Implementation of PROGRASS and IFBB in Poland

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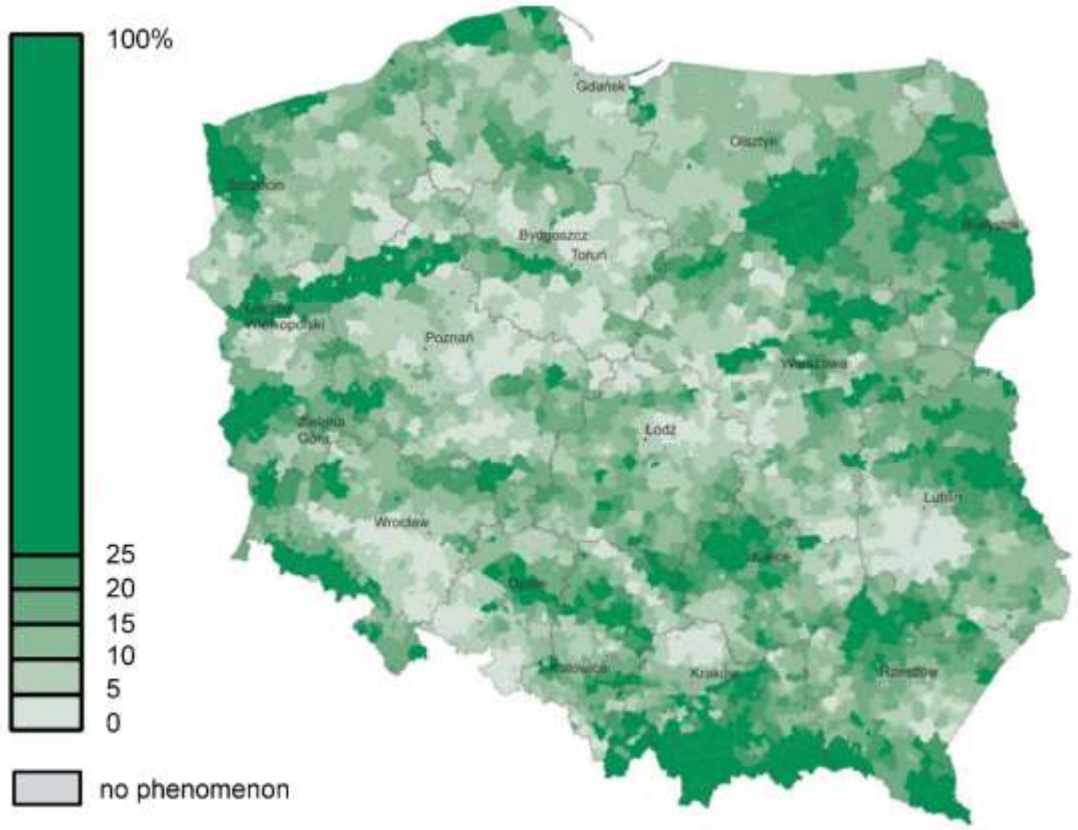
Contents

- Semi-natural grasslands in Poland – resource assessment for biomass production capability
- Polish case study
  - Assessment of the Project feasibility – experimental site
  - Site of planned IFBB implementation
- Conclusions

Meadows in Poland



- 2 565 000 ha
- about 66% are semi-natural
- 11.6% of AUA

Share of meadows in agriculturally utilized area (AUA)

Semi-natural grassland habitats in Poland – conservation status and trends

Habitat	Surface area (ha)	Trend	Protection score
6510 *Arrhenatherion*	685	↓	U1
6520 *Polygono-Trisetion*	140	↓	U1
6410 *Molinion caerulae*	xx	↓	U1
6440 *Cnidion dubii*	1.64	↓	U1
6210 *Festuco-Brometea*	3-4	↓	U1/U2

↓ - fall; xx – lack of data
Habitat status: U1 – poor protection, U2 – insufficient protection

