



26th World Gas Conference

1 – 5 June 2015 – Paris, France



TS WOC 5.4 : Technology and economic aspects for power to gas and upgrading of biogas to natural gas quality

GENEVA BIOGAS PURIFICATION PLANT

Caroline MAZZOLENI / Julien ANDRE
Services Industriels de Genève, Switzerland



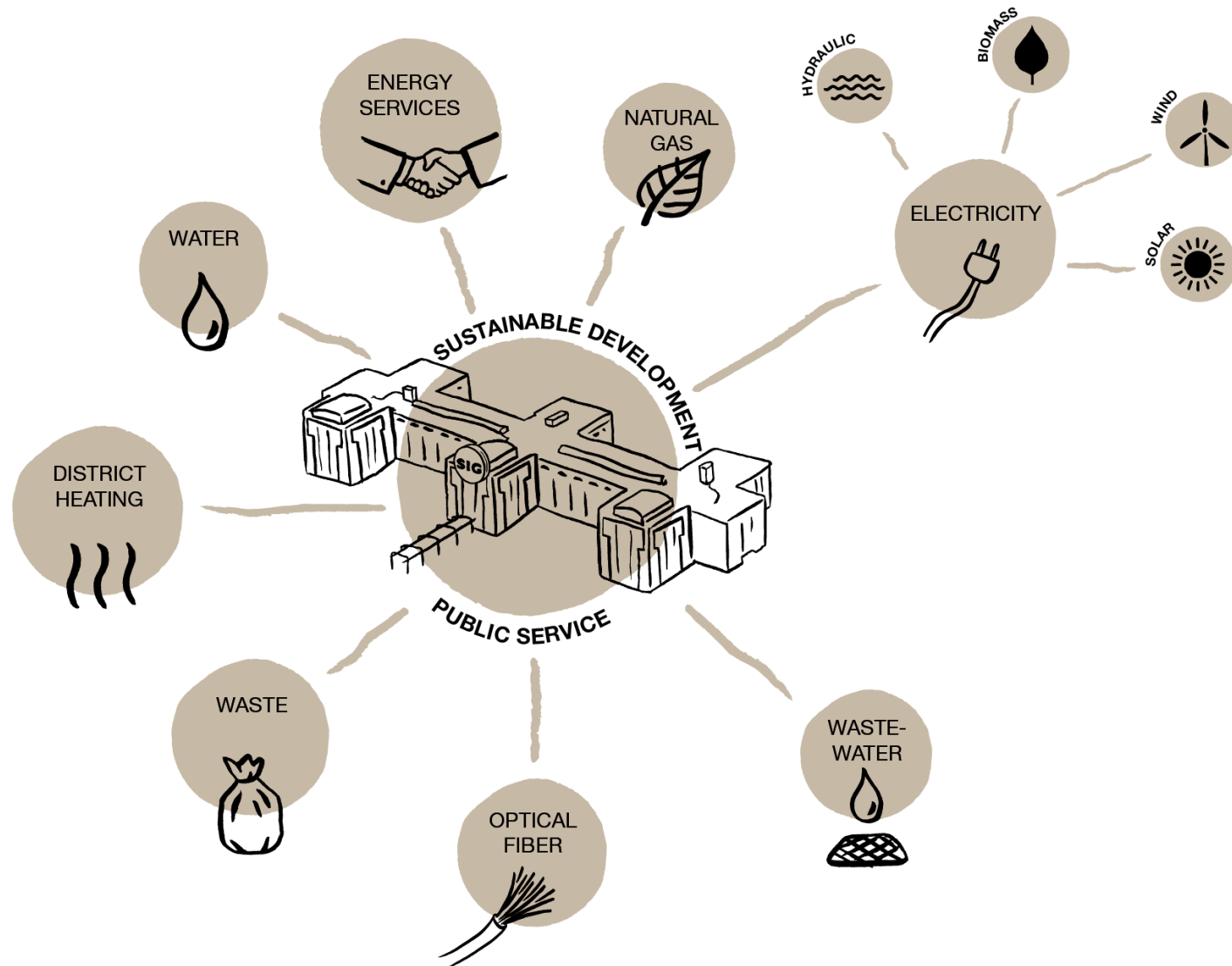
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Services Industriels de Genève

