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Workshop «Biogas Process Optimisation», Task 37

Energy from biogas as an operating reserve?

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The question

Virtual biogas power plant: The solution for power grid stability?

Contents

- Cooperative Ökostrom Schweiz (Switzerland)
- Principle of a virtual power plant
- The uses for the balance group renewable energy
- The necessary installations
- Next steps

Cooperative Ökostrom Schweiz

name:	Ökostrom Schweiz
legal form:	cooperative
board:	agricultural biogas producers
Members:	only agricultural biogas producers
locations:	Frauenfeld TG (headquarter) Brugg AG and Posieux FR
number of employees:	9 Full/part-time employees
Member committees:	biomass, carbon reduction certificates
Biomass Switzerland:	Member as the representative of the agricultural biogas producers

Cooperative Ökostrom Schweiz

- Currently are about 100 farmers members. More and more are joining. They produce green electricity and heat from the manure / organic waste.
- About 65 members are in production
- About 40 biogas plants are in the planning and implementation phase.
- These members are representing about 95 percent of all agricultural producers.

Cooperative Ökostrom Schweiz

- Selling renewable energy certificates from agricultural biogas plants.

- Administrative processing and sale of carbon equivalent certificates from agricultural biogas plants.

- Ökostrom Schweiz is the owner of the first registered projects of the guidance of the Federal Office for the Environment in Switzerland and recipients of the first carbon reduction certificates issued .

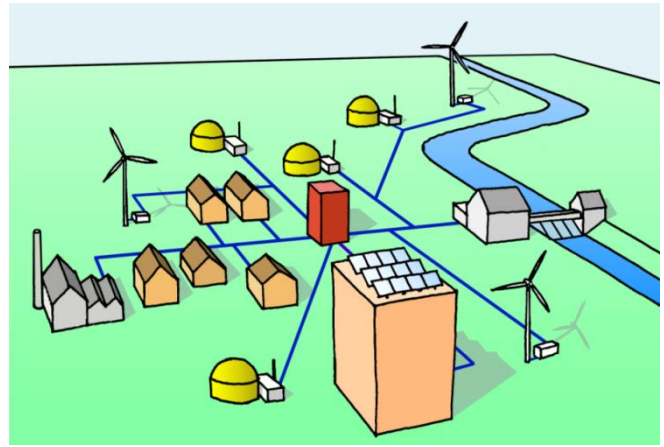
Cooperative Ökostrom Schweiz

- Political lobbying
- Coordination of organic waste. Total solutions for industrial companies and municipalities for organic waste and distribution on agricultural biogas plants
- Collaboration with other biomass organizations
- Other activities, which generate additional revenue for the agricultural biogas plant operators: for example the agricultural virtual power plant.
- developing a benchmarking system for agricultural biogas plants

Principle of a virtual power plant

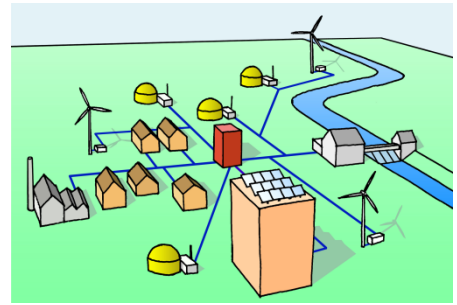
Characteristics of renewable energy production:

- Power plants from renewable energy sources (biomass, solar, small hydro, wind) are usually small
- The power plants are decentralized
- The independent producers have no strong position
- Electricity production from solar and wind plants are swaying



