Project
Voltage stabilization by central reactive power control of biogas power plants

“Virtual Biogas Power Plant”

Concept for a demonstration project

Project in the frame of the Austrian „Impulsprogramm Nachhaltig Wirtschaften“
(Pr. No 811253)

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Overview

- Aims of the project
- Consortium
- Methodology
- Results

Aims of the project

- **Central reactive power control of agricultural biogas plants by the grid operator**
  - 1 – 3 MW active power
  - Region of South Styria
- **Decreasing long distance reactive power transmission**
- **Decreasing energy losses**
- **Decreasing costs, increasing benefits**
- **Increasing grid stability**

Consortium

- **Joanneum Research**
  - Project co-ordination
  - Scientific work
- **STEWEAG / STEG**
  - Grid operator (Styrian top ranking Electricity Concern)
  - Information about reactive power needs (grid data)
  - Technical possibilities / requests of the grid operator
  - Contracutal issues in the viewpoint of the grid operator
- **Biogas plant operators**
  - Plant operation
  - Operation data
  - Technical possibilities / requests of the biogas plant operator
  - Contracutal issues in the viewpoint of the biogas plant operator

Methodology

- **Task 1: Analysis**
  - Technical boundary conditions (local reactive power needs, 1 year observation)
  - Organizational boundary conditions (control flexibility)
  - Economical boundary conditions (Eco-power-tariffs, reactive power remuneration)
  - Leglislative boundary conditions (external interference in the operation process)
  - Comparisson to other decentral suppliers (wind, photovoltaics, RPmarket in UK)
  - Life Cycle Analysis
- **Task 2: Interactive problem dealing (Workshops)**
  - Grid operators
  - Biogas plant operators
  - Representatives in policy and economy
- **Task 3: Preparation of a „Realization Guide“**
  - Contract preparation with (the) grid operator(s) and biogas plant operators

