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THE USE OF MICRO-RENEWABLE ENERGY INSTALLATIONS IN AGRICULTURE

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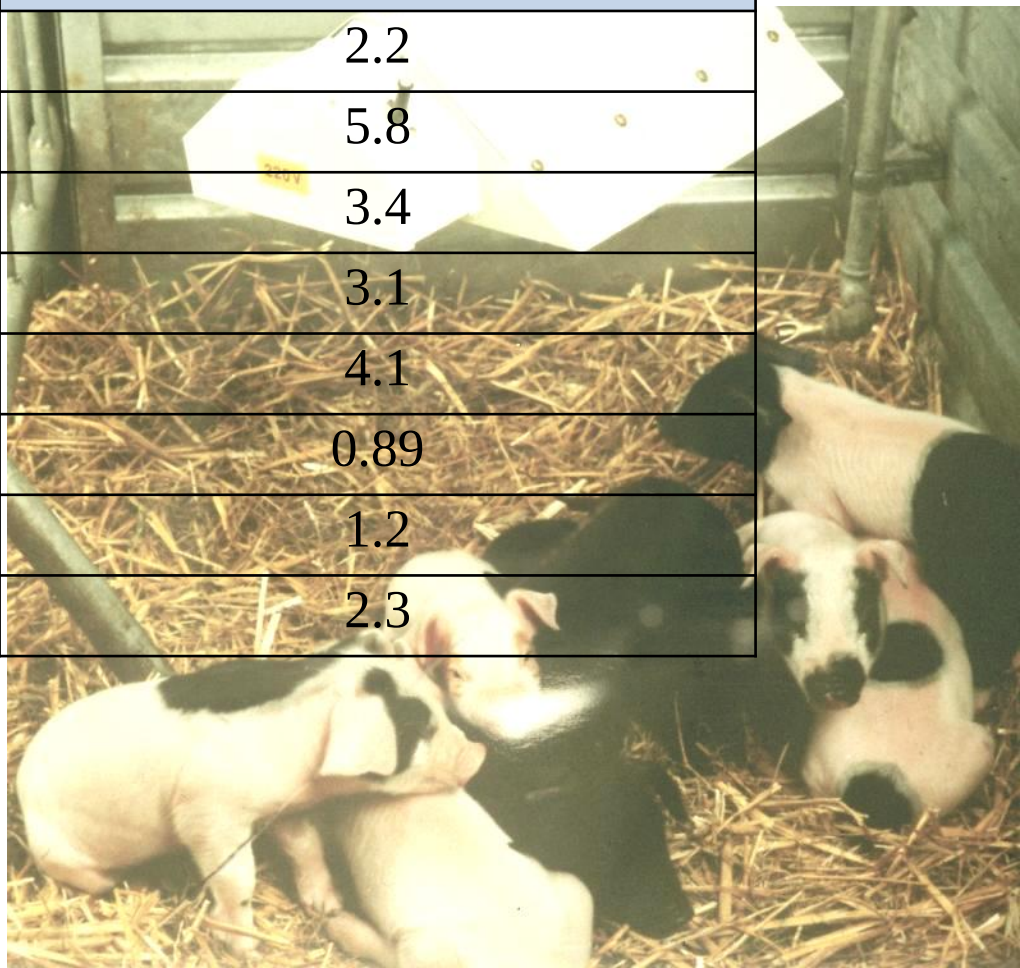
The strategy for the development of the Polish power industry presented in the document *Poland's Energy Policy until 2030*, adopted by the Council of Ministers on 10 November 2009, assumes that renewable energy will account for 15% of the gross final energy structure by 2020. Agricultural micro-renewable installations can play a significant role in obtaining it.

Contemporary intensive agricultural production requires a substantial energy input at the stage of producing food and fodder sources.