- **Biogas plants produce base load energy and have storage options**

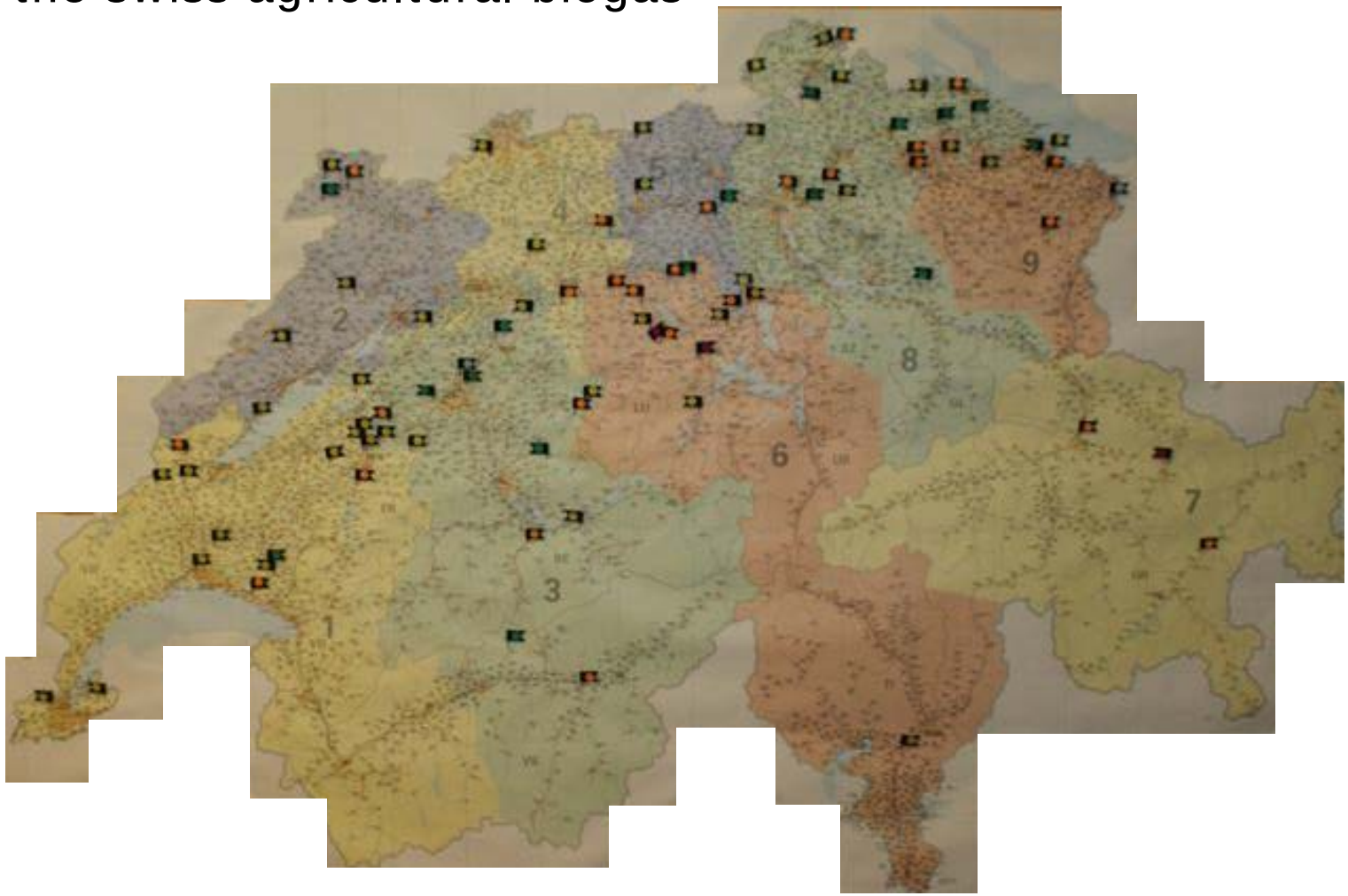
Principle of a virtual power plant



- Individual decentralized biogas plants are combined to a virtual large power plant by an intelligent central control system based on modern communication technologies. It doesn't matter where the individual plants are located.
- Wind energy, photovoltaic and small hydro power plants could also be integrated in the biomass virtual power plant
- Large consumers could be integrated too

Principle of a virtual power plant

Map of the swiss agricultural biogas plants



Principle of a virtual power plant

The potential of control energy production

Year	2012	2014	2016	2030 *
Amount biogas plants	65	90	120	1000
installed capacity (megawatts)	9	13	16	80

Source: the minimum, estimation Ökostrom Schweiz

* It is only possible, when the policy creates good conditions for pure manure biogas power plants

The average performance rate is 67%, which means the agricultural biogas plants have

- a capacity of 33% for the production of positive control energy
- a capacity of 67% for the production of negative control energy

Principle of a virtual power plant

Possibility to produce control energy (negative or positive) ...