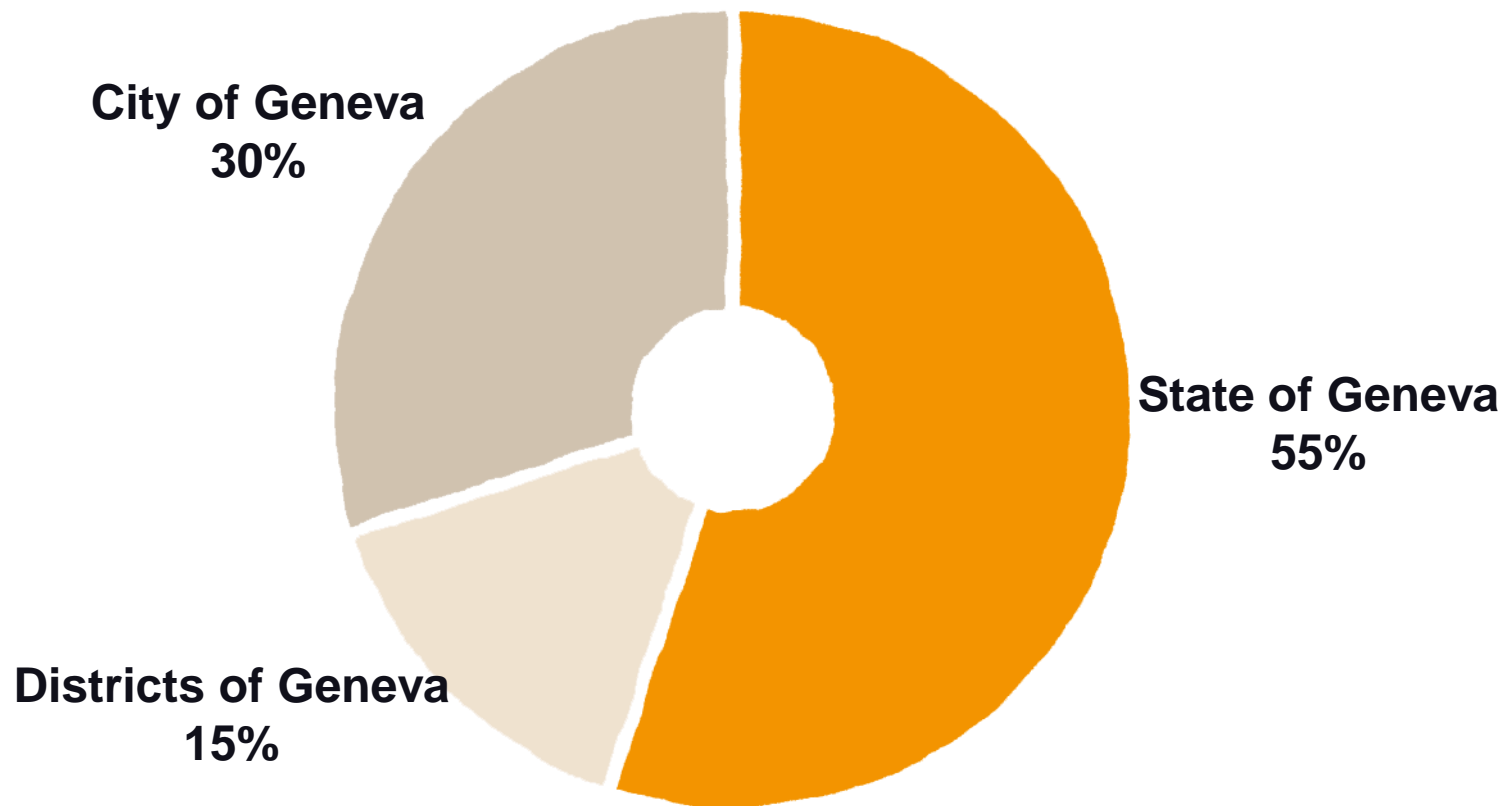


SIG – Areas of expertise



SIG - Owners

- Autonomous public company
- Capital of CHF 100 million :



SIG – Our employees

- 1'700 employees
- More than 100 trades and professions presented
- Serving the needs of 250'000 customers

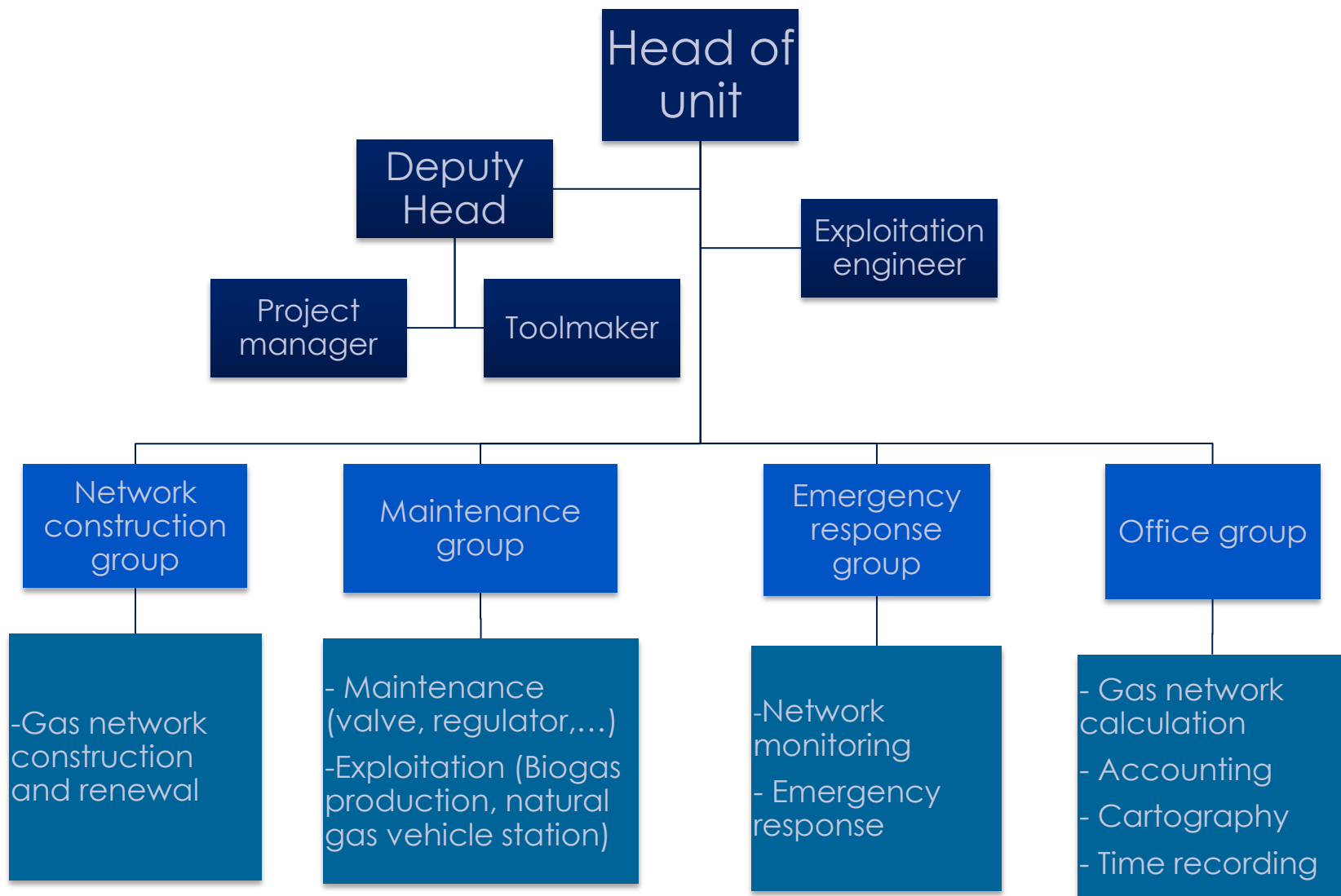


SIG – Natural gas distribution networks

- A reliable and efficient network
 - Which meets the goals of the cantonal policy in terms of reduction of CO₂ (substitution fuel oil / gas)
 - Which pursues safety control in particular through a program of replacement of steel with PE pipes
 - Integrating renewable energies (biogas production)
- 68 employees manage 720 km of gas pipes
 - 3000 GWh of natural gas delivered in 2014
 - 120 regulator stations ensure the distribution of natural gas



