

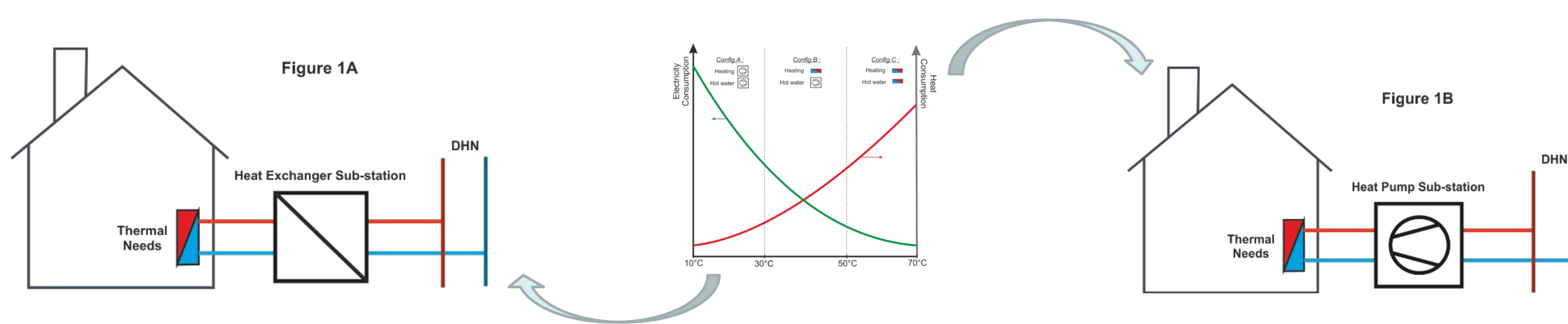


BlueCAD

Energy integration and performance evaluation of a new concept of advanced solar district heating/cooling networks for energy supply in buildings

Context: Low-grade district heating/cooling network

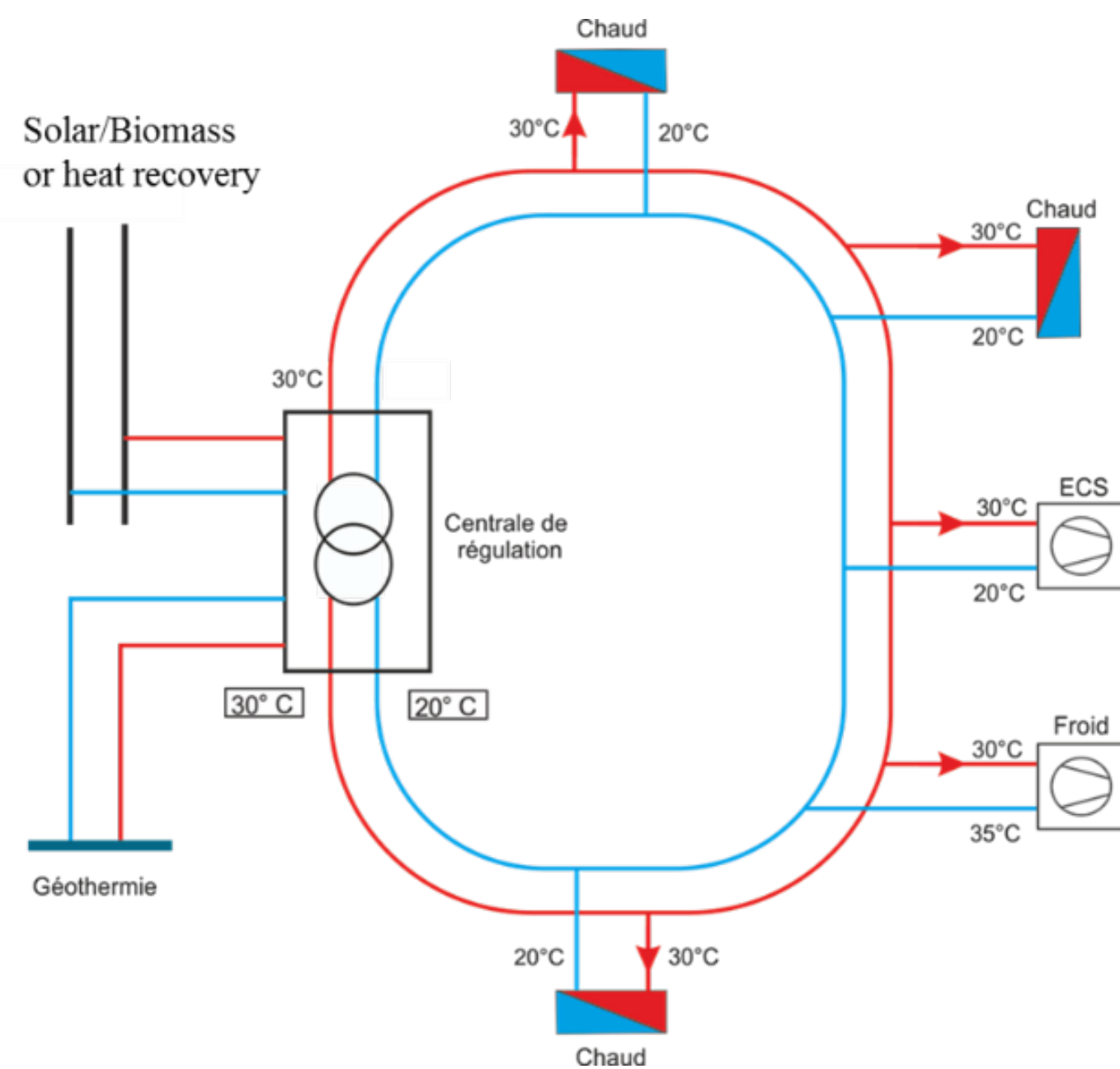
Low-grade district heating networks (DHN) operate at temperature levels of around 8-12° C with geothermal sources and use decentralized heat pump (HP) units to raise the temperature in buildings for heating and domestic hot water production. The high differential temperature between the DHN and the level of energy supply for heating and hot water process in the building corresponds to an important consumption of electricity in the decentralized HP units.