Technical requirements	1 - 2 hours	3 - 4 hours	4 - 6 hours	7 - 8 hours	Longer than 12 hours
Without additional technical installations					
Gas level measurement					
Methane content meters					
Control by adjusting the feeding					
Procurement of additional gas storage (par example airbag)					

Uses for the balance group renewable energy

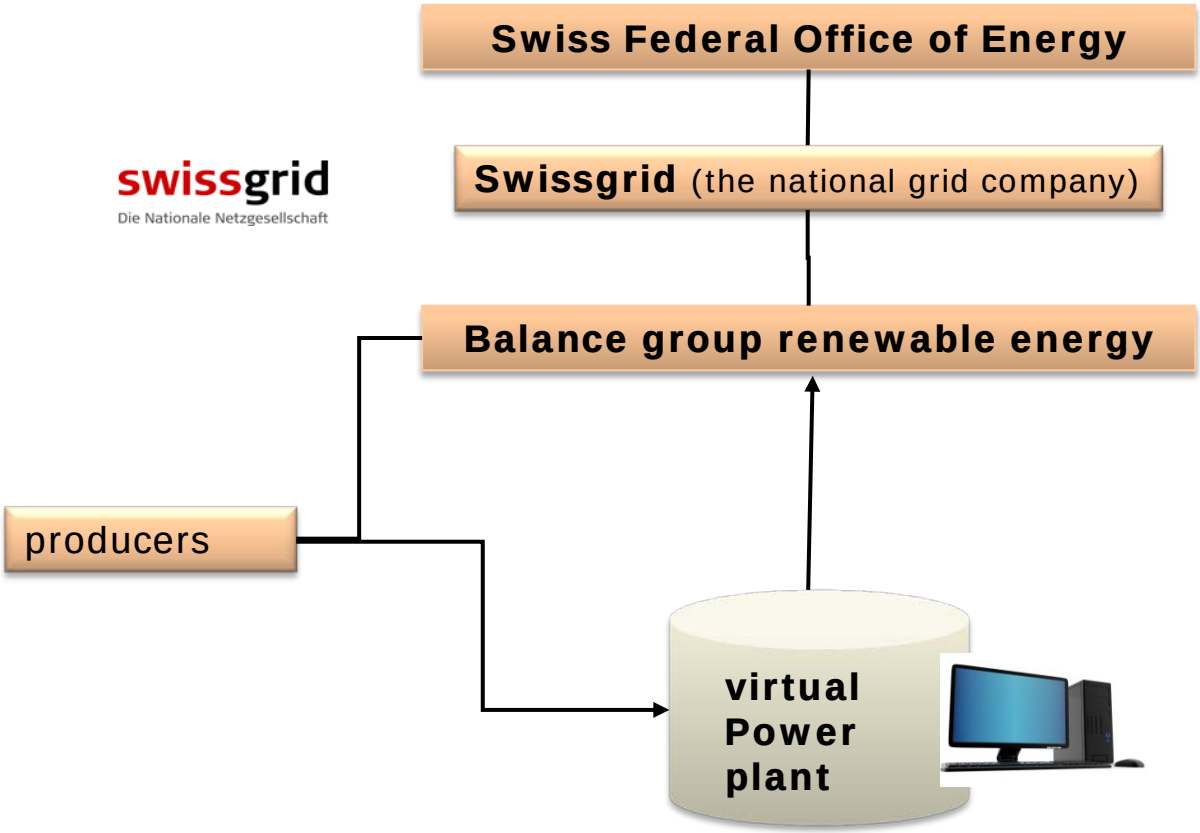
agricultural biogas plants are ideal:

- to produce balancing energy
- for the scheduled controlled production

For:

- the balance group renewable energy
- any balance group
- for regions / communities
- system service provider for swiss grid

