Co-simulation for complex urban energy systems

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Observations and hypothesis

• Utilities tend to diversify
• Territorial energy systems become more complexe
• Optimisation tools exist but
  → operational and territorial constraints
• Multi-energy and multi-network
  → Exploiting synergies
  → Efficient, resilient and robust
  → Control strategies ?

→ Tool(s) ?
The IntegrCiTy project

EraNET Smart Cities

http://integrcity.epfl.ch/

March 2016 to February 2019 – 3.5M€

→ Decision support tool
  - Design and planning
  - Energy networks interoperability
The IntegrCiTy project

Energy Systems
Simulation
Results

Studied Area
Optimization
Results
Why co-simulation?

- Multi-disciplinary challenges
- Multi-energy and multi-network systems
- Multiple partners with existing dedicated tools

Separating a problem into distributed sub-problems → multi-rate and multi-method modular time integration
Jacobi method
Gauss-Seidel method

\[ t^n \quad t^{n+1} \quad t^{n+2} \]
Problematics and challenges

Influence of:
- Sampling times
- Control strategies
- Dynamic/Static models
- Cyclic dependencies

On:
- Stability
- Error
- Computation time
Proof of concept and solvers
Tests, implementation and co-simulation tools

- **Mosaik**
  
  → https://mosaik.offis.de/

- **OpenBuildNet**
  
  → https://sites.google.com/site/buildnetproject/software
Creating a tool

- OpenSource technologies
- Highly scalable structure
- Highly adaptive and modular architecture
- Distributed computation
- Academic work suited to industrial needs