SIG - Gas network unity



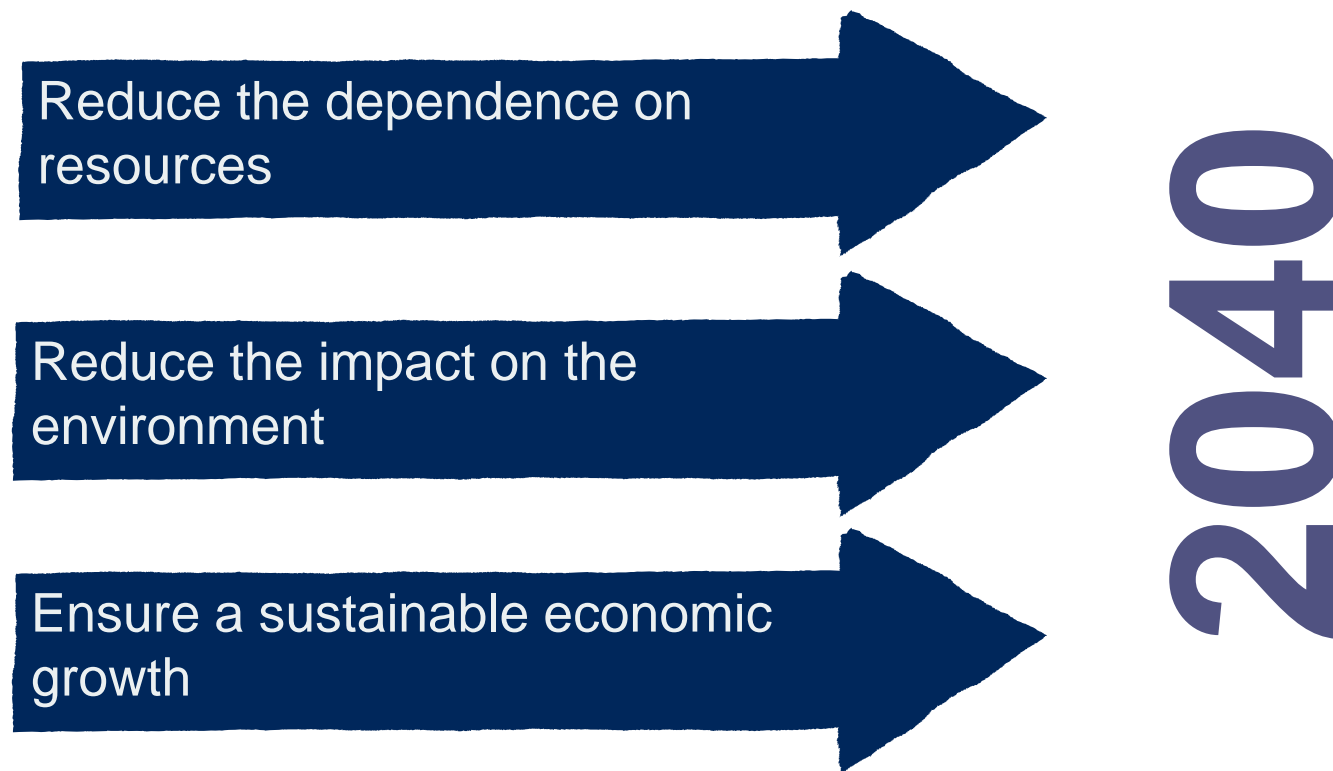


Energy strategy 2050 & Biomethane production legal frame

Energy Strategy 2050 – Switzerland

- Fukushima accident (2011) \Rightarrow Progressive closing of the 5 nuclear plant
- Development of a New Energy strategy. Objectives :
 - Decrease the electricity consumption
 - Develop sustainable energy
 - Decrease CO₂ emissions
 - Ensure supply security
 - Economical energy system

SIG - Strategy 2040



■ SIG projects examples :

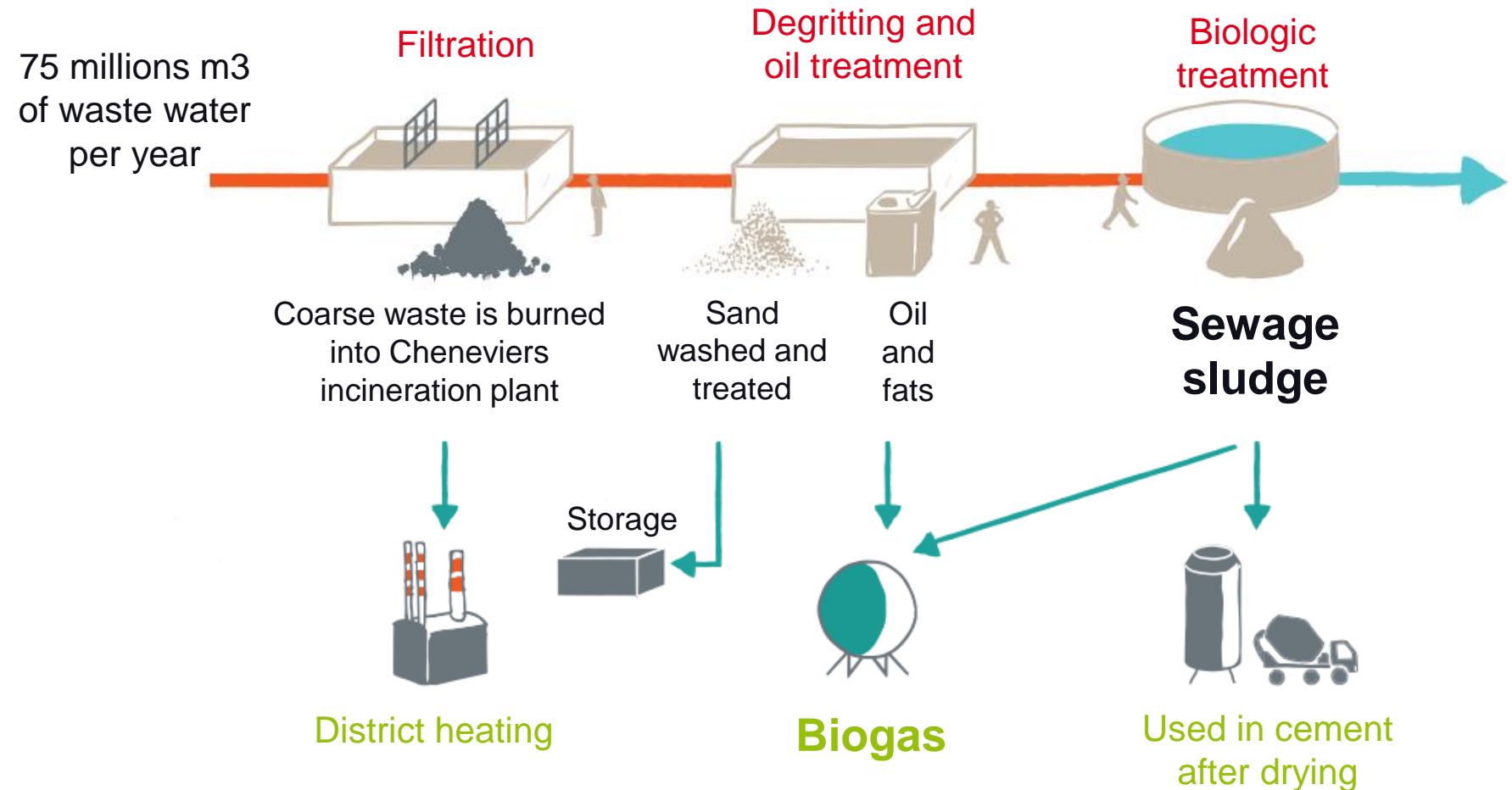
- Eco21 program : Advices and financial incentive to reduce electrical consumptions
- “Geothermie 2020” : Highlight the potential of geothermal energy
- Biomethane Production : Value waste (sewage sludge and green waste) into energy

Biomethane Production – Legal frame

- In Switzerland, the production of biogas is regulated by the Gas and Water Industrial Swiss Society (SSIGE)
- Untreated biogas can be valorised directly into :
 - Heat (combustion in a boiler)
 - Electricity (turbine)
 - Heat and electricity (Cogeneration)
- Biogas can be also injected in the natural gas network. Depending on the biogas quality (\Leftrightarrow %CH₄) the injection could be :
 - Unlimited : biogas quality is comparable to an H type gas (>96% CH₄)
 - Limited : the gas quality (natural gas+ biogas) at the first consumer should respect Swiss quality standard (H type gas). CH₄ content in biogas must be higher than 50%.
- Gas injected in cars must contain minimum 10% of biogas