Source: Report for EU Commission 2013

Reasons for the decline of semi-natural grassland area in Poland

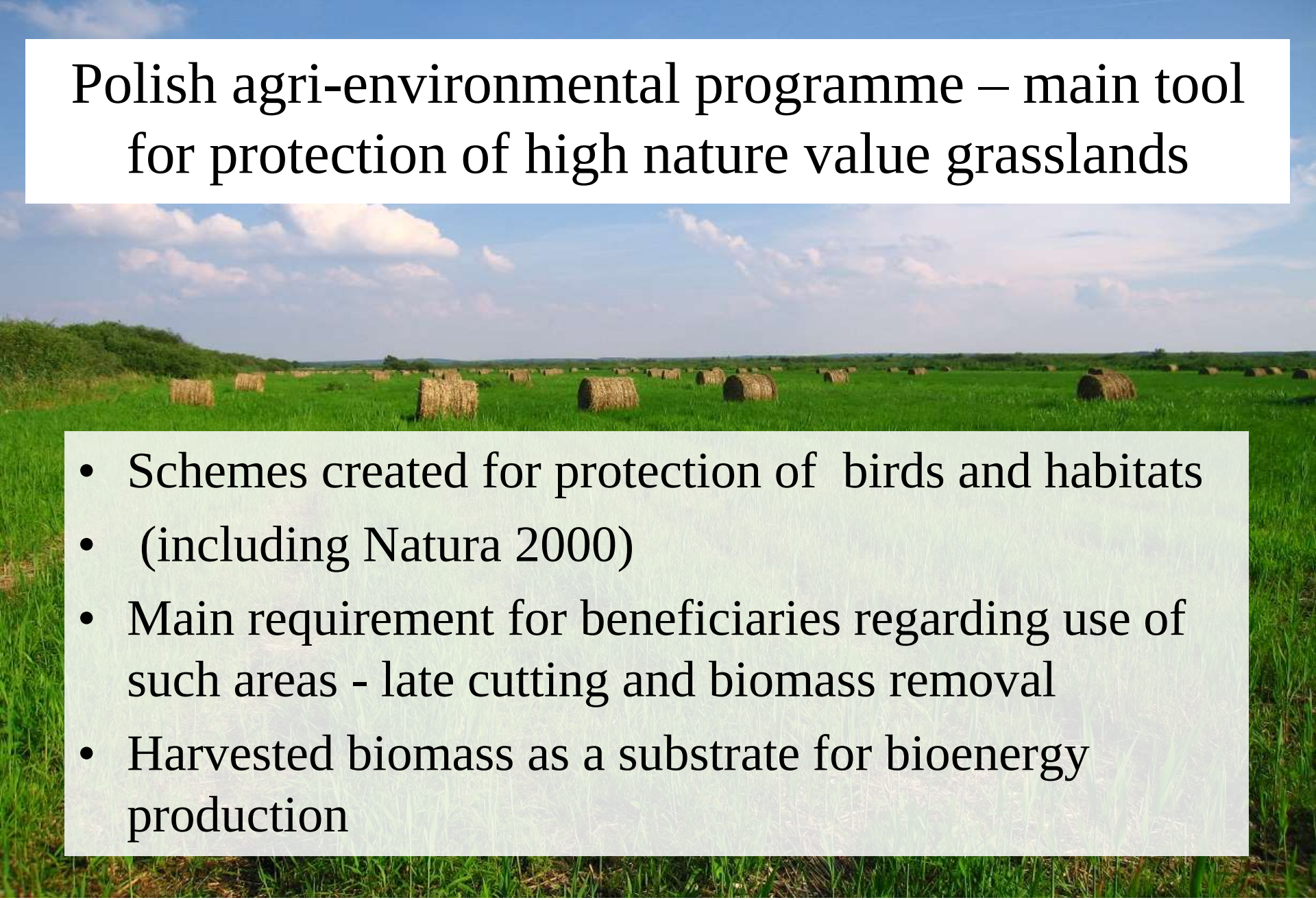
Reason	Priority scale (1-highest, 5-lowest)
land/farm abandonment	1.32
low productivity	2.47
lack of agricultural policy	2.94
intensification of use	3.34
disadvantageous management	4.92
$NIR_{0.05}$	0.40

Source: Goliński i Golińska 2011

The reasons for the abandonment of semi-natural grasslands utilization in Poland

- Drop in livestock numbers (sheep – from 4 million to 220 thousand, cattle – from 10 million to 5 million)
- Low quality of forage (low digestibility, poor feeding value, low efficiency of forage conversion into animal products)
- Concentration of cattle production in particular regions (increase of livestock number per farm), change of the cattle keeping from grazing into indoor