Uses for the balance group renewable energy



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

- Schedule-controlled production
- intraday balance energy (positive and negative)

Uses for the balance group renewable energy

Bundled Schedule controlled production

Balance group renewable energy

Einzelfahrpläne A01-A100

index	Zeit von - bis	Sollwert (kW)	Produktion (kWh)
0	0:00 - 0:15	50,00	12,50
1	0:15 - 0:30	50,00	12,50
2	0:30 - 0:45	50,00	12,50
3	0:45 - 1:00	50,00	12,50
4	1:00 - 1:15	50,00	12,50
5	1:15 - 1:30	50,00	12,50
6	1:30 - 1:45	50,00	12,50
7	1:45 - 2:00	50,00	12,50
8	2:00 - 2:15	50,00	12,50
9	2:15 - 2:30	50,00	12,50
10	2:30 - 2:45	50,00	12,50
11	2:45 - 3:00	50,00	12,50
12	3:00 - 3:15	50,00	12,50
13	3:15 - 3:30	50,00	12,50
14	3:30 - 3:45	50,00	12,50
15	3:45 - 4:00	100,00	25,00
16	4:00 - 4:15	100,00	25,00
17	4:15 - 4:30	100,00	25,00
18	4:30 - 4:45	100,00	25,00
19	4:45 - 5:00	100,00	25,00
20	5:00 - 5:15	100,00	25,00
21	5:15 - 5:30	100,00	25,00
22	5:30 - 5:45	100,00	25,00
23	5:45 - 6:00	100,00	25,00

automatisch generierter Poolfahrplan A

index	Zeit von - bis	Sollwert (MW)	Produktion (MWh)
0	0:00 - 0:15	5,00	1,25
1	0:15 - 0:30	5,00	1,25
2	0:30 - 0:45	5,00	1,25
3	0:45 - 1:00	5,00	1,25
4	1:00 - 1:15	5,00	1,25
5	1:15 - 1:30	5,00	1,25
6	1:30 - 1:45	5,00	1,25
7	1:45 - 2:00	5,00	1,25
8	2:00 - 2:15	5,00	1,25
9	2:15 - 2:30	5,00	1,25
10	2:30 - 2:45	5,00	1,25
11	2:45 - 3:00	5,00	1,25
12	3:00 - 3:15	5,00	1,25
13	3:15 - 3:30	5,00	1,25
14	3:30 - 3:45	5,00	1,25
15	3:45 - 4:00	10,00	2,50
16	4:00 - 4:15	10,00	2,50
17	4:15 - 4:30	10,00	2,50
18	4:30 - 4:45	10,00	2,50
19	4:45 - 5:00	10,00	2,50
20	5:00 - 5:15	10,00	2,50
21	5:15 - 5:30	10,00	2,50
22	5:30 - 5:45	10,00	2,50
23	5:45 - 6:00	10,00	2,50