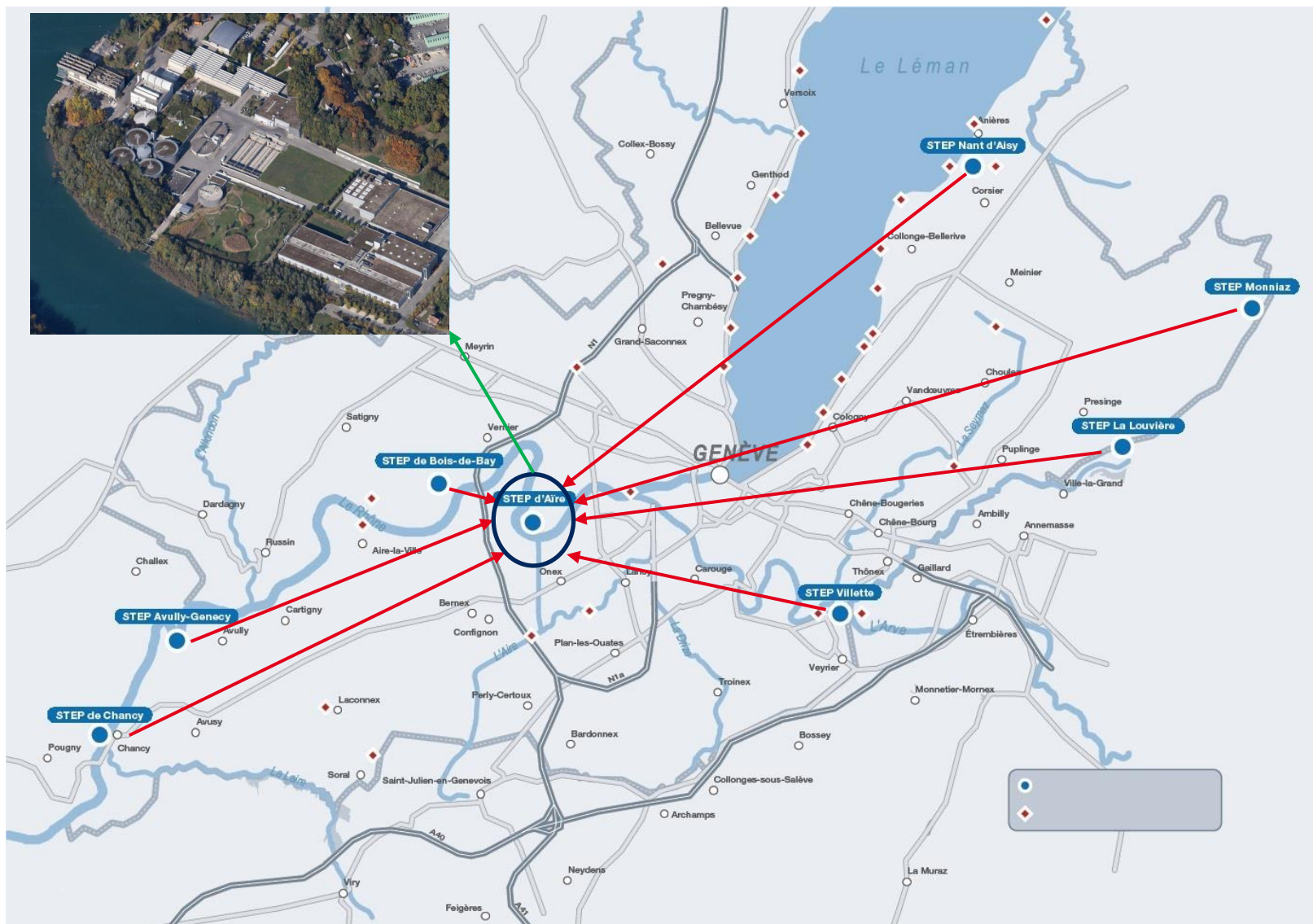
Biogas and Biomethane operating principle

