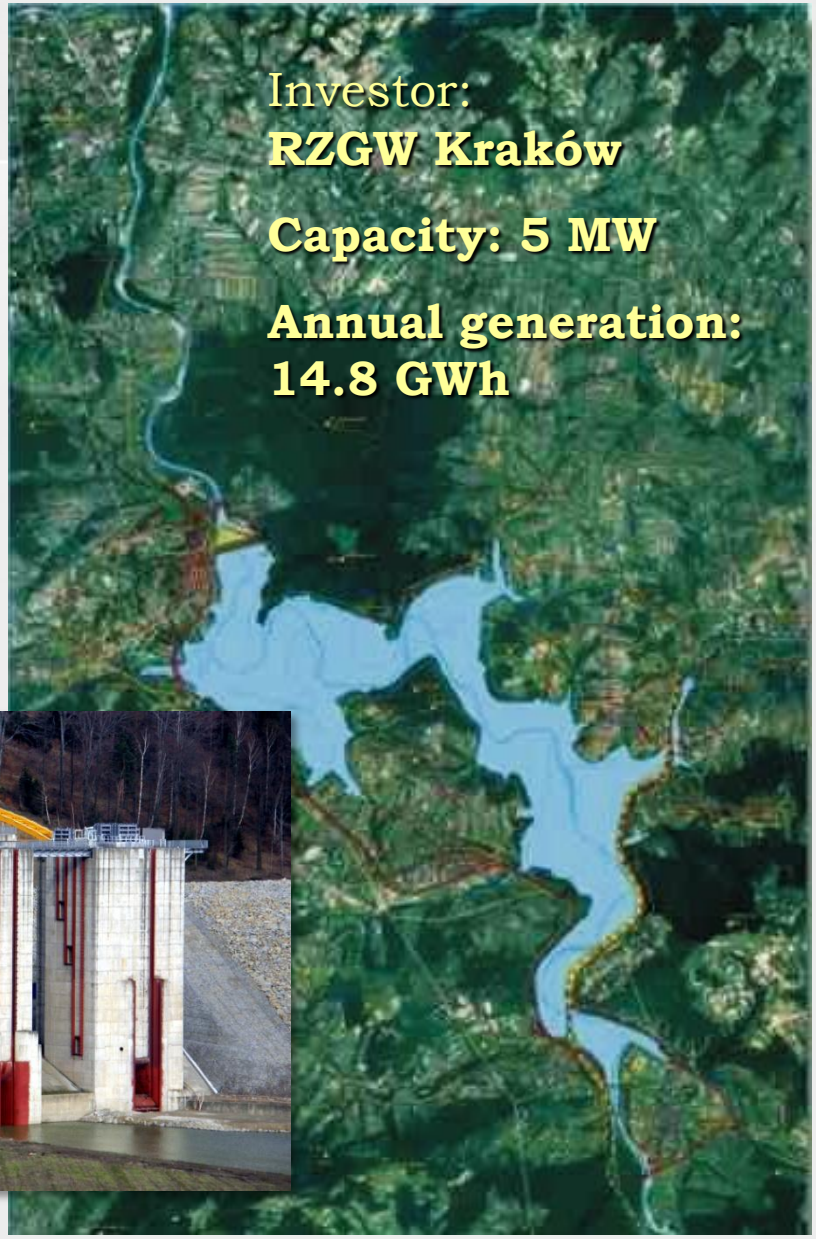


Major small hydro projects under construction/preparation

- EW Świnna Poręba, 5 MW
- EW Malczyce, 9 MW
- EW Oława, 3,2 MW
- EW Niepołomice, 3 MW

Small hydro under construction





EW Świnna Poręba

Small hydro under construction

Malczyce SHP
(Oder river, 45 km downstream of Wroclaw)