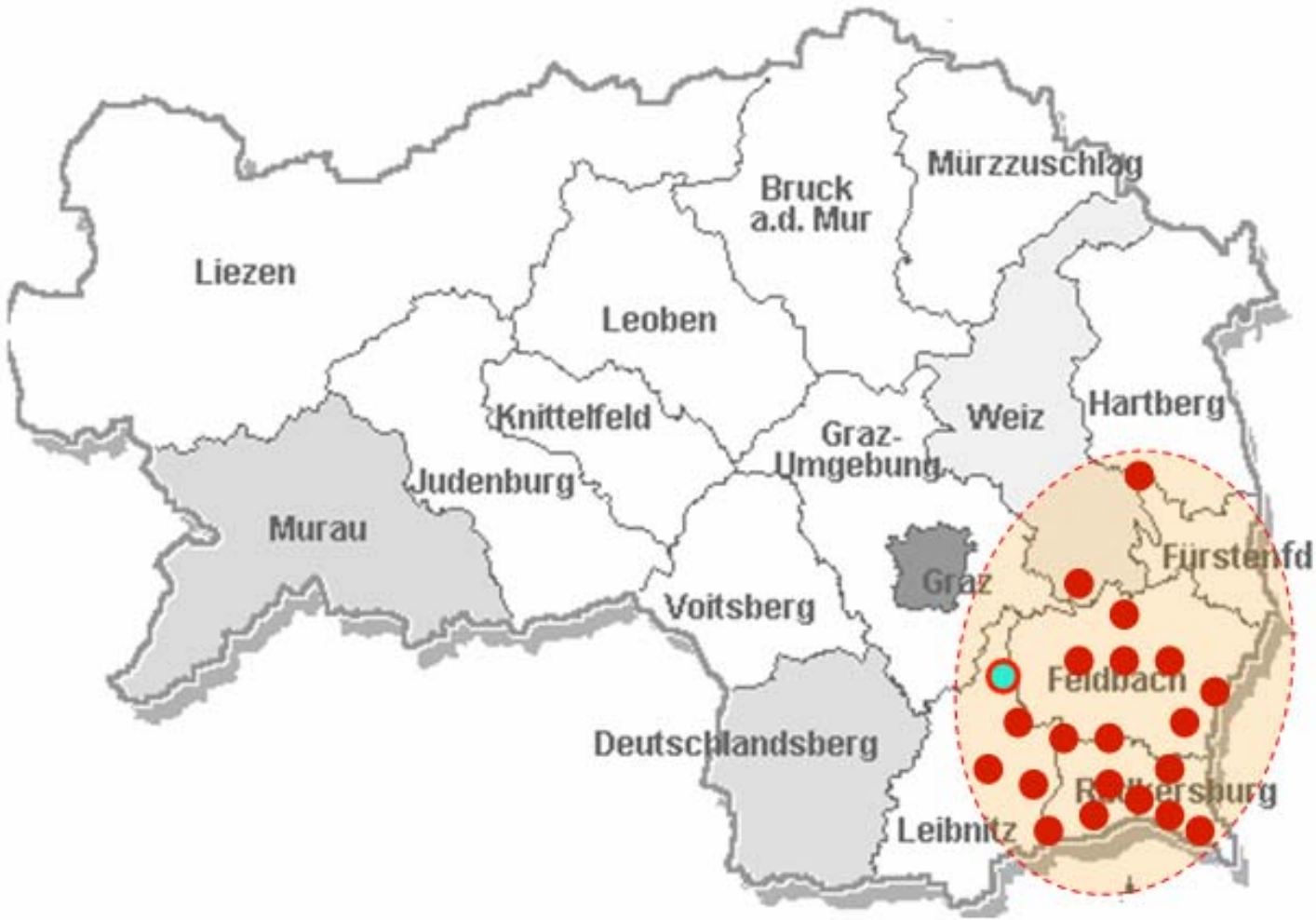
Benefits expected

- **Benefits in Energy Policy**
  - Identification of possibilities to upgrade biogas technology in a techno-economical viewpoint
- **Benefits for biogas plant operators**
  - Possible economic benefit via a better cos φ (yearly avarage)
  - Possible reactive power remuneration (?)
- **Benefits for grid operators**
  - Decreasing of transmission losses
  - Increasing grid stability
- **Benefits in terms of climate protection / international policies**
  - Decreasing of green house gas emissions
  - Decreasing of fossile fuel consumption