Sewage treatment plant – Operating Principle

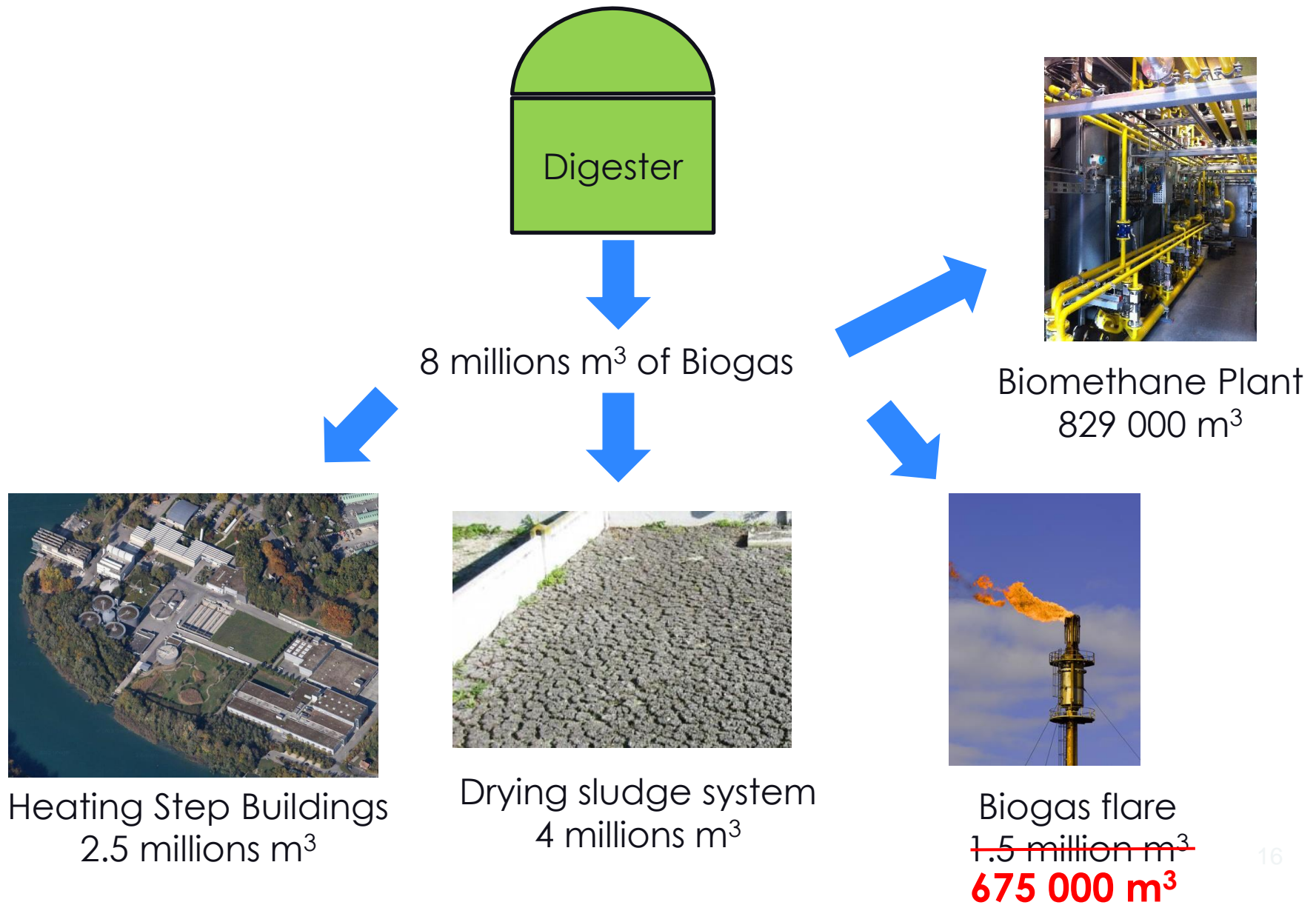


95% of the waste are valorised electricity, heat or biogas

Biogas production - STEP d'Aire



Geneva sewage treatment plant – Biogas production



Biomethane plant - Objectives

- Purify biogas (60% CH₄ + 40% CO₂) to produce biomethane (quality comparable to an H type natural gas)
- Operating 24h/24 automatically
- Biomethane production :
 - Nominal capacity : 350Nm³/h of biogas \Rightarrow 220 Nm³/h of biomethane
 - Maximum annual production : 16.7 GWh \Leftrightarrow Energy consumptions of 2500 apartments with BBC European Standards

STEP d'Aire



Biomethane plant



PSA system



Biomethane plant – Planning

- Study phase : 2010 – 2012
- Plant construction : March 2012- March 2013
 - Project Ownership : SIG - Geneva
 - Project management : Acrona Systems
 - Investment : 5.5 millions CHF
 - Return on Investment : 15 years
- Tuning phase : March – December 2013
- Nominal operating : since January 2014