Investor: **RZGW Wrocław**

Supplier of hydraulic units: **Mavel**

***H* = 4.2 – 6.4 m**
***P* = 2 × 4.5 MW**

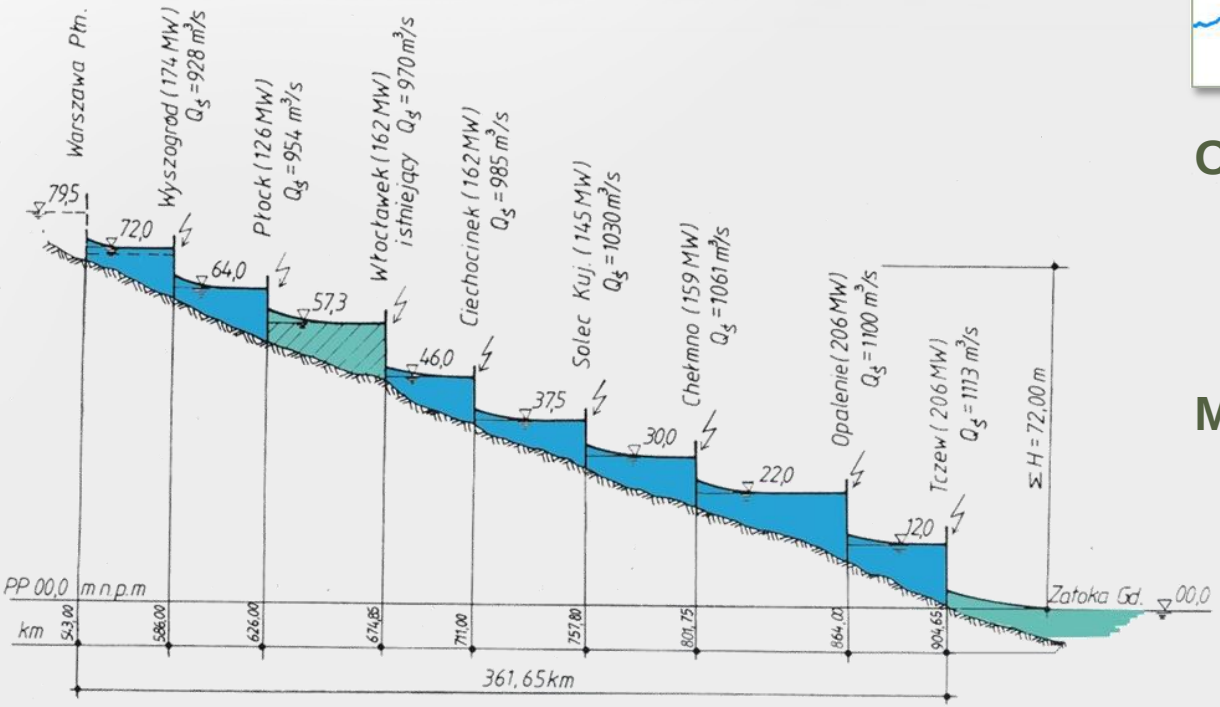
Large hydro projects

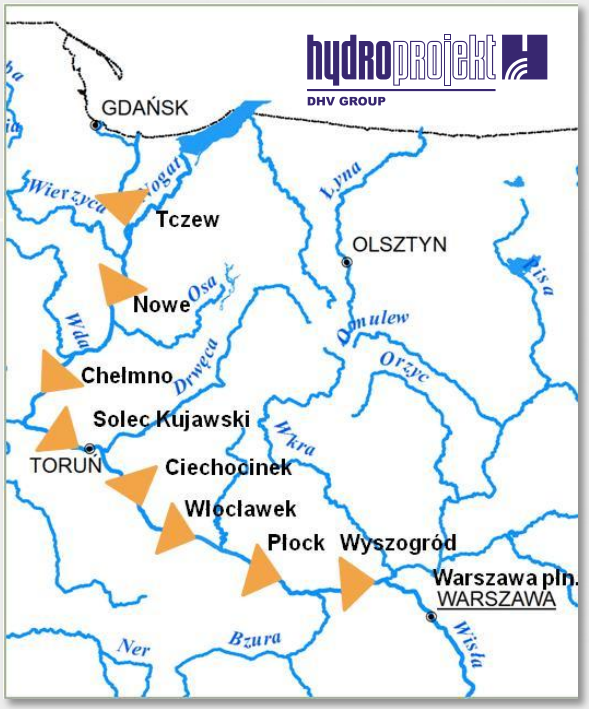
Lower Vistula Cascade (1980)

installed power: 1340 MW

annual production: 4300 GWh

peak-load operation





Other variants (1999):

installed power 640 MW

annual generation 3350 GWh

run-of-river plants

Most recently:

only one power plant downstream of Wloclawek

Source: Zygmunt Babiński, Michał Habel
Lower Vistula Valley from the Air

UNIWERSYTET KAZIMIERZA WIELKIEGO W BYDGOSZCZY

Dni Nauki 2009

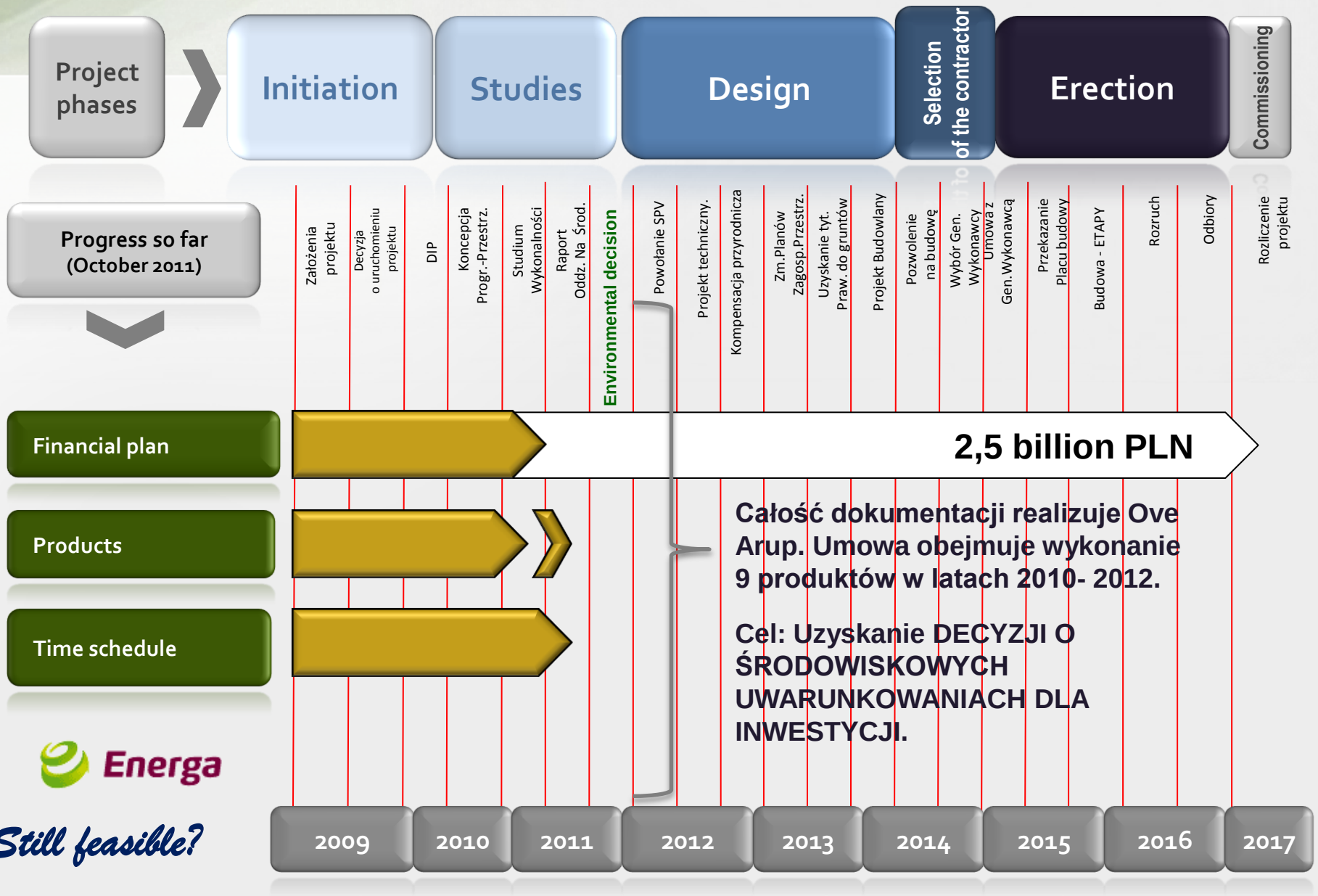
Source: Zygmunt Babiński, Michał Habel

Lower Vistula Valley from the Air

Stabilising weir downstream of the Wloclawek Dam

ENERGA Vistula Project – status of October 2011

Source: **M.Laskowski** (ENERGA SA): **Erection of a Dam and Hydropower Plant at the Vistula River**, RENEXPO, Warsaw, October 26th, 2011



Energa

Still feasible?

Essential barriers in development of hydropower sector in Poland

- Strong opposition from green NGOs and lack of understanding for the significance of hydropower and water management for country prosperity and development among the decision makers
- Ever more harsh environmental requirements - also due to incorporating the valleys of rivers with highest hydropower potential to Natura 2000
- Privileged position of Regional Environmental Directors resulting in lengthy and complicated procedures
- Limited number of attractive and accessible sites for small hydro installations

Polish Renewable Energy Act – a new threat for the sector?