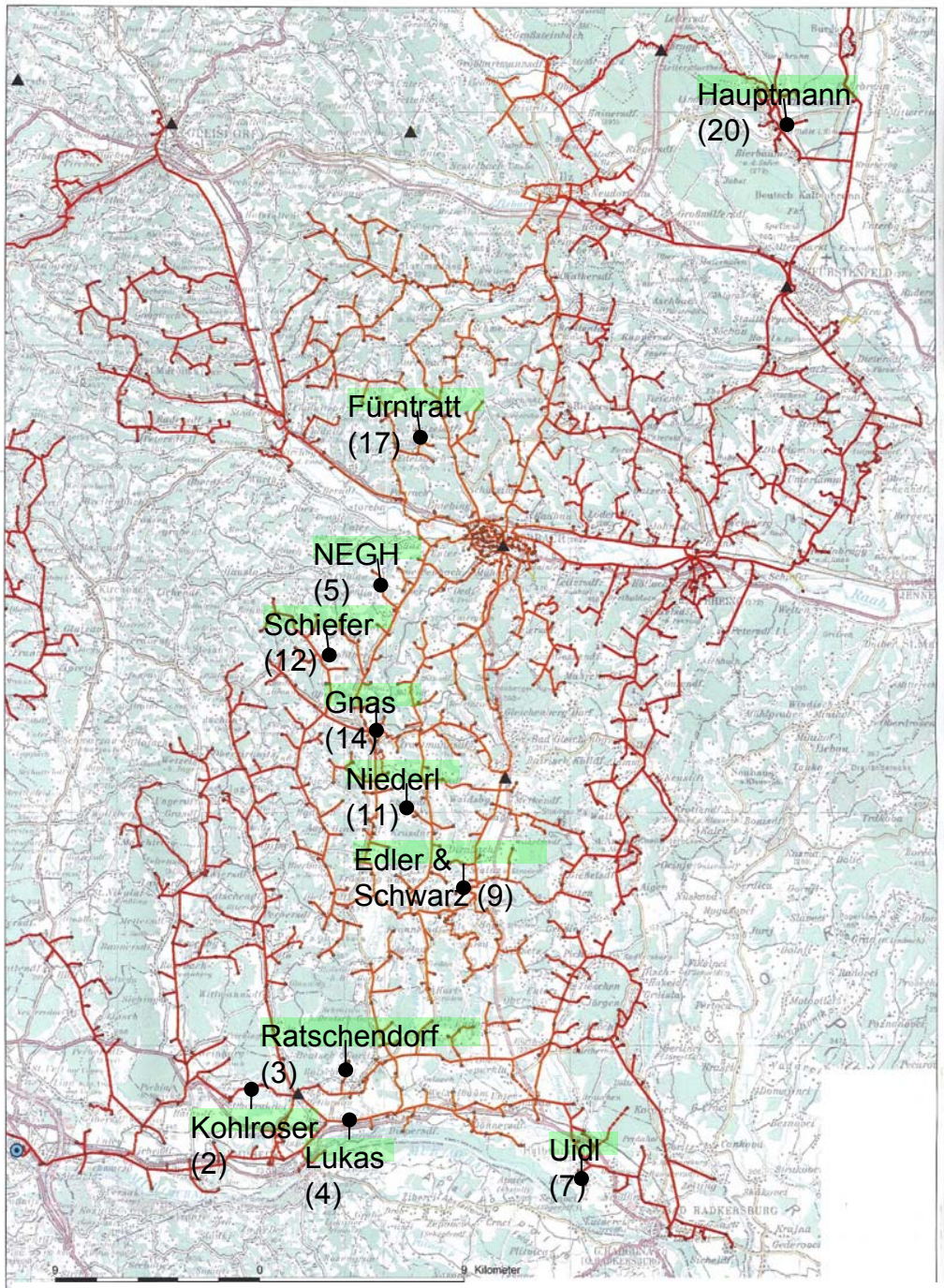
Boundary conditions

- **Currently 27 biogas plants operating in South Styria**
- **Total electrical power 8.8 MW_{el}**
- **11 different grid operators involved**
- **Biggest grid operator: STEWEAG-STEG**
  - 11 biogas plants feeding into the grid of STEWEAG-STEG
  - Total electrical power: 5,1 MW_{el}
- **Most of the biogas plants are equiped with a synchronous generator**
- **All the biogas plants are operating under full active power load conditions in go/stop modus**
- **cos φ of most biogas plants is currently set to 0,9 – 0,92**
- **Operators of biogas plants are co-operative and interested in improvements / innovations in terms of economy and ecology**

