

Retrofitting multi-family buildings with air/water heat pumps

Swiss contribution to the IEA annex 50

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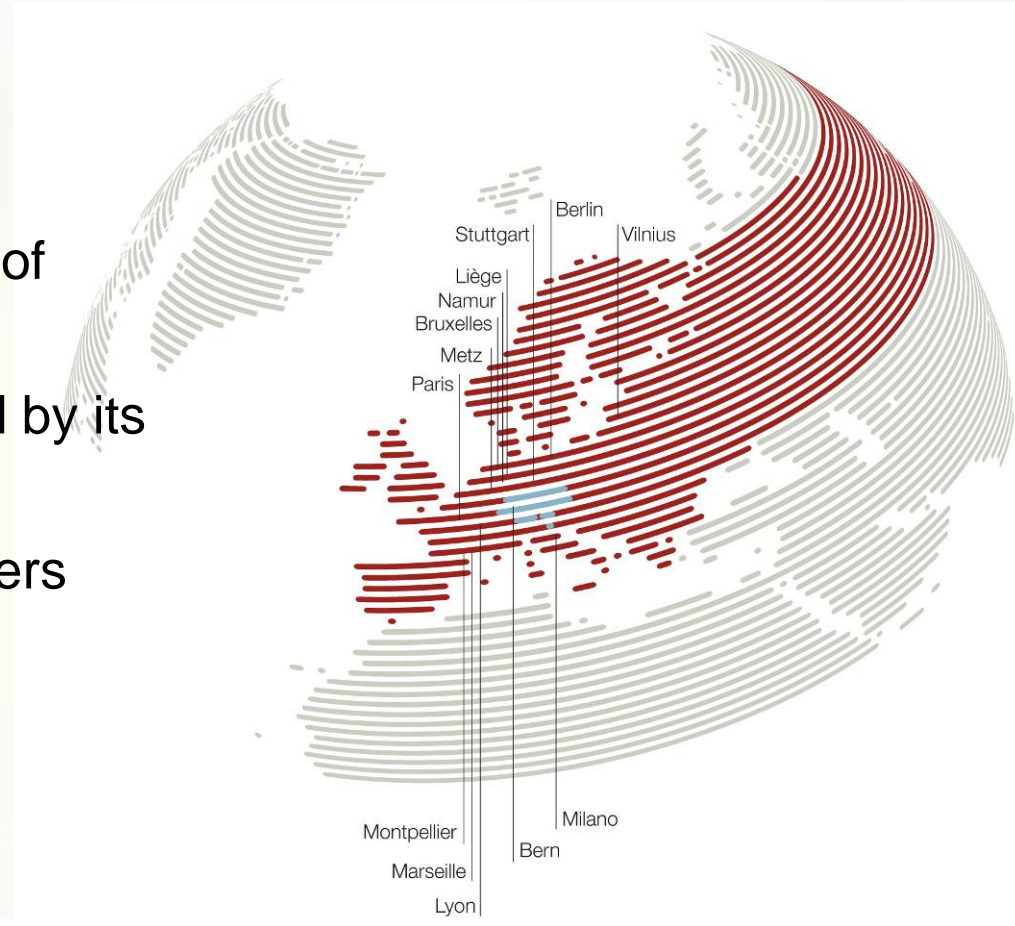


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CSDINGENIEURS 
INGÉNIEUX PAR NATURE

- 45 years
- 30 offices CH, B, D, I, LT
- 700 employees
- Global approach and skills of specialists
- Totally independent, owned by its employees
- Associated with local partners
- SO 9001 et 14001



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CSD Energy

➤ Energy efficiency

- Efficient buildings
- Efficiency in industry
- CO₂ reduction and compensation

➤ Renewables

- Wind
- Biogas
- Small hydro
- Géothermy with or without heat pumps
- Heat pumping technologies

➤ Thermal networks

- District heating and cooling (especially lakes and geothermy)