Basic goals:

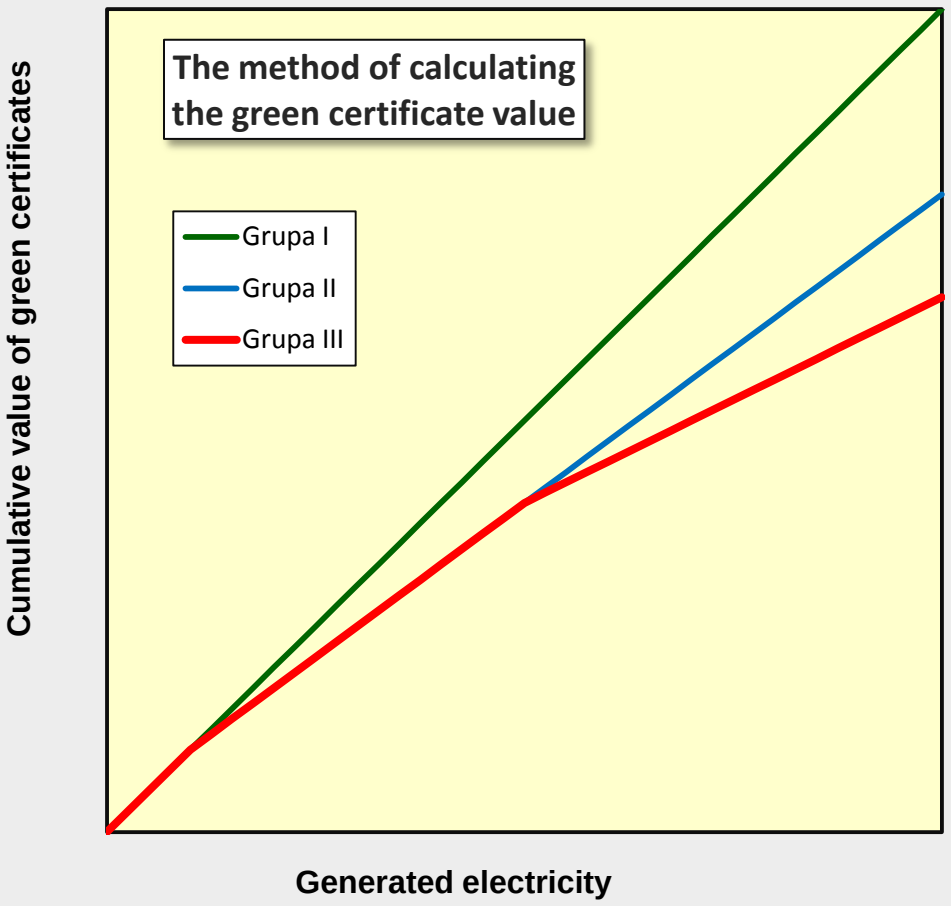
1. Lowering the cost of green certificate system.
2. Optimisation of the system by strengthening support for developers of new technologies (e.g. solar & biogas) and limiting that for economically sustainable ones (co-firing technology, old hydro, .

Methods:

1. Shortening of the support duration to 15 years since (re) commissioning.
2. Applying differentiated weight factors to green certificates depending on the installed capacity.

The last proposal is hardly acceptable for the sector as it discriminates peak load installations. Furthermore, as it follows from the **SHP STREAMMAP** study there is an order of magnitude scatter in specific investment costs between installations - large hydro specific costs may appear higher than those of the small hydro. Lack of state participation in multipurpose projects gives no chance for economic feasibility of projects developed with full civil engineering infrastructure.

Mechanism proposed by TEW (2010)



	≤P_1	≤ P_2	> P_2
≤ 15 years	I	I	I
≤ 25 years	I	II	II
> 25 years	I	II	III

In case of hydropower the installed power often does not reflect the generation capability!

The future of hydropower sector in Poland is not sure. Therefore few reflections instead of a conclusion

- **The position of hydropower in the eyes of decision makers and highly influential circles is fable**. Poor position of hydropower sector is reflected also in the programmes of local and national development, research and development as well as RES related conferences and seminars. Unfavourable opinions about hydropower sector are often disseminated by media – including the public ones – which usually sympathise with pro-ecological NGOs.
- **The greatest threat for the sector is probably the lack of balanced consideration of various environmental, social and economical priorities** when taking decisions on the hydropower future.
- Therefore **promoting the positive image of the sector and lobbying for reasonable compromises in the new legislative and political acts is the essential task** for national hydropower associations and ESHA.

Thank you for your attention!