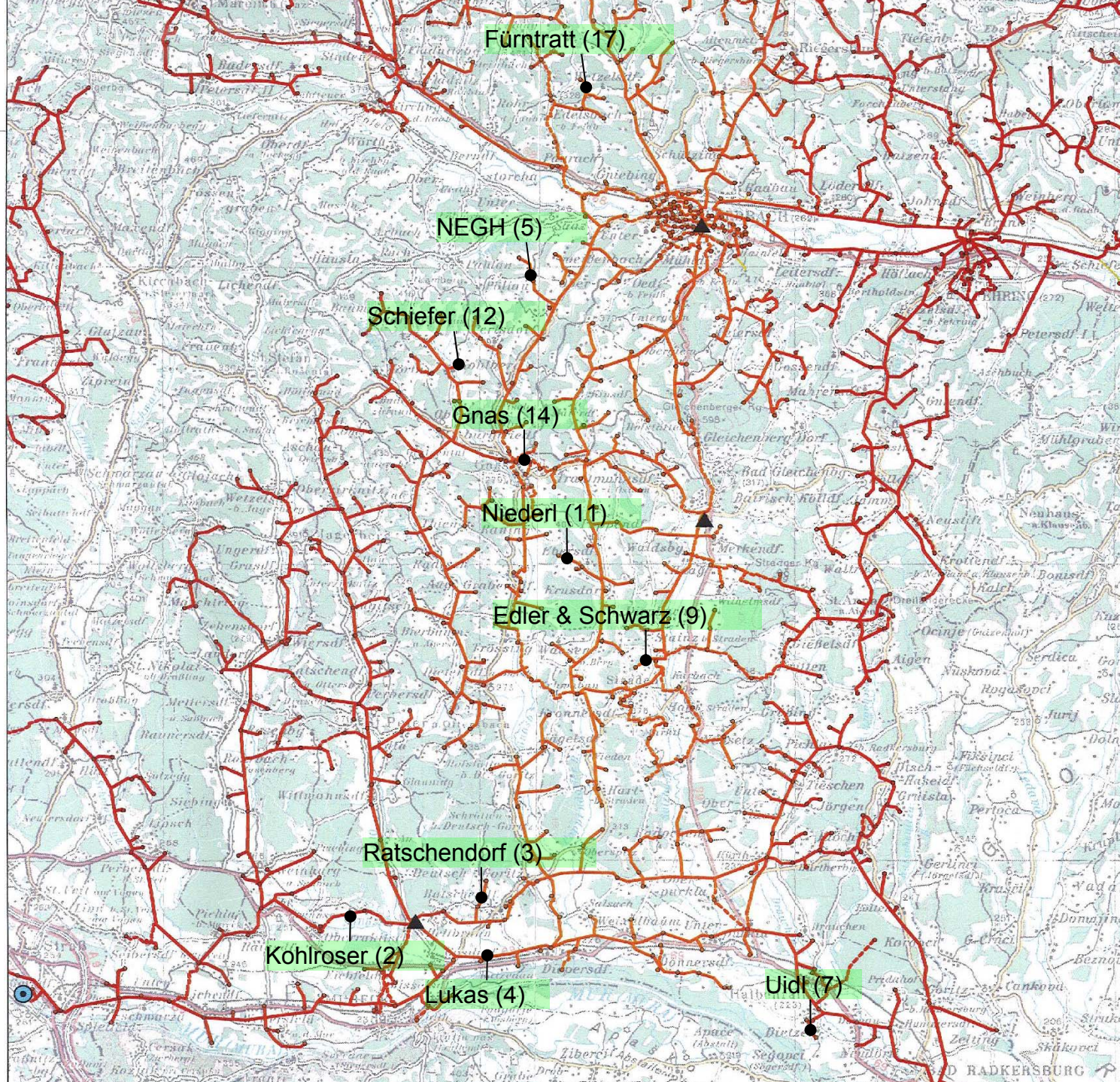
Selected biogas plants in Styria



Biogas-plants at the grid of STEWEAG-STEG (1)



Biogas-plants at the grid of STEWEAG-STEG (2)