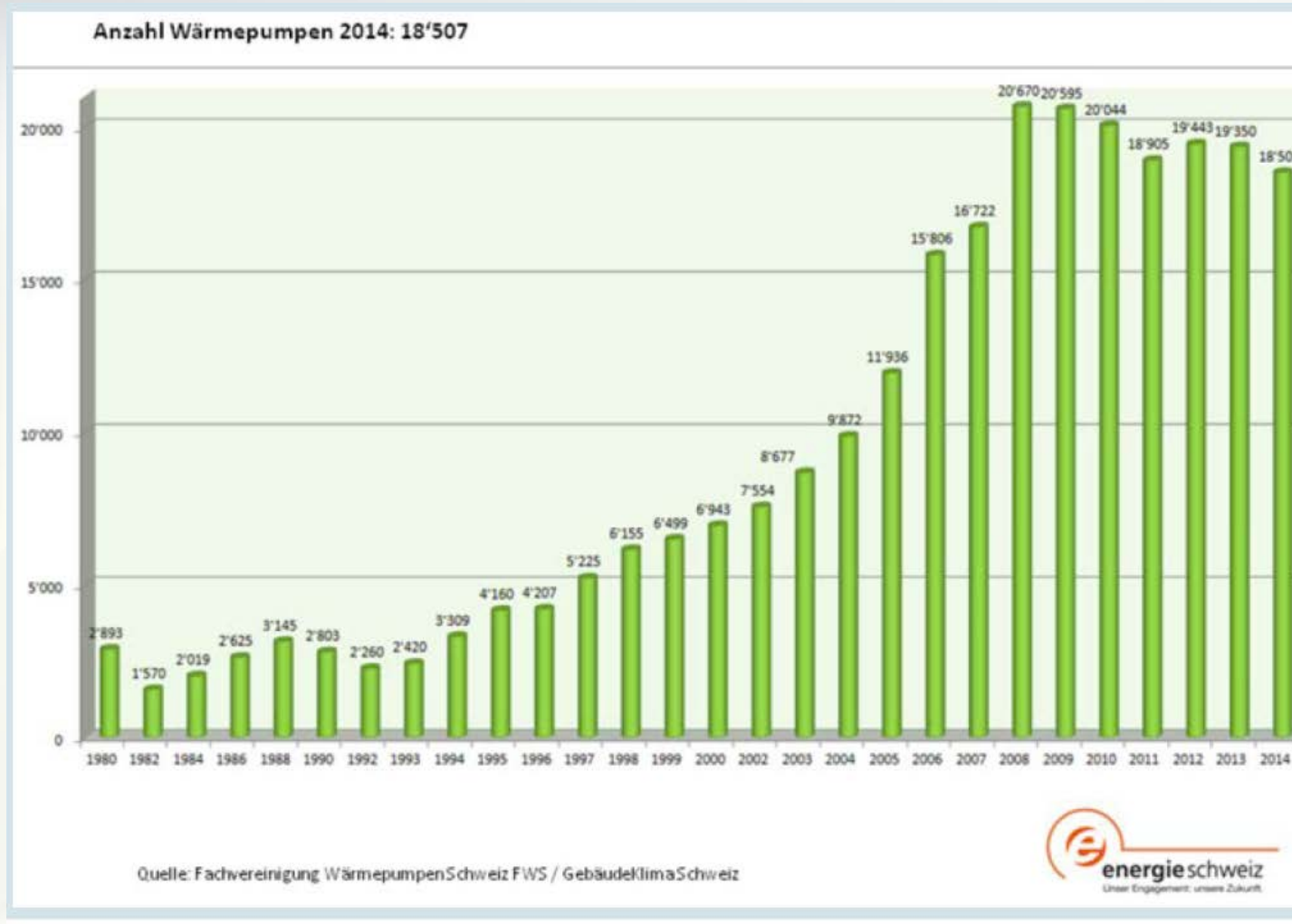


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Heat pumps sales Switzerland