Biomethane plant - Pictures

Biomethane plant



PSA Room

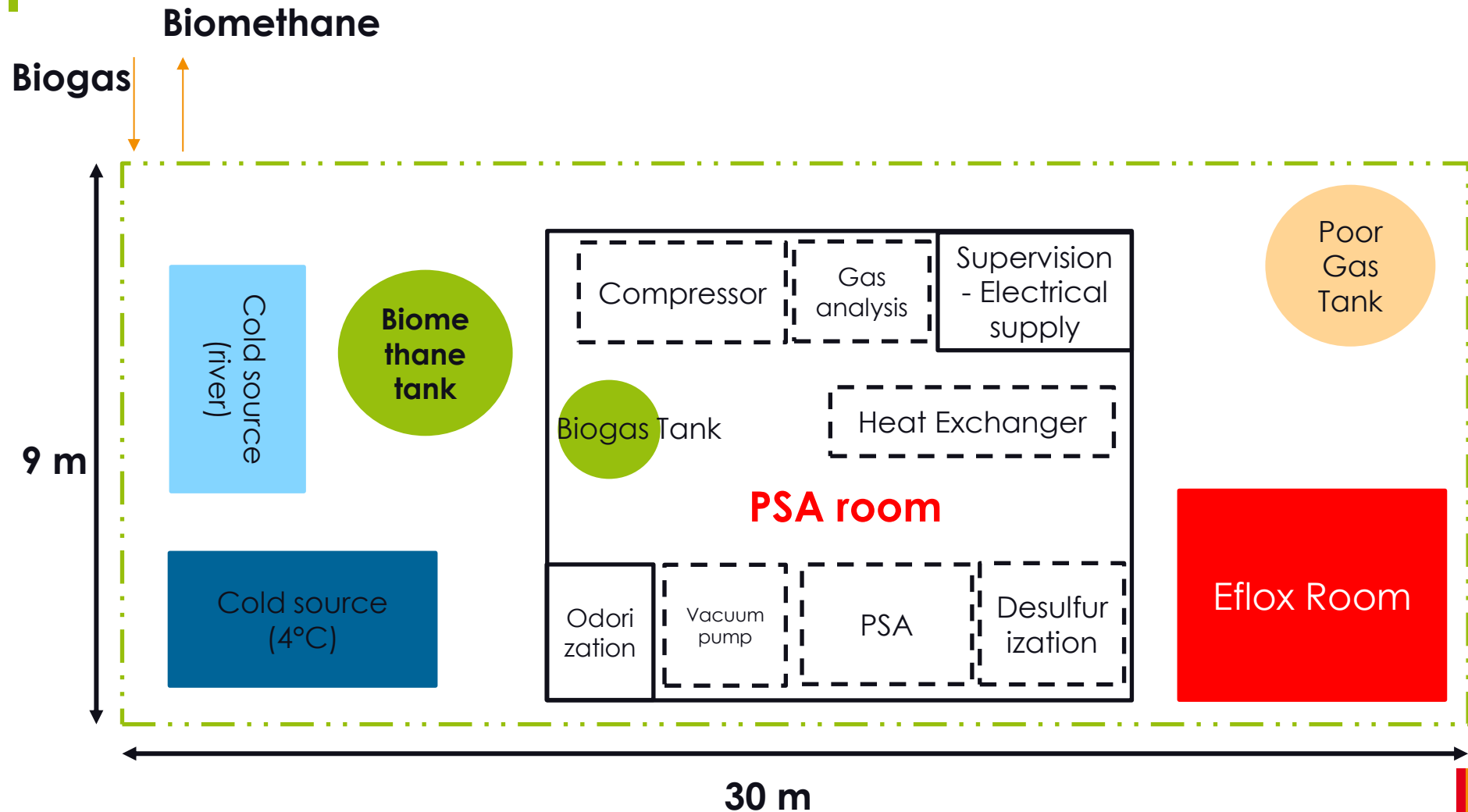


EFLOX room

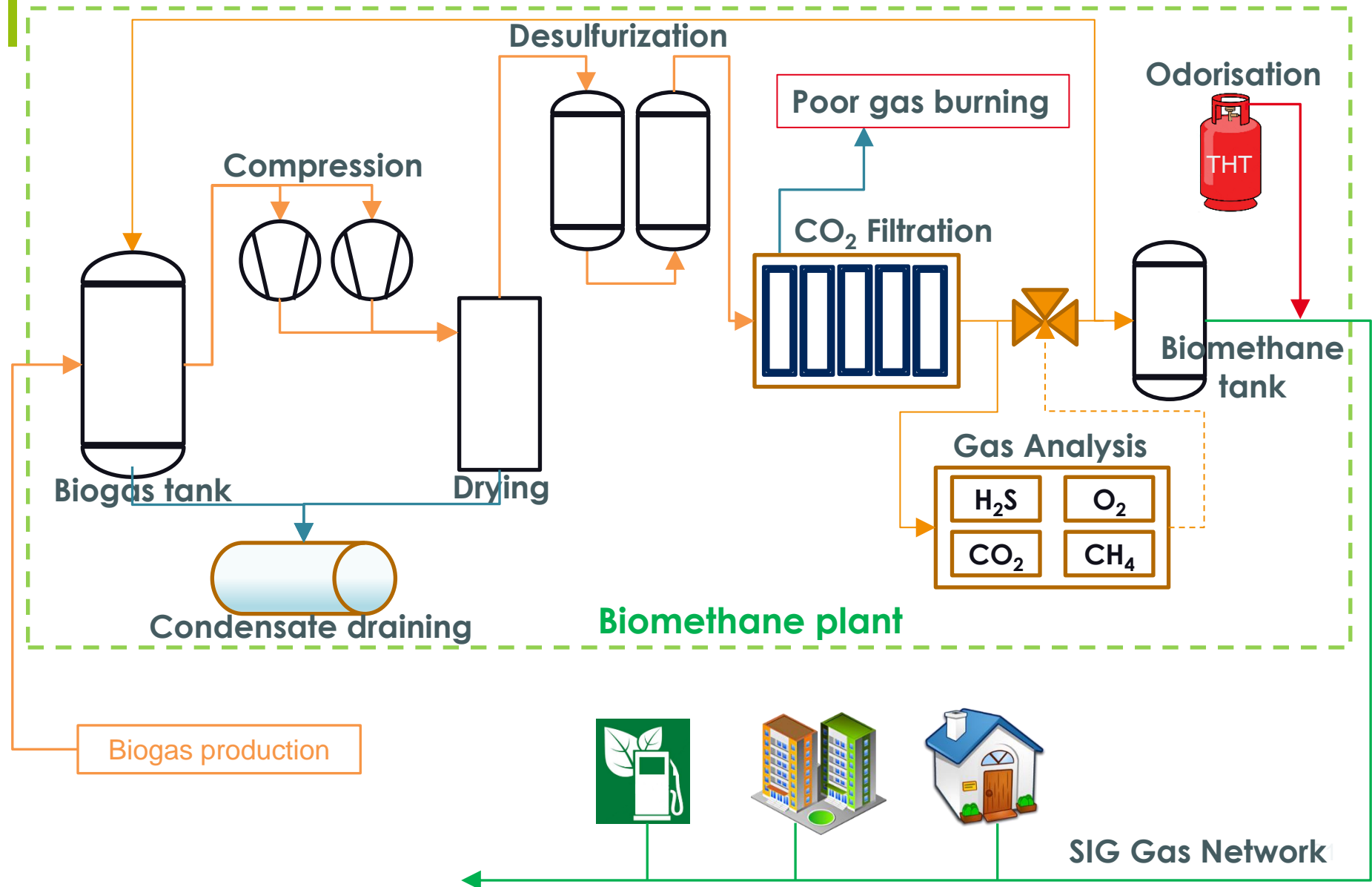


**Cold Sources
Biomethane tank**

Biomethane plant – Top view

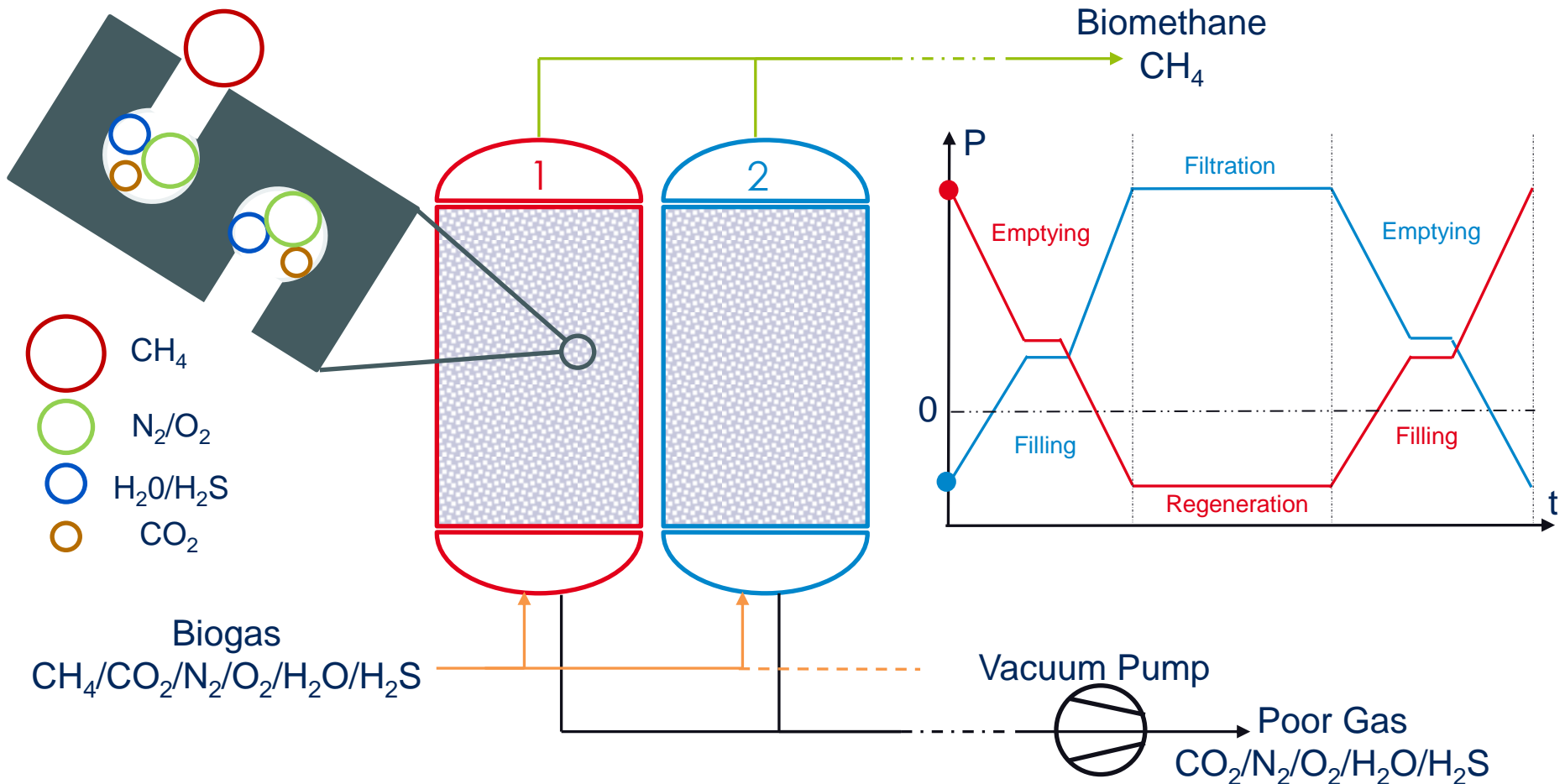


Biomethane plant – Operating principle



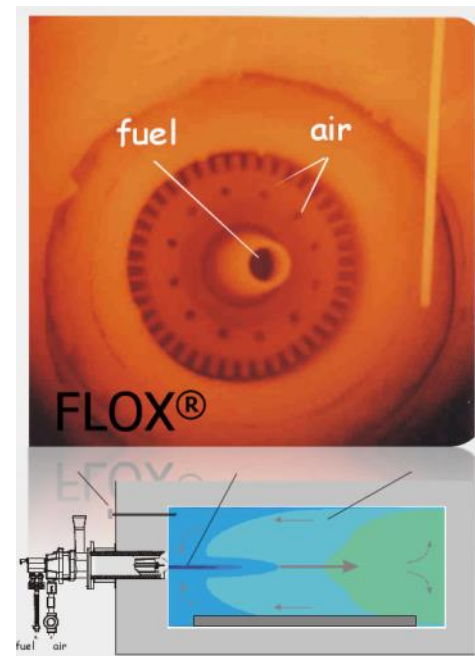
Biomethane plant – PSA system

- Pressure swing adsorption system :
 - Selective filtration with a Charbon Molecular Sieve (under pressure)
 - Auto regeneration of the CMS (under vacuum)
 - Cyclic operating : 5 identic tank filled with CMS