delivery

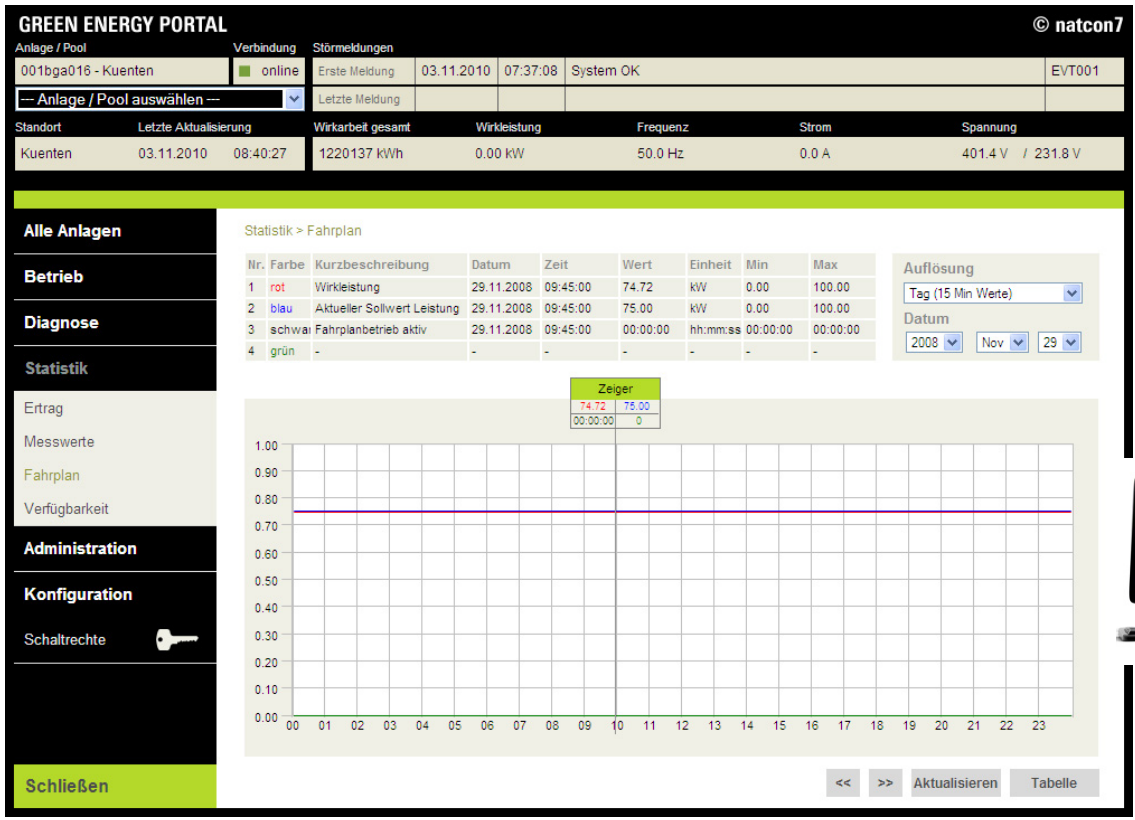




Uses for the balance group renewable energy

Bundled Schedule controlled production

Balance group renewable energy



- setting schedule
- Information on the previous day
- delivery

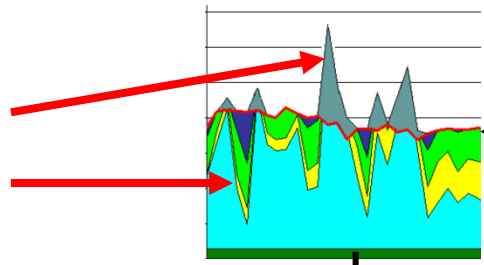
Uses for the balance group renewable energy

Intra day balance energy

Balance group renewable energy

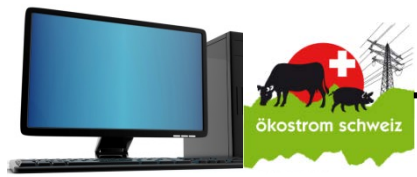
- Daily forecasts
- Allocation to balance groups
- Balance energy procurement