40% BAW 3% WAW 56% A/W 1% A/A

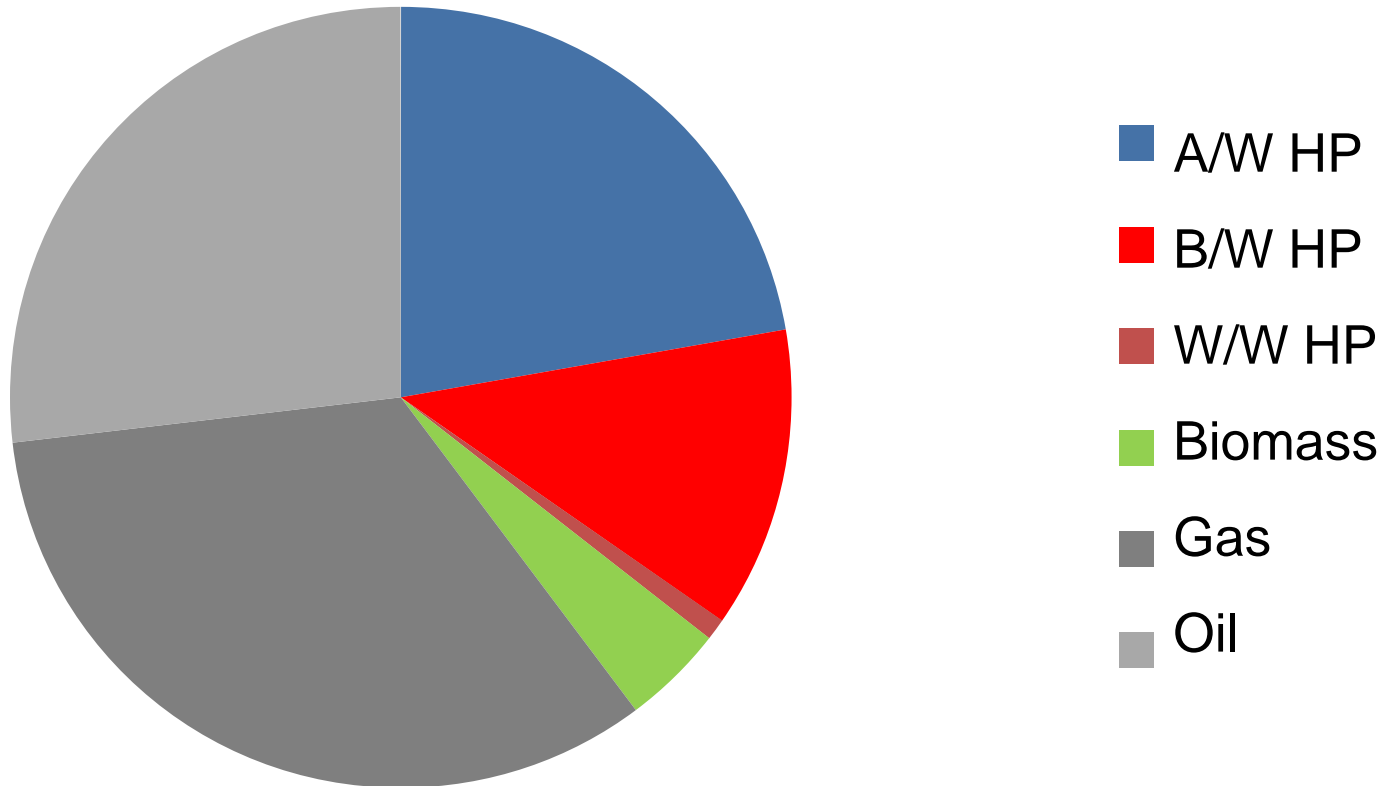


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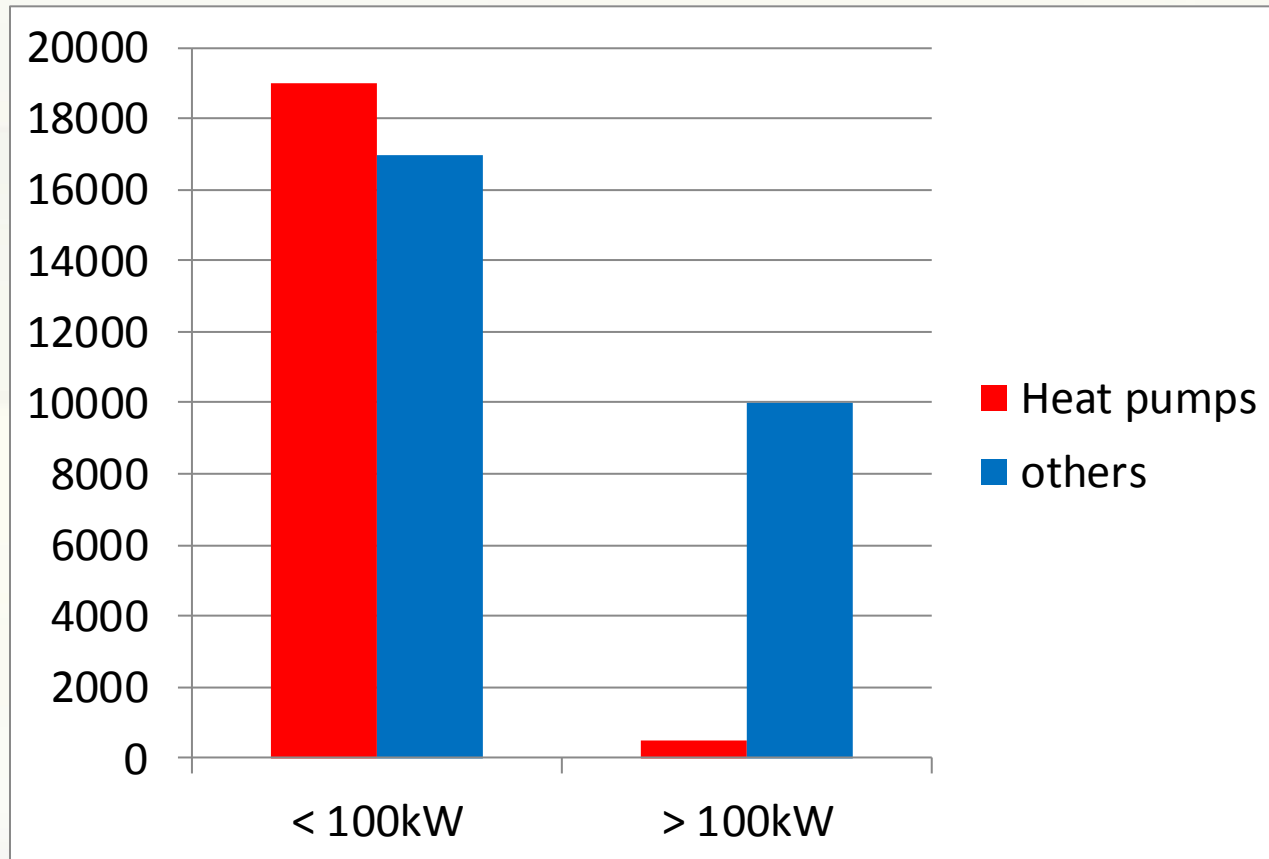
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Marché du chauffage en Suisse



Heating market

Large potential above 50...100kW



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0

Eco21 SIG



Program Eco21 in short

- Buildings =40% of the national CO2 - emissions
- Building stock in urban area = heating power of 50kW to some MW
- Geneva-city: renewable energies not available: no ground water, no district heating, wood forbidden (clean air act), solar with hard restraints. Only air is available.
- Switzerland: less extreme but similar