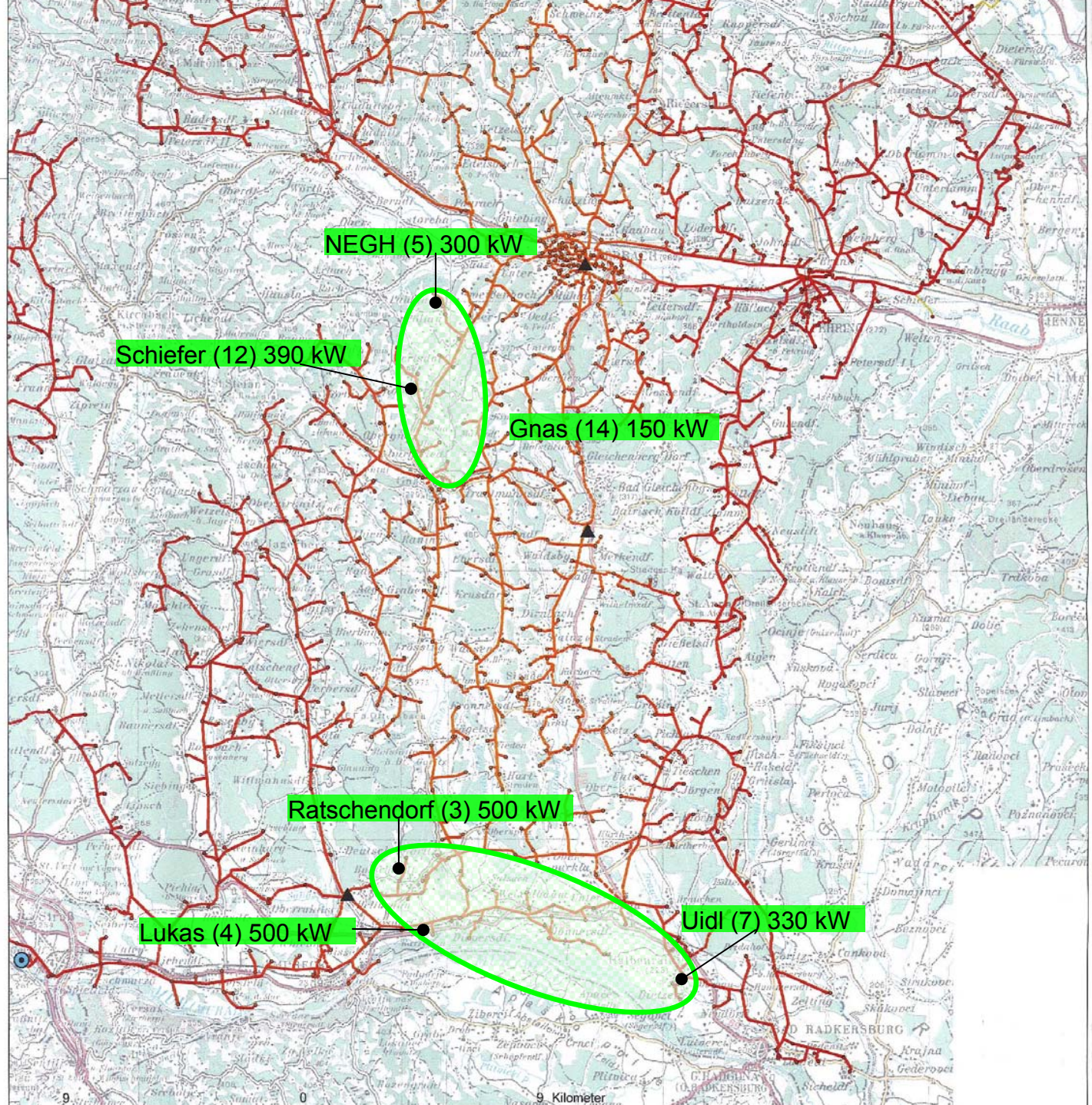


Preliminary results

- **In the investigated region 6 (2 * 3) biogas plants are feeding into the same middle voltage grid section:**
  - **3 biogas plants with together 0.8 MW_{el} (total grid section power 10.8 MW)**
  - **3 biogas plants (other grid section), together 1.3 MW_{el} (total grid section power 10 MW)**

Selected biogas plants

Virtual biogas power plant



Summary

- Technically suitable options for realization of a „Virtual biogas power plant” have been identified and investigated in detail.
- 6 of 27 biogas plants suitable, due to some boundary conditions of the grid (11 different grid operators)
- Expected reactive power: +/- 0,21 MVAr
- Possibilities for practical realization are currently discussed with the biogas plant operators and the grid operators.