Polish agri-environmental programme – main tool for protection of high nature value grasslands



- Schemes created for protection of birds and habitats
- (including Natura 2000)
- Main requirement for beneficiaries regarding use of such areas - late cutting and biomass removal
- Harvested biomass as a substrate for bioenergy production

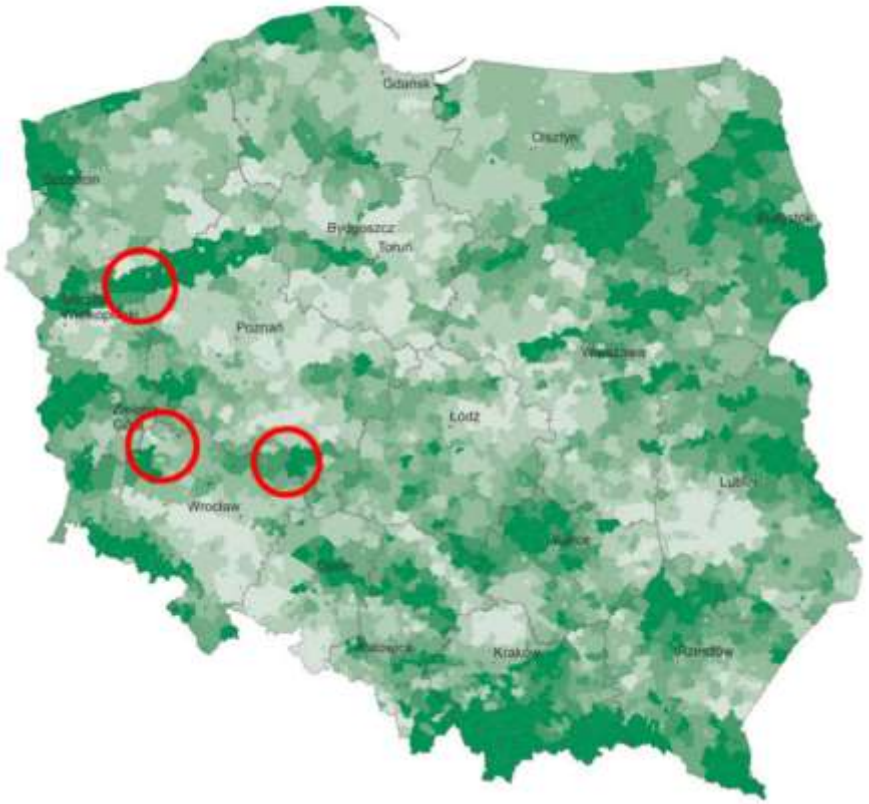
PROGRASS and IFBB in Poland – circumstances of implementation

- The capability of biomass production on Polish grasslands in significant
- Maintainance of the grasslands use is an urgent task of nature conservation in Poland
- The IFBB technology is a chance for preserving semi-natural grasslands

Polish case study – selection of sites and plant communities

Vegetation of selected sites:

- *Phalaris arundinacea* dominated community
- *Phragmitetum australis*
- Tall-sedge community dominated by *Carex riparia*



Noteć River valley
Barycz River valley
Przemkowski Landscape Park

Analysis of the biomass harvested in the selected sites

Item	Unit	Barycz River valley		Noteć River valley	
		Mean	Range	Mean	Range
DM yield	t ha^{-1}	5.7	3.5-9.0	5.4	4.0-7.0
DM content	%	30.8	21-43	36.4	30-39
Crude protein	g kg^{-1} DM	103.5	68-180	84.6	65-103
Neutral detergent fiber	g kg^{-1} DM	509.8	459-583	563.1	510-592
Acid detergent fiber	g kg^{-1} DM	316.1	279-351	367.0	302-397
Crude ash	g kg^{-1} DM	63.6	52-75	64.5	50-84

Harvest date: 1-10 August 2012; dry matter yield estimation and chemical analyses: commonly used methods