Program Eco21 in short

- Training of professionals: electro-, heating – installers, engineers
- Development of web-tools for projects on efficiency d'efficiency
- More than 60 companies are partners of the program
- Customer acquisition: owners, companies, large consumers



1

Beginning with program for single-family houses

Eco21 help and support the retrofit of fossile heating systems with renewables energies



installers

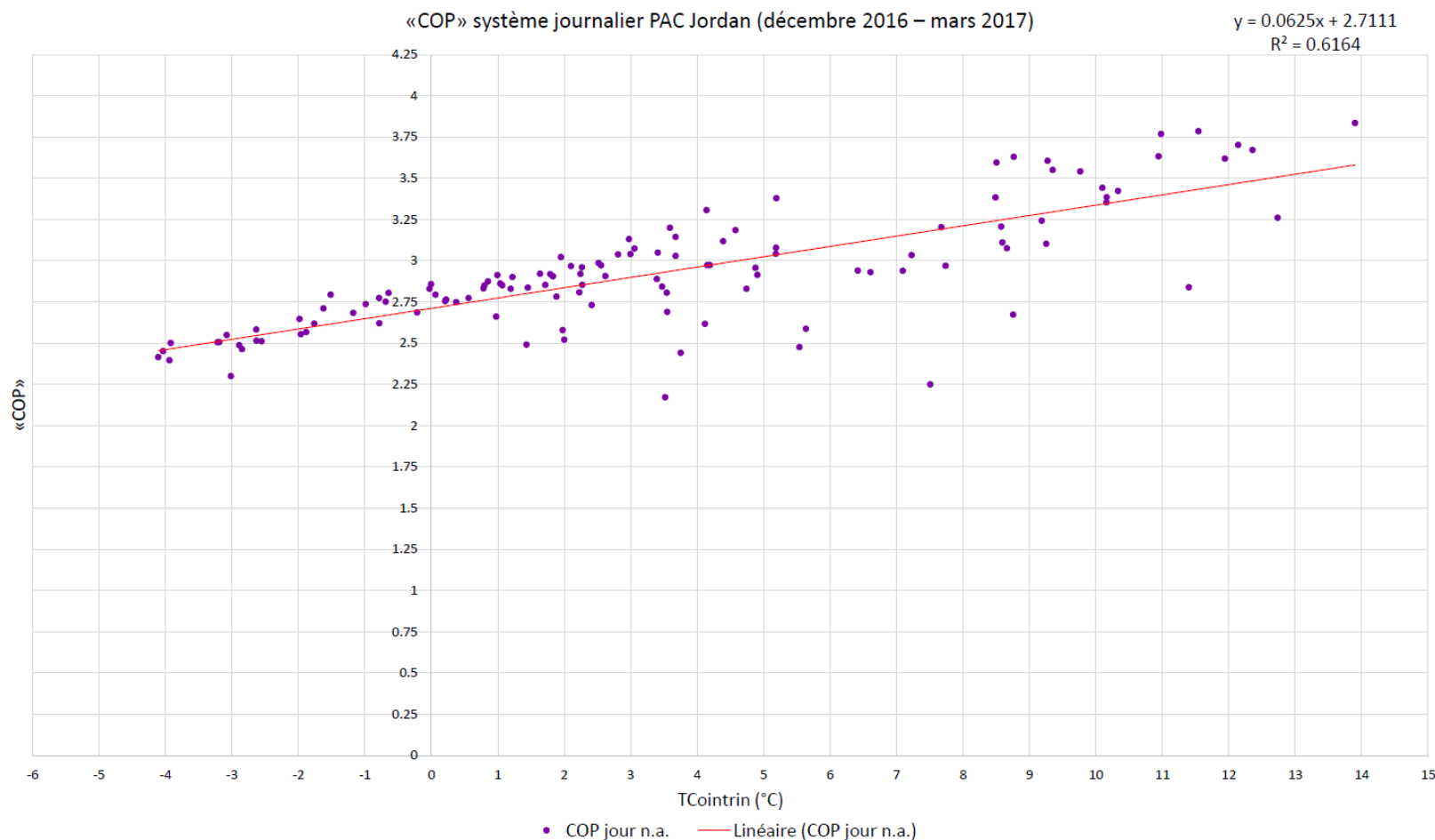
- 180 installers trained on renewable energy systems
- On-line tool to compare heating solutions
- 27 installers are now partner in Eco21

Owners

- 155 owners of single-family houses and small buildings retrofitted their heating system with renewables
- 37'000 tCO₂ avoided since 2013;
17'000 tCO₂ in 2016

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Results were encouraging: COP are ok