Product	Energy cost of product (MJ/kg)
Poultry meat	2.2
Eggs	5.8
Pork	3.4
Sheep meat	3.1
Beef	4.1
Milk	0.89
Cheese	1.2
Butter	2.3



Exhaust gas emissions from different sources in g per 1GJ of extracted energy

Gas Type	Fuel Type			
	Straw	**Wood**	**Fuel oil**	**Coal**
CO_2	332.6	420.65	883.05	1663.13
CO	8.23	15.46	0.152	19.18
SO_2	35.97	15.13	40.65	178.2
NO_X	119.18	79.56	123.24	156.5
CH_4	4.87	6.73	2.92	12.07
TOC	6.45	8.54	13.23	18.45
WWA	0.045	0.065	0.13	0.18
BTX	$127x10^{-2}$	$182x10^{-2}$	$245x10^{-2}$	$698x10^{-2}$
VOC	16.64	25.32	45.12	60.24
PCDDs	$12.4x10^{-3}$	$2.34x10^{-3}$	$7.34x10^{-3}$	$22.76x10^{-3}$
Dust	4.03	13.44	1.73	56.7

All differences in periods statistically relevant at $P \leq 0{,}05$

Breakdown of energy consumption on poultry farms

Factor	Daily energy consumption (Wh/fowl/day)	
	Broilers	Layers
Heating	13 - 20	-
Feeding	0.4 – 0.6	0.5 - 0.8
Ventilation	0.10 - 0.14	0.13 - 0.45
Lighting	-	0.15 – 0.40
Egg storage	-	0.30 – 0.35

Energy consumption in pig production depending on the intensity of production.

Type of production	Energy consumption (kWh/sow/year)	Energy consumption (kWh/fattening pig/year)
Extensive	457 – 1038	385 – 780
Semi-intensive	498 – 914	51 – 134
Intensive	83 – 124	41 – 147

Agricultural micro-renewable energy installations can provide livestock, fruit-growing and vegetable farms with an energy self-sufficiency rate of 70%.

Agricultural micro-renewable energy installations use mostly biomass, wind and solar energy.

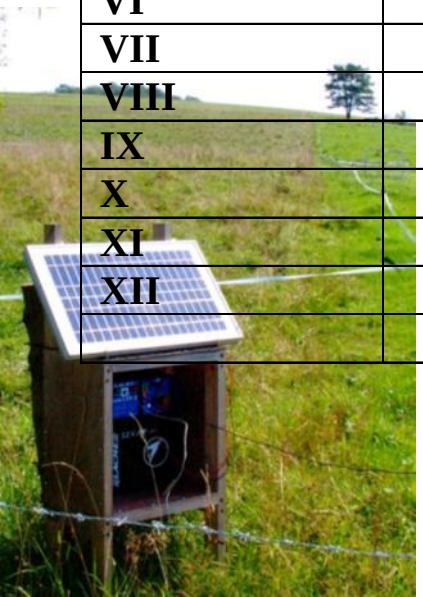
Effective unit energy yield from different renewable sources on a farm

Parameter/ Month	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Photovoltaic system (kWh/m^2/day)	0.16	0.31	0.64	0.80	1.18	1.35	1.36	1.1	0.7	0.65	0.21	0.12
Solar collector (kWh/m^2/day)	0.09	0.65	1.5	3.1	4.76	5.1	5.1	4.3	2.54	0.99	0.13	0.05
1.5 kW wind-powered generator (kWh/day)	56.4	56.3	55.7	54.6	52.3	49.7	47.4	50.7	57.8	59.1	57.4	58.3

The table shows the relationship between weather conditions and the extraction of solar energy and wind energy. For solar energy, the values in the period from October to March are low in comparison with the summer. The efficiency of the wind-powered generator depends on terrain and its distance from the ground. Generally, wind starts to blow at the height of 50 m. The photo shows photovoltaic systems in the piggery of ZD IZ PIB Żerniki Wlk.

Balance of energy necessary to supply the floor heating system of a pig farrowing house.

Month	Requirement (kWh)	Coverage		
		Generator (%)	Collector (%)	Photovoltaic System (%)
I	412.3	410.3	3.23	10.4
II	372.4	453.5	26.2	22.5
III	412.3	405.2	54.5	41.7
IV	399.0	410.5	178.9	52.6
V	412.3	380.8	173.1	77.6
VI	399.0	373.6	191.7	91.3
VII	412.3	344.9	185.5	89.0
VIII	412.3	368.9	156.4	89.0
IX	399.0	434.5	95.4	74.4
X	412.3	430.0	36.0	45.8
XI	399.0	431.5	4.9	14.2
XII	412.3	424.2	1.8	7.8
	On average	405.6	92.3	58.9



Example of using three sources for heating a pig farrowing house. A 1.5 kW wind-powered generator, a 400 kW photovoltaic system, a 500 kW solar collector. Floor heated with hot water. The photo shows a photovoltaic system supplying power to an electric fence on mountain pastures.