Źródło: Goliński i Goliński 2013

Experimental site – Noteć River valley characteristics of vegetation

- syntaxons typical for riparian areas in Poland
- Important Natura 2000 birds site
- *Molinio-Arrhenatheretea* community with a rich flora characteristic of *Agropyro-Rumicion crispi* and *Calthion* alliances, differentiated towards *Phalaridetum arundinaceae*
- If abandoned, the communities evaluate in direction of shrubby vegetation (e.g. *Salicetum pentandro-cinerea*) and than to the woody vegetation (e.g. *Alnion glutinosae*)

Plant diversity of vegetation on experimental site

The nature of Lower Noteć Valley

Substrate production at the experimental site

Cutting:

- Equipment adjusted to wet areas
- Delayed cutting date

Substrate production at the experimental site

Biomass treatment before ensiling:

- High dry matter content may cause for problems with fermentation
- Solution: application of microbial inoculants

Substrate production at the experimental site

Harvesting:

- Biomass compaction into round bales
- Transport into a storage place

Substrate production at the experimental site

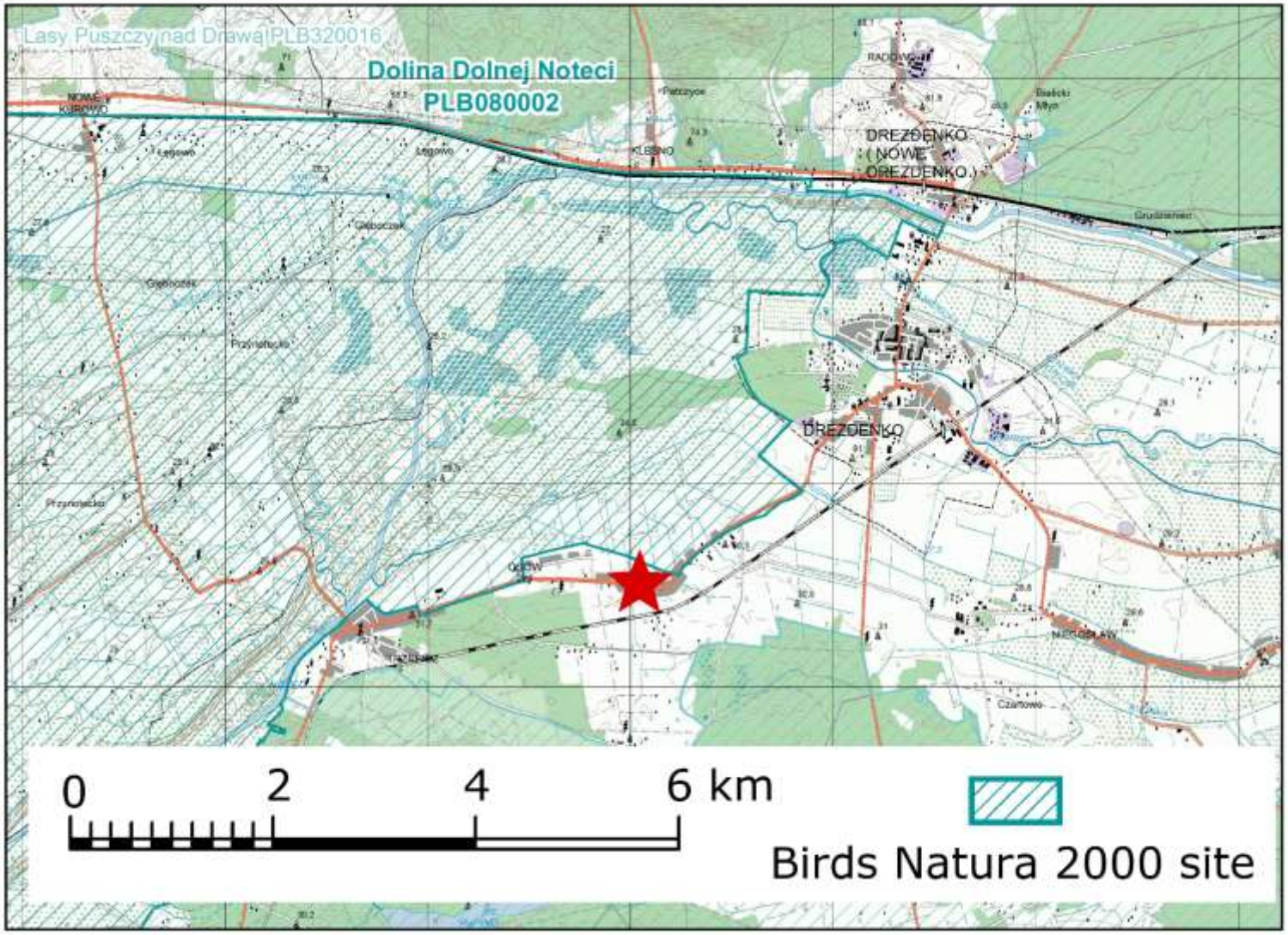
Biomass conservation:

- Wrapping bales with a film
- Quality assessment of ensiled biomass

Test combustion characteristics of biomass from Polish experimental site

Dominant species	*Phalaris arundinacea, Carex acutiformis, Carex acuta*	
Ash	g kg^{-1} DM	35.4
Dry matter (DM)	% of FM	93.3
Heating value (LHV)	(MJ kg^{-1} DM)	17.94
	(MJ kg^{-1} FM)	16.57
N	g kg^{-1} DM	7.0
K		1.1
Cl		0.8
S		0.9

Polish case study – Site of IFBB implementation



Planned investment

- Plant investor – BioEn Ventures
- IFBB add-on installation connected with a 2MW biogas plant
- Substrate for biogas plant – vegetable waste and chicken manure
- Grassland area covered with the agri-environment scheme „Birds protection”
- Substrate for IFBB add-on – biomass collected from 1st August on
- 1000 ha of grasslands located up to 15 km from the plant
- 1 cut per year, app. 5 tones per ha

Economic analysis

Pre-calculation of an IFBB plant in Poland

Assumptions:

Parameter	**Unit**	**Value**
Biomass throughput	t DM / year	5000
Grassland production costs	€ / t DM	35
Electricity costs	€ ct./kWh$_{el}$	10.70
Heat costs	€ ct./kWh$_{th}$	3.00
Briquette price	€ / t	100.00
Rate of briquette price increase	% / year	5.7

Economic analysis

Investment costs	€
Machinery, technical equipment	
Biomass macerator	90.000
Solids feeder (two feeders)	158.000
Conditioning of biomass	165.000
Screw press	170.000
Storage tank for biomass mash	17.171
Press fluid storage tank	19.747
Press cake drying	98.000
Press cake briquetting	250.000
Pumping devices	66.967
Elevation technique	41.210
Briquette storage	35.000
Other technical and constructional installations, Planning	
Factory building	165.996
Storage for grassland material (concrete silos)	338.175
Wheel loader	67.000
Costs for construction grounds	50.000
Costs for plant infrastructure	150.000
Costs for plant installation	150.000
Planning and permission	203.227
Total investment costs	**2.235.493**

Economic analysis

Investment costs	€
Machinery, technical equipment: Biomass macerator, solids feeder (two feeders), conditioning of biomass, screw press, storage tank for biomass mash, press fluid storage tank, press cake drying, press cake briquetting, pumping devices, elevation technique, briquette storage	1.111.095
Other technical and constructional installations, planning: Factory building, storage for grassland material (concrete silos), wheel loader, costs for construction grounds, costs for plant infrastructure, costs for plant installation, planning and permission	1.124.398
Total investment costs	**2.235.493**

Economic analysis

Capital-related costs (€ a^{-1})		343.139
Operation-related costs (€ a^{-1})		70.606
Consumption-related costs (€ a^{-1})		553.997
	Electrical process energy	206.655
	Thermal process energy	148.268
	Substrate input	199.054
Other costs (€ a^{-1})		14.989
Total costs (€ a^{-1})		**982.711**
Incoming payments (€ a^{-1})		**1.051.525**
	Electricity (market sales)	-
	Electricity (from green certificates)	348.210
	Electricity (heat usage)	-
	Grass pellets	703.315
Total annuity (€ a^{-1})		**68.814**
Internal Rate of Return (IRR; %)		**11.05**

Conclusions

- Riparian vegetation in Poland is dominated by plant communities which provide promising substrate for the bioenergy production
- Agri-environment law in Poland favors the application of IFBB technology
- Although legal and financial tools which support the green energy production in Poland are unstable, some companies are seriously considering the implementation of IFBB technology

Thank you for your attention!