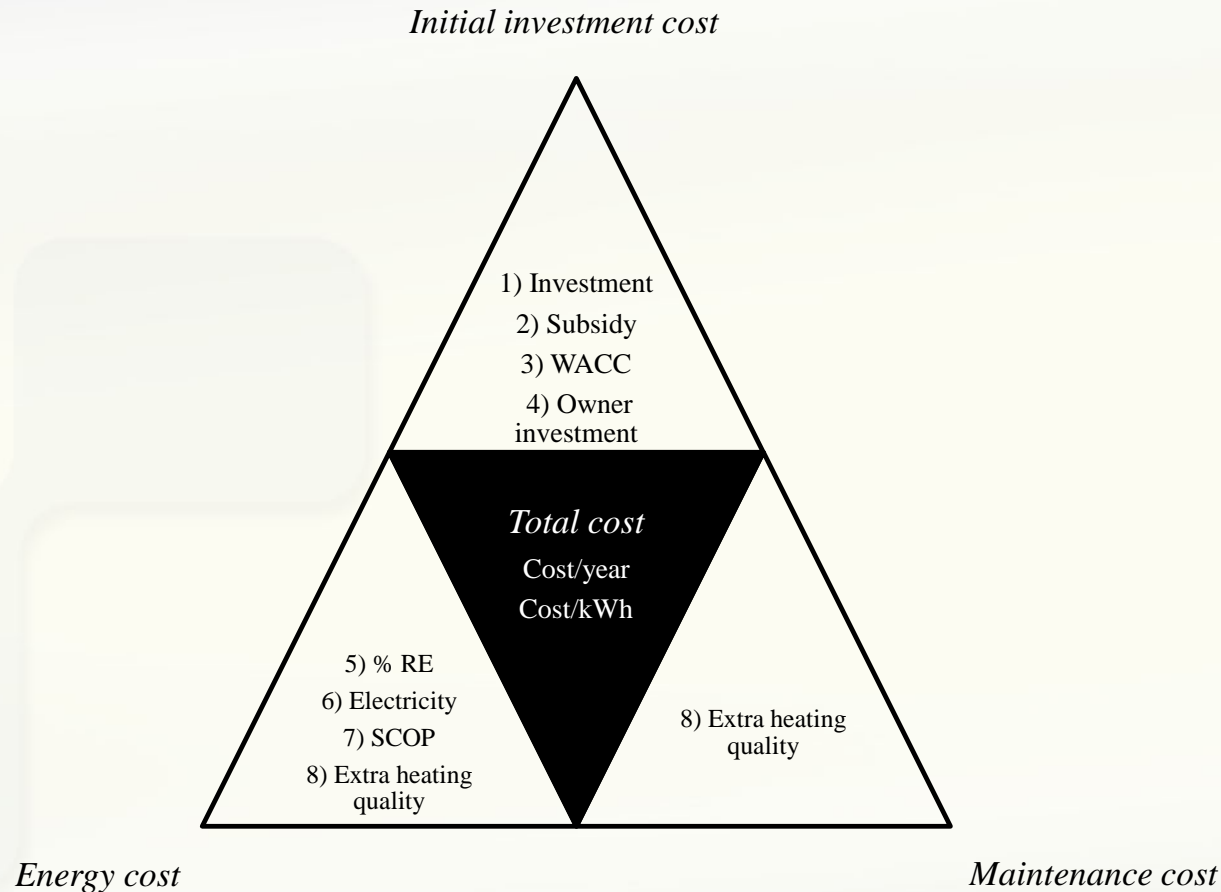




2

Next step multi-family houses

Decision based on global economic invests, energy expenses, maintenance



3 typical building times in urban part of Geneva

Building year	Heated surface [m2]	Heating	Previous demand [kWh/m2]	Specific [kW]	Power [kW]	Heat consumption [kWh]
1911	1'902	Oil	180	170	342	360
1972	4'047	Oil	144	280	582	768
1992	7'563	Gas	147	550	1'111	761

3 typical times for buildings in the urban part of Geneva

Criteria

- No district heating nearby
- Drilling for geothermy forbidden
- Biomass restricted by local clean air act
- Solar thermal restricted or very difficult