Biomethane plant – EFLOX flare system

- Objective of the EFLOX flare system:
 - Burn the poor gas which contains a small quantity of CH₄ (Greenhouses gas)
- A boiler with two special burners :
 - One operating with Biogas (starting up)
 - One operating with Poor gas (autotherm reaction at 800°C, no visible flame)



Biomethane plant – Monitoring and Maintenance

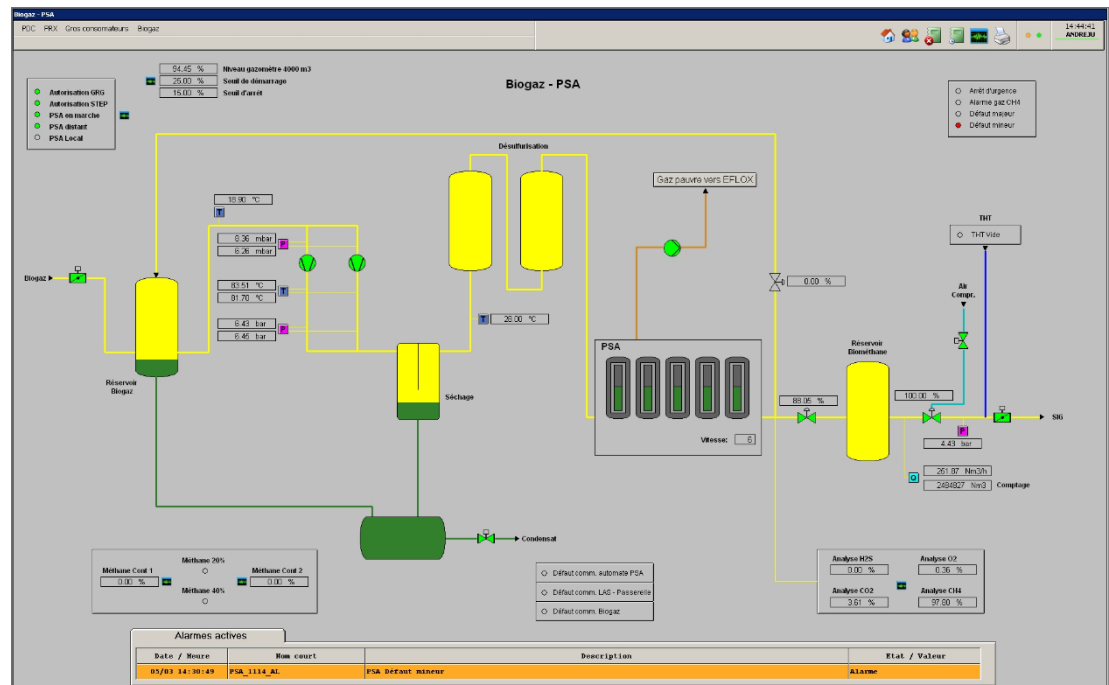
■ Monitoring and Maintenance :

Periodicity	Responsible	Actions
One week	SIG	Visual Check Consultation of the logbook
3 month	Acrona Systems (constructor)	Installation control
4000h of exploitation	Acrona Systems (constructor)	Preventive maintenance on the main systems (compressors, filters, ...)
8000h of exploitation	Acrona Systems (constructor)	Preventive maintenance on all systems

Biomethane plant – Emergencies

- 3 levels of automatic alarm :
 - Minor (excessive flow rate,...) : No actions
 - Major (compressor failure,...) : Automatic shutdown of the installation and intervention of SIG on working days
 - Urgent (gas leak,...): Automatic shutdown and immediate intervention on site to secure the installation

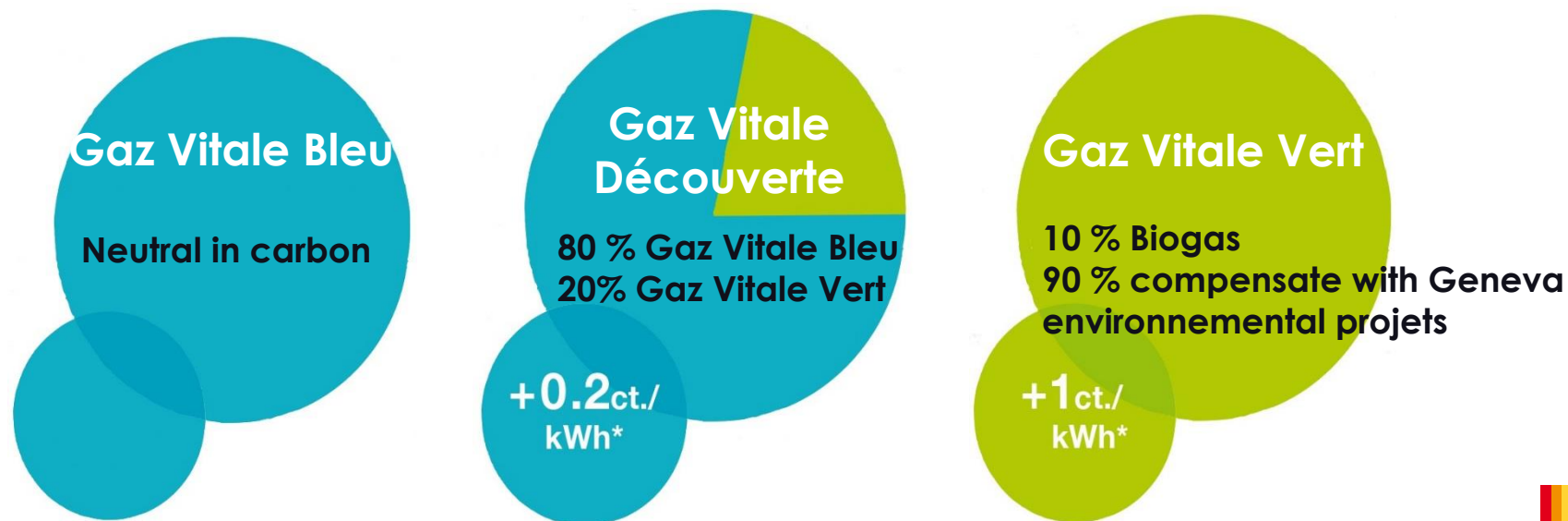
- In case of an urgent alarm, a message is automatically send to the SIG duty person by our supervision system.