- reduce production
- increase production



short call

delivery

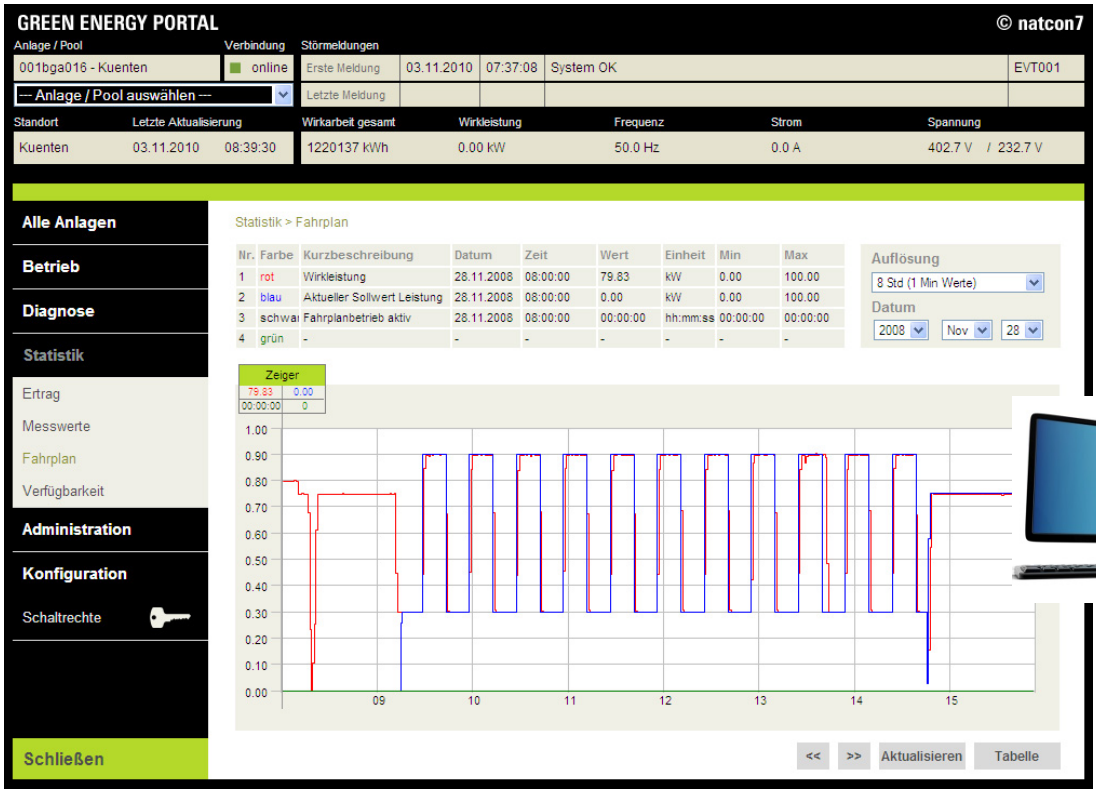


Uses for the balance group renewable energy

Intra day balance energy

Balance group renewable energy

delivery upon order

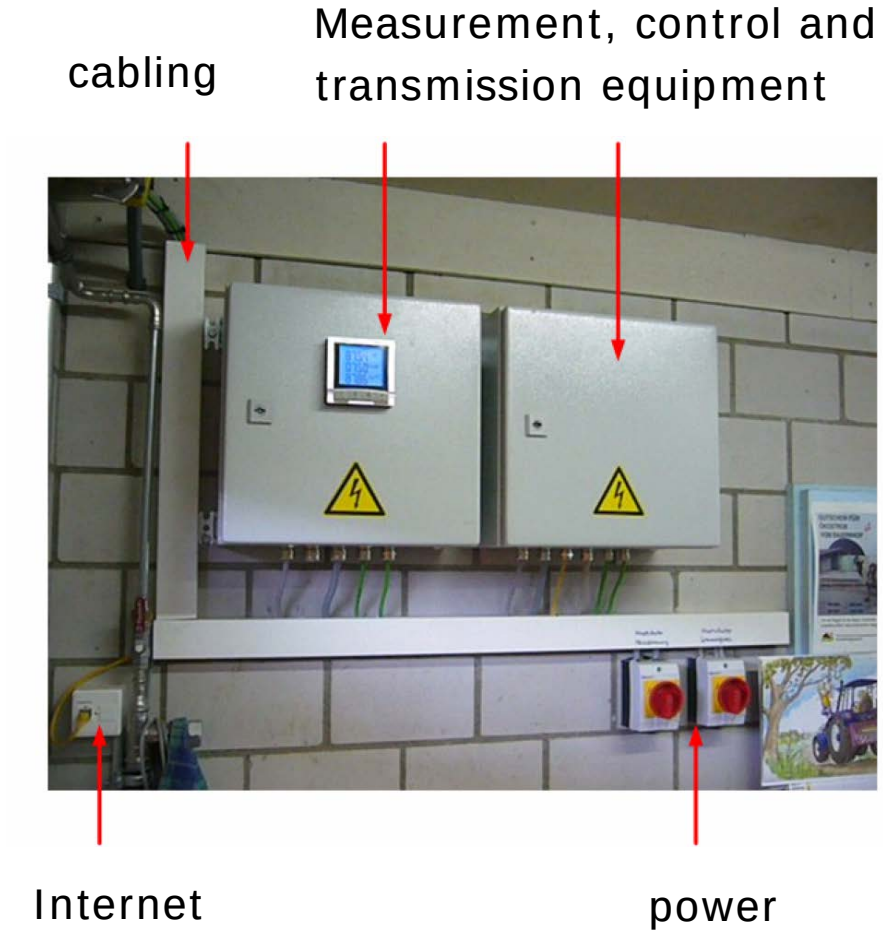


Uses for the balance group renewable energy

General benefits

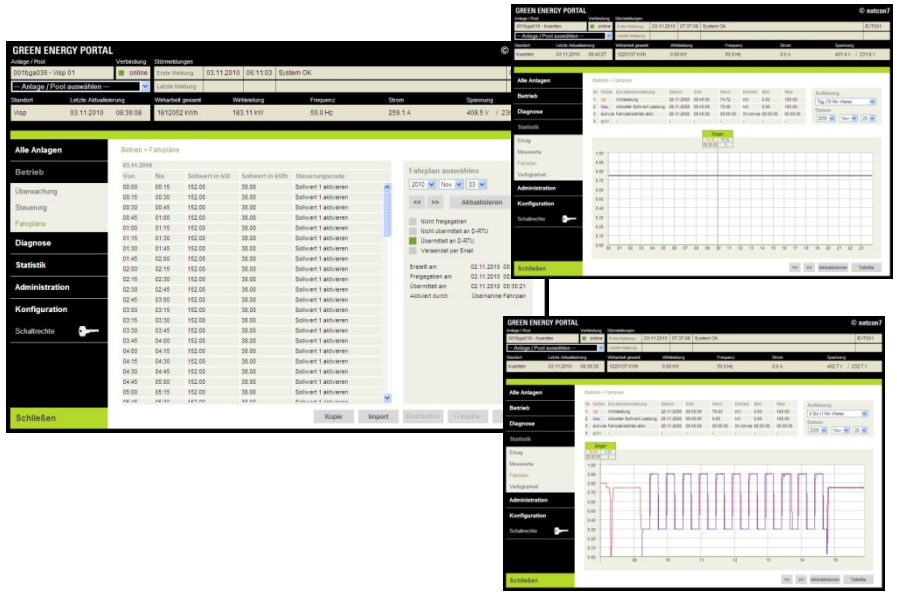
- reduced costs for the balance group renewable energy
- additional bonus for the biogas power plants which are ready to take the extra effort
- create a win-win situation (balance group and power plant operators)

The necessary installation for the biogas power plants



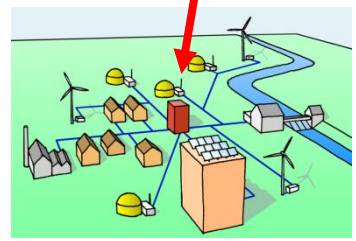
The virtual power plant control

The centerpiece is the web-based “Green Energy Portal”



schedule controlled production

Balance energy production



With this intelligent central control system based on modern communication technologies is it possible to control output from each biogas plant automatically. In the frame of the power plant pooling it’s possible to produce energy like one large power plant.

Achieved project milestones

- autumn of 2008 first agricultural biogas plant was equipped
- autumn and winter 2009/2010 eleven biogas plants were equipped with the necessary installation
- 2011 the first test phase was completed. The result:

  - ➢ Schedule-controlled production works
  - ➢ Evaluation of Green Energy Portal is complete (individual plants, all plants together)
  - ➢ Increase / reduce the production is centrally possible