Pilot 1911, old heart of the city

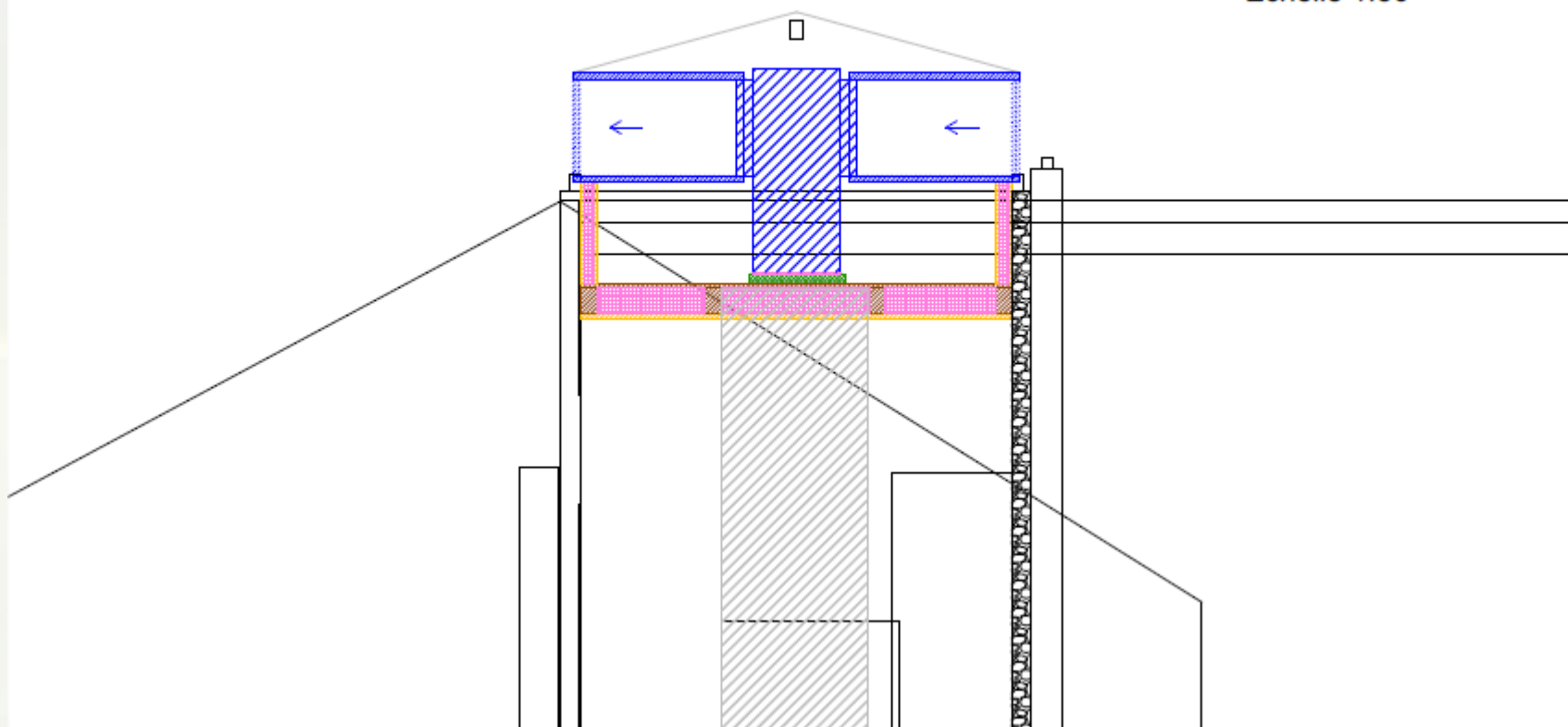
- 37'000 l oil a year
- Invests CHF 100'000 to retrofit heating and glazed roof
- + CHF 220'000 to cover 80% of the demande with renewable energy (HP)



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Adaptation of the roof

Rue Patru 6
PAC air-eau
Etude d'implantation
Echelle 1:50



Blocked by administration

- **Protection of buildings of interests, monuments and sites**
 - Change of roof not accepted even if looks better
 - New room for heat pumps reduces natural light in staircase
- **Fire protection**
 - Building must be brought up to actual fire protections standards
 - Changing all doors
 - Adding new doors
 - Adapting ventilation
 - Cost about CHF 300'000.-
 - « the law is the law »

Pilot 1972, first suburbs



- 66'000 l oil a year
- CHF 80'000 to change old oil furnace
- + CHF 400'000 to retrofit with 100% renewables with HP