SIG Marketing – Gaz Vitale

SIG Marketing – Gaz Vitale

- “SIG Gaz Vitale” offer is an innovative solution to promote the development of natural gas and biogas in Geneva. This offer propose a natural gas neutral in CO2 (environmental project funding) .
- “SIG Gaz Vitale” :



SIG Marketing – Key figures

- Geneva population : 480'000
- SIG gas customers : 40'000

	Gaz Vitale Bleu	Gaz Vitale Découverte	Gaz Vitale Vert
Customers	37000	1800	1200
Market share	88%	11 %	1%

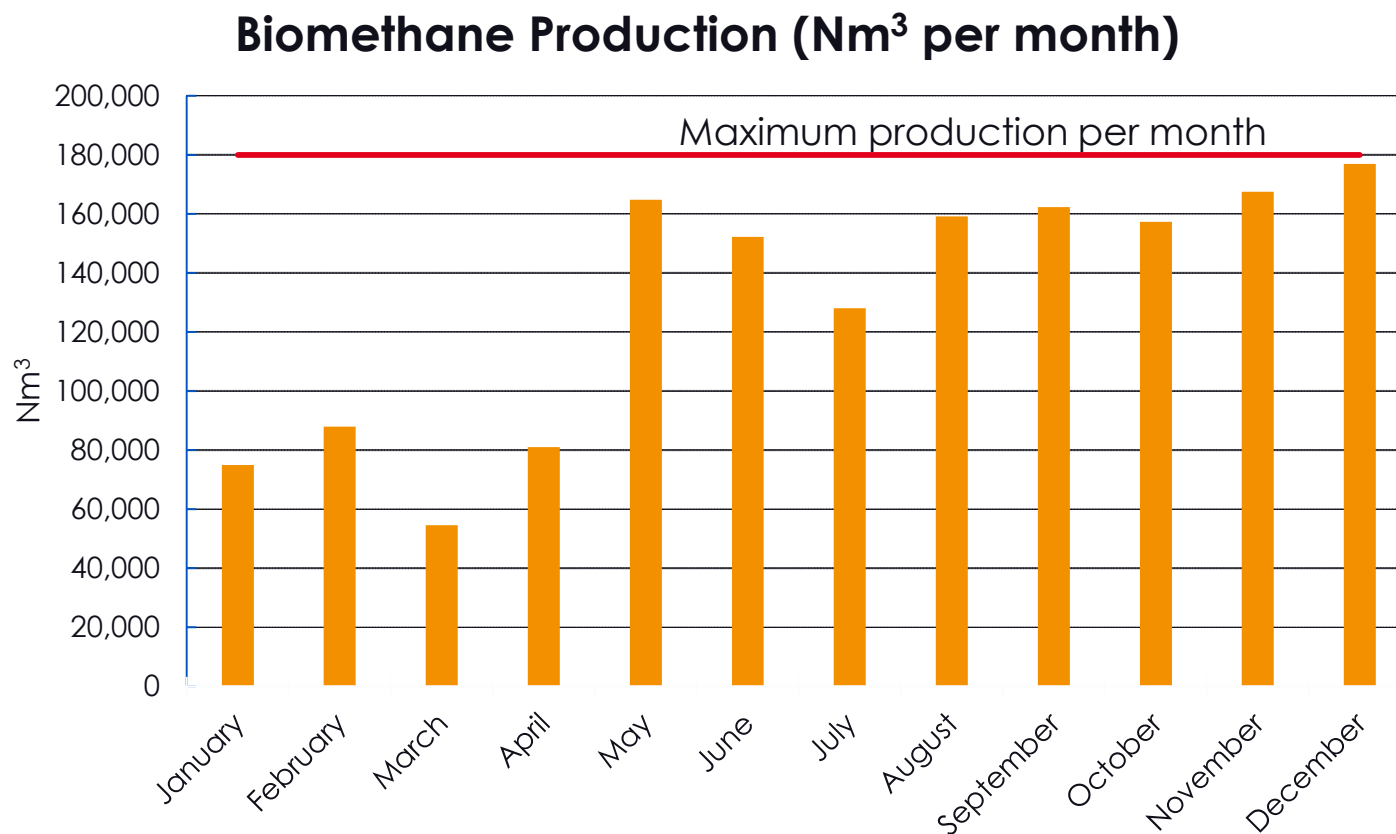
- Biomethane sale forecast (GWh) :

2013	2014	2015	2016	2017	2018	2019
4.7	8.5	12.3	12.7	13.7	14.7	15.7

- Geneva production is sufficient to meet the demand until 2017.
- After 2017, new sources of production are necessary

Feedbacks & Perspectives

Biomethane Production – 2014



■ Remarks :

- No major failures since January 2014
- May 2014 : Increase of the available biogas quantity ⇒ Operating at full capacity (180'000 Nm³ per month)

Biomethane production – Advantages and drawbacks

■ Advantages:

- Value the gas network
- Same physical properties than natural gas
- Energy easily storable
- Diversification of skills

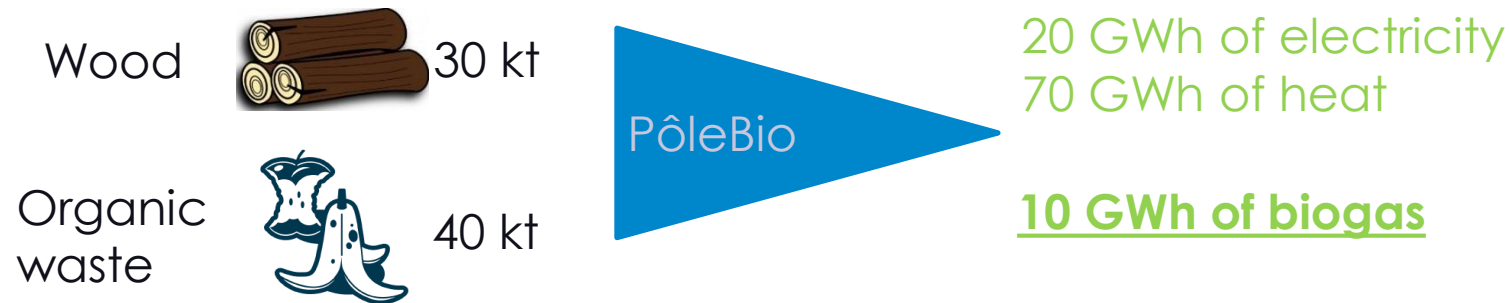
■ Drawbacks:

- A critical size is necessary in order to be profitable
- Proximity with a gas network is mandatory

Future perspectives

- Biomethane plant (2015): +10% Production
 - Software modifications to increase the production
- STEP d'Aire (2016): + 5GWh
 - Reduction of the biogas consumption of the sludge heater
 - Energy saving (heating buildings,...)

- “PôleBio” project (2018): + 10GWh



- STEP d'Aire (2022) : Production *4 (1000 Nm³/h or 40GWh)
 - Stop drying sludge with biogas \Rightarrow 4 millions m³ of biogas available

Questions