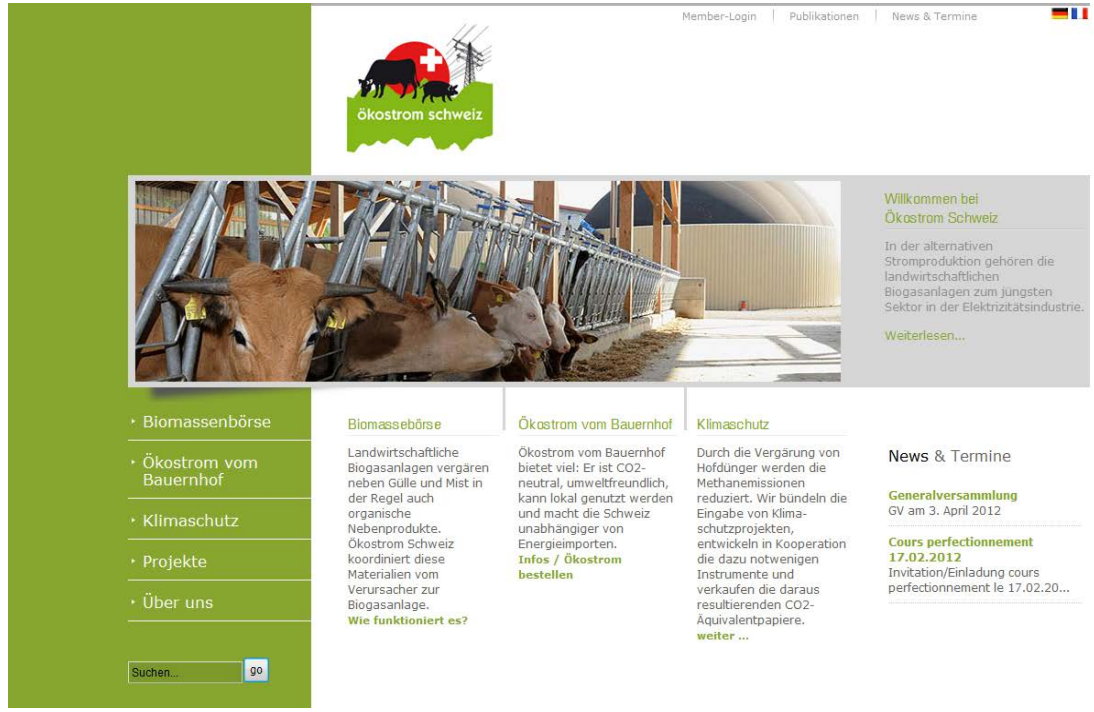
Next steps

- It is positive that in the new Energy Act, explicitly the bonus opportunity, and virtual power plants have been established.
- In the context of a research pilot project (supported by the Swiss Federal Office of Energy) unanswered questions about the structure and operation of the virtual power plant of Ökostrom Schweiz should be clarified.
- The aim is going to the market with the virtual power plant by 2015.

Thank you for your attention!

Virtual biogas power plant: The solution for the power system stability?

Smart grid solutions are a part of the solution.



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Principle of a virtual power plant

Providing positive and negative balancing power (theoretically)

	2012		2014		2016		2030	
power	9'000	kW	13'000	kW	16'000	kW	96'000	kW
utilization	67.0	%	67.0	%	67.0	%	67.0	%
electricity production	**52.82**	**GWh**	**76.30**	**GWh**	**93.91**	**GWh**	**563.44**	**GWh**

Uses for the balance group renewable energy

Benefits of a virtual power plant for renewable energy balance group

- Optimization for funds is given by forecast improvements
- Settlement at Swiss Grid unaffected
- Foundations for additions in the Treaties and safety guidelines EE available
- Current systems can be used for transactions
- Implementation leads to further more market
- Given further development perspectives "market model»
- no additional effort, because the virtual power plant management is handled externally. No countless contacts only with one organisation
- The balance energy needs decreases and the cost are reduced.

Principle of a virtual power plant

The possibility to produce control energy in average performance (67%)

	2012		2014		2016		2030	
positiv	2'970	kW	4'290	kW	5'280	kW	31'680	kW
negativ	9'000	kW	13'000	kW	16'000	kW	96'000	kW
positive 1 our/day and year	1.08	GWh	1.57	GWh	1.93	GWh	11.56	GWh
negative 1 our/day and year	3.29	GWh	4.75	GWh	5.84	GWh	35.04	GWh

Uses for the balance group renewable energy