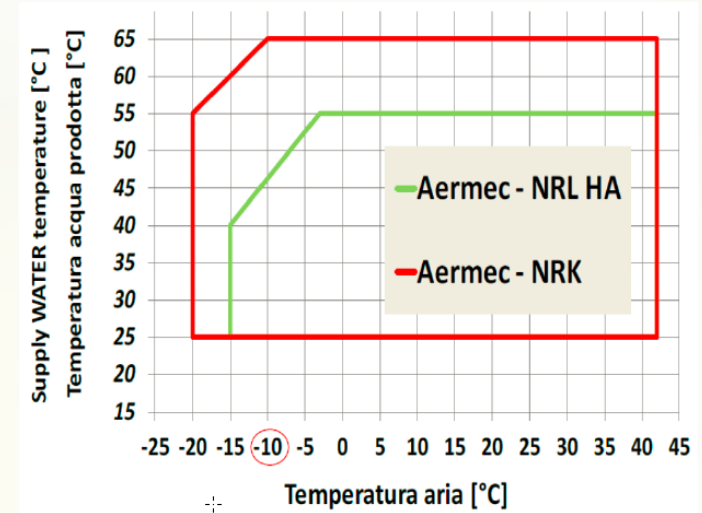


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Pilot 1972

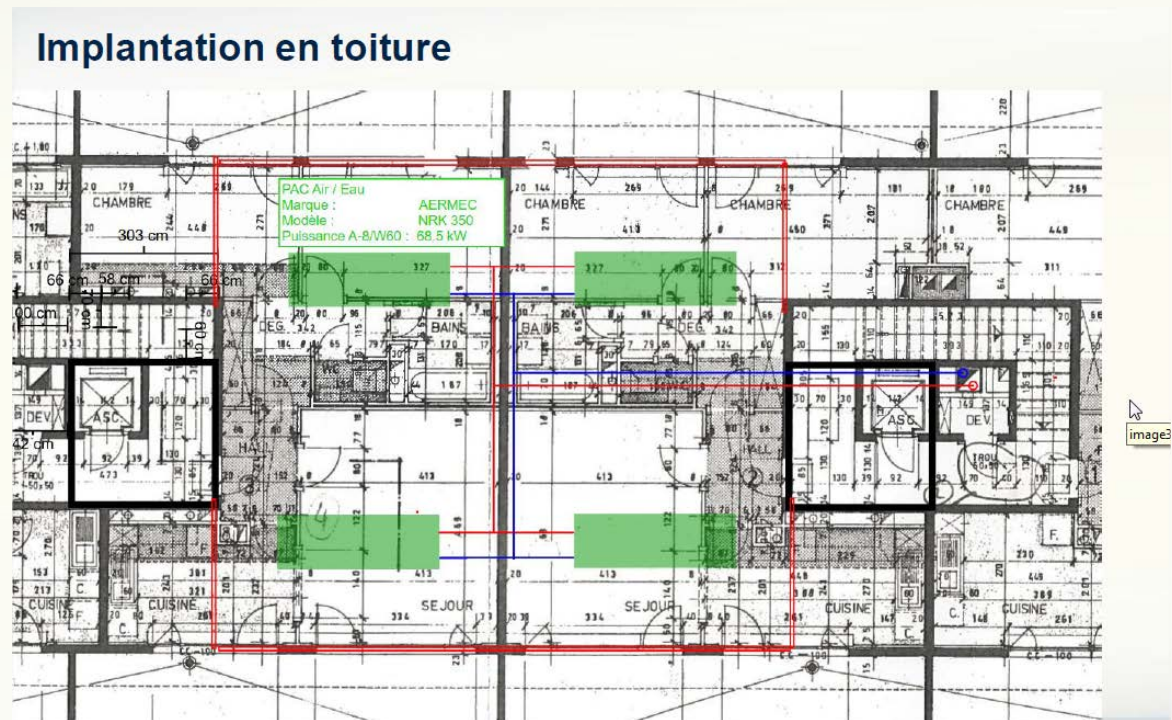
100% of demand with heat pump

- Customer wanted 100% HP
- Gas not present nearby



On the roof

- Acoustic
- Resistance
- Deformation
- Maintenance



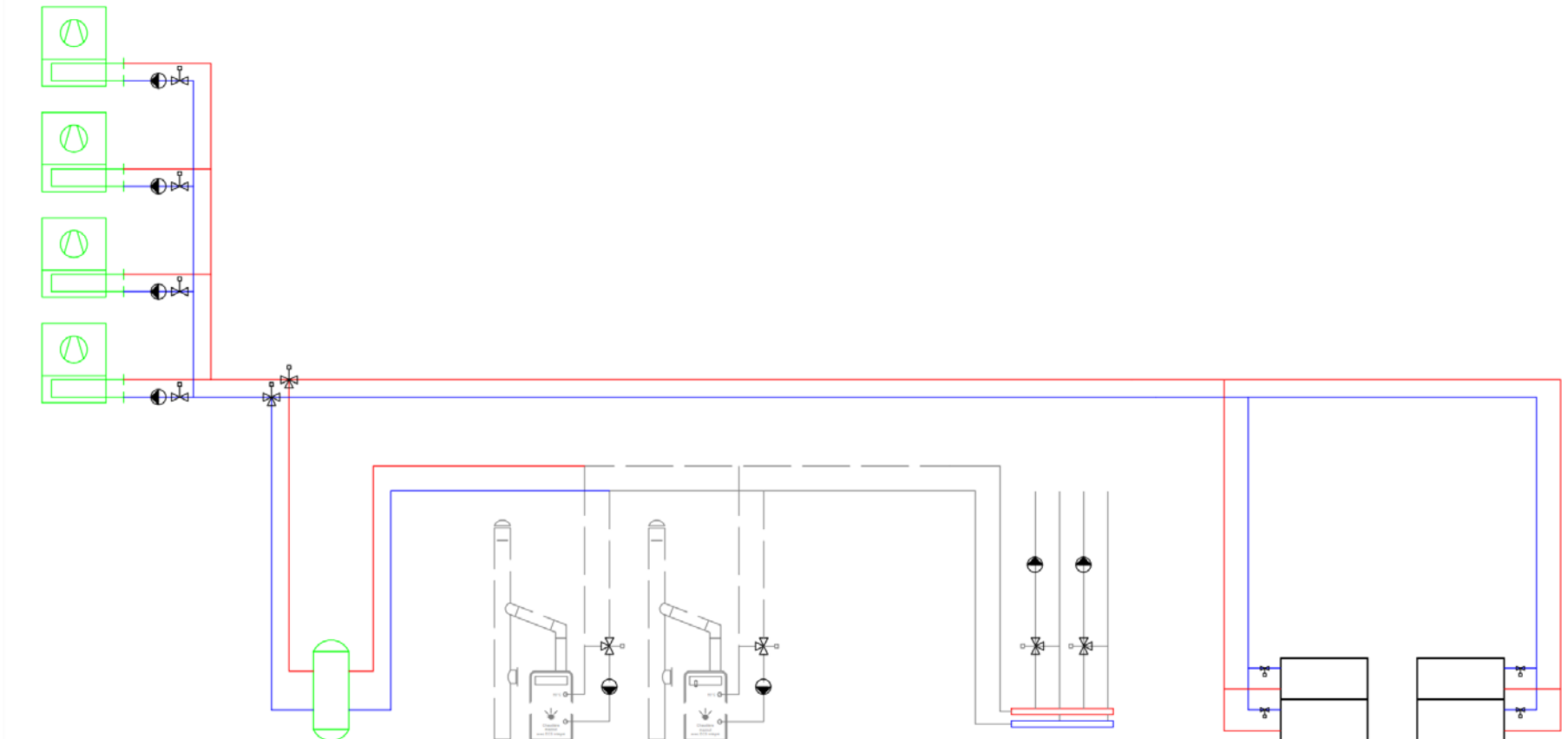
Pilot 1972

On the roof



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Hydraulic scheme: simple



Pilot 1972



- Actual costs oil: **80'000 CHF/year**
- Costs with HP: **80'000 CHF/year (no difference !)**