Concept of alternate thermal network

The concept integrates :

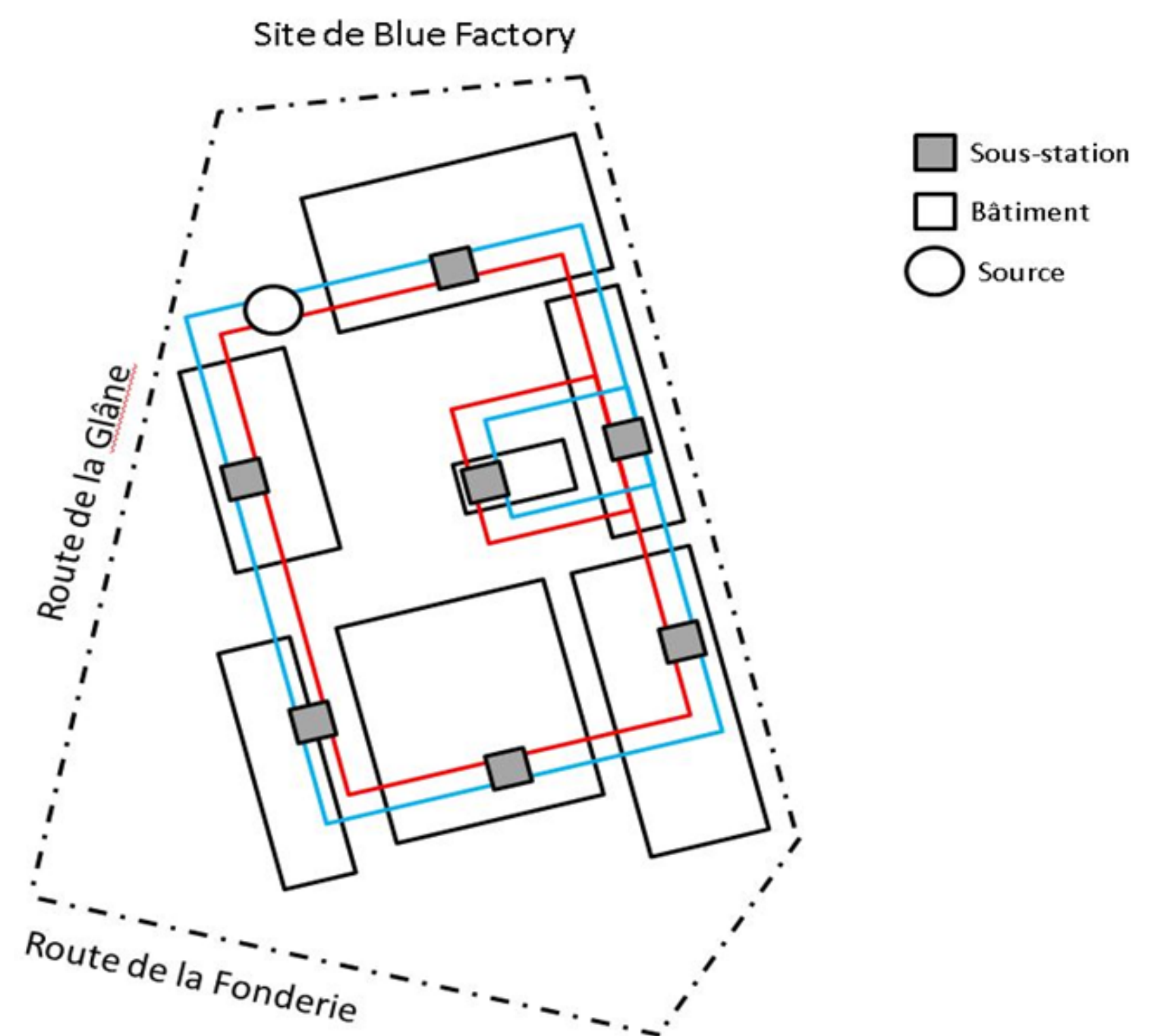
- Decentralized substation units using simple heat exchangers for winter heating and summer cooling and booster heat pump (HP) units for domestic hot water production;
- Centralized energy conversion (CEC) unit that can be choose from different possible options: a thermally driven heat pump (THP) or an organic rankine cycle (ORC) cogeneration module;
- Solar thermal collectors coupled with a biomass boiler and/or a waste heat recovery system, used as a heat source to drive the CEC unit;



Case of Study

The site of BlueFactory is composed of 11 buildings with a total surface area of 74'500 m².

The temperature level can be chosen below or respectively above 20° C, by using an intelligent centralized energy conversion unit able to integrate and manage different local energy sources.



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Exergy analysis results

An exergy modelling has been performed in function of the temperature of the network to evaluate the performance of the substation units in term of exergy efficiency and results have been compared to a reference system based on an "anergic" low-grad (8/12° C) heating/cooling network. An exergy efficiency of the substations units of more than 55% can be achieved for the proposed concept, reducing electricity consumption of about 20% compared to the "anergic" DH network.