→ Access to favorable electricity prices important

Status

- Project realized, heat pumps are delivered and being connected
- Monitoring of efficiency and part of renewable starting this month
- Problems during installation: installer not used to install air HP

Pilot 1992, close suburb



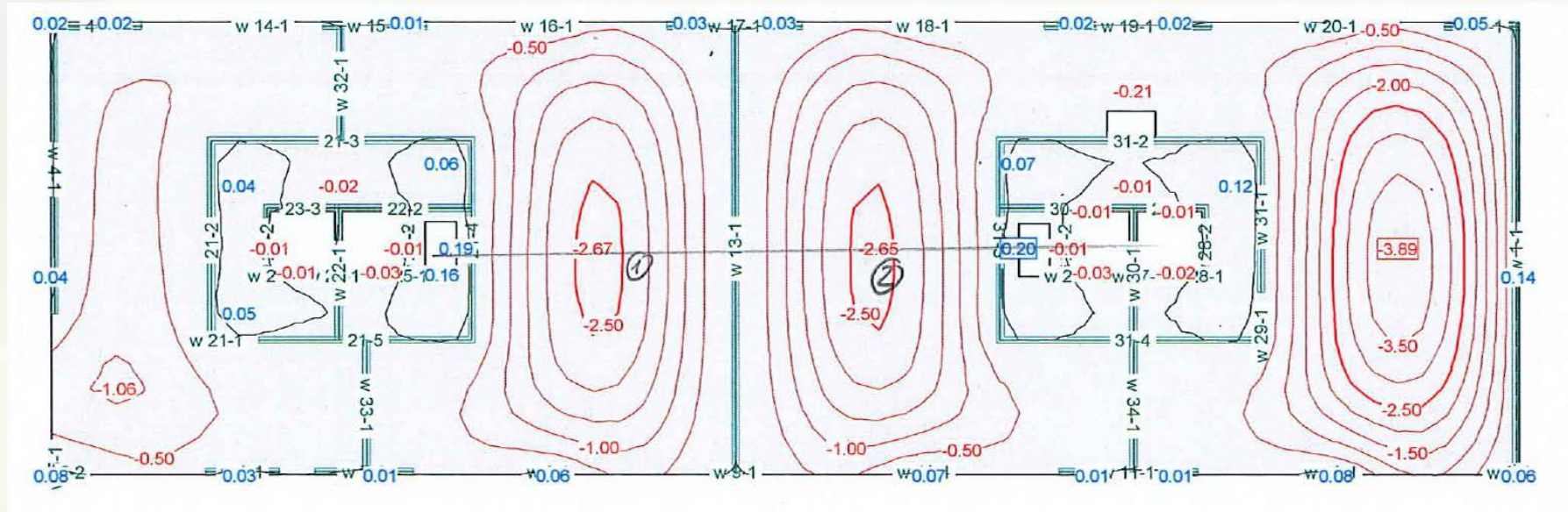
- 1'000'000 kWh gas / year
- CHF 50'000.- to retrofit domestic hot water production
- + CHF 440'000 to cover 70% with renewable energy (HP)



Schéma hydraulique AIT



Static: deformation



Pilot 1992 - economics



- Annual cost so far: **112'000 CHF/an**
- Annual costs with HP: **120'000 CHF/an (+ 7 %,)**
- Owner increased participation to invest with + CHF10'000 CHF to bring annual costs to balance

→ Access to favorable electricity prices important

Status

- Project realized, heat pumps are running, customer is satisfied
- Monitoring of efficiency and part of renewable going on
- Users satisfied

Pilot 1992



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Pilot 1992



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Pilot 1992



Possible contribution to the annex 50

Task 1 market, barriers

- Market overview
- Suitable systems and products
- Technical, commercial, legal barriers



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Possible contribution to the annex 50

Task 2 modeling of economic models

- Overview of classical models
- Definition of a new model



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Possible contribution to the annex 50

Task 3 technology development

- Suitable systems and products
- Re-visit dimensioning of HP in a bivalent system
- **Hydraulic schemes for large A/W systems with existing boilers as standards**
- Performances (COP) calculation / real



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Possible contribution to the annex 50

Task 4 demonstration and monitoring

- 2 pilot plants now running
- 3d pilot to be soon realized
- Monitoring of energy performances and reliability



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Possible contribution to the annex 50

Task 5 dissemination

- Handbook for enginners including also
 - Static
 - Noise, acoustic, vibrations
 - Hydronic integration
 - Control, command, measures



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Thank you

Any questions?

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