CHRONICLE

Joint Workshop

“Digitalisation of energy performance assessment to enable retrofits”

"Closing the Performance Gap": Data Driven Building Performance Assessment in the CHRONICLE project

SUSTAINABLE PLACES 2023

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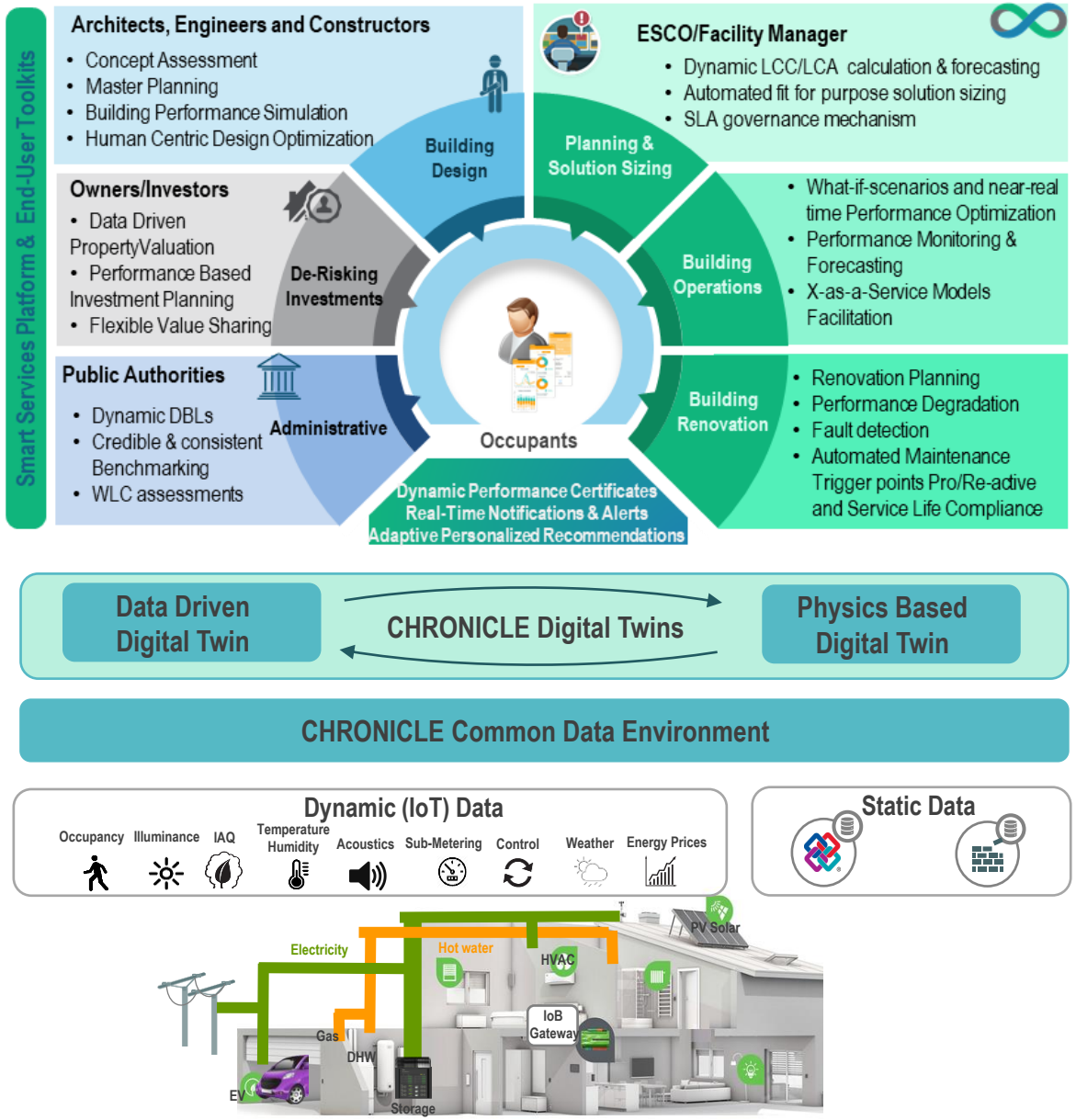
Hypertech Energy Labs (HSRT)

Funded by the European Union

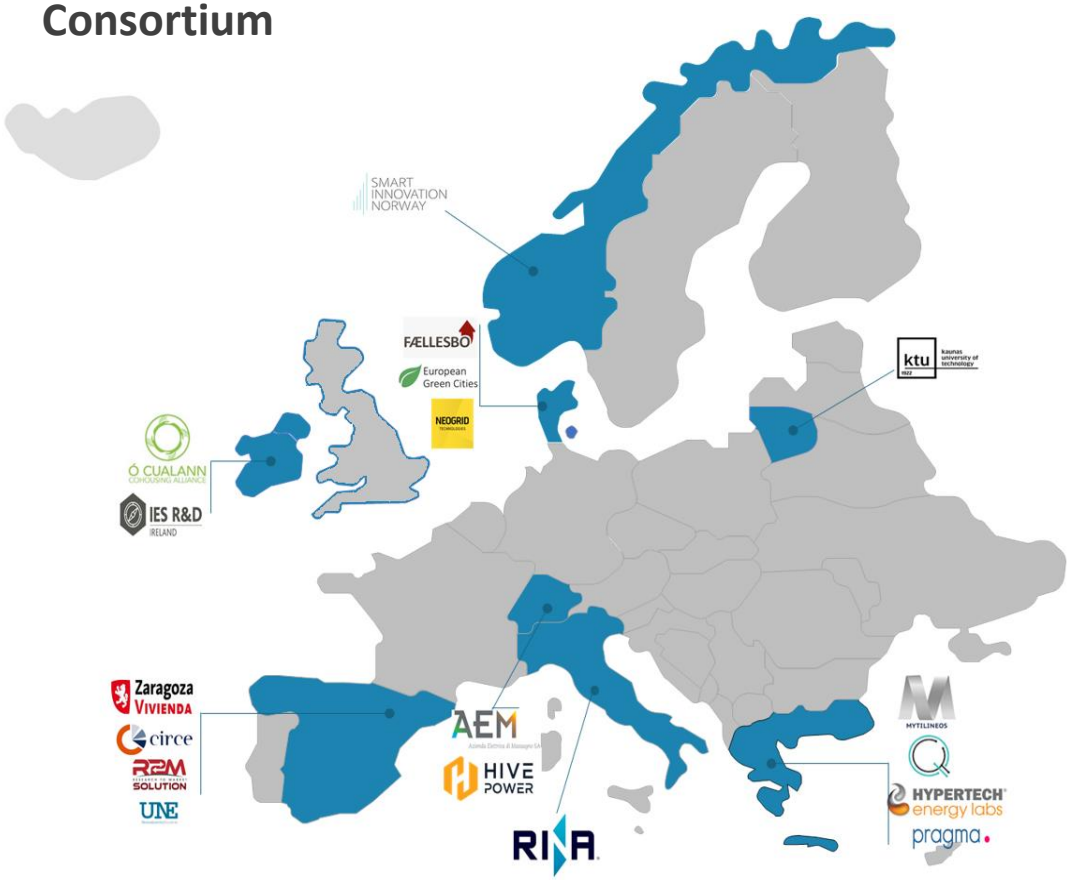
Madrid, 15/6/2023

CHRONICLE "in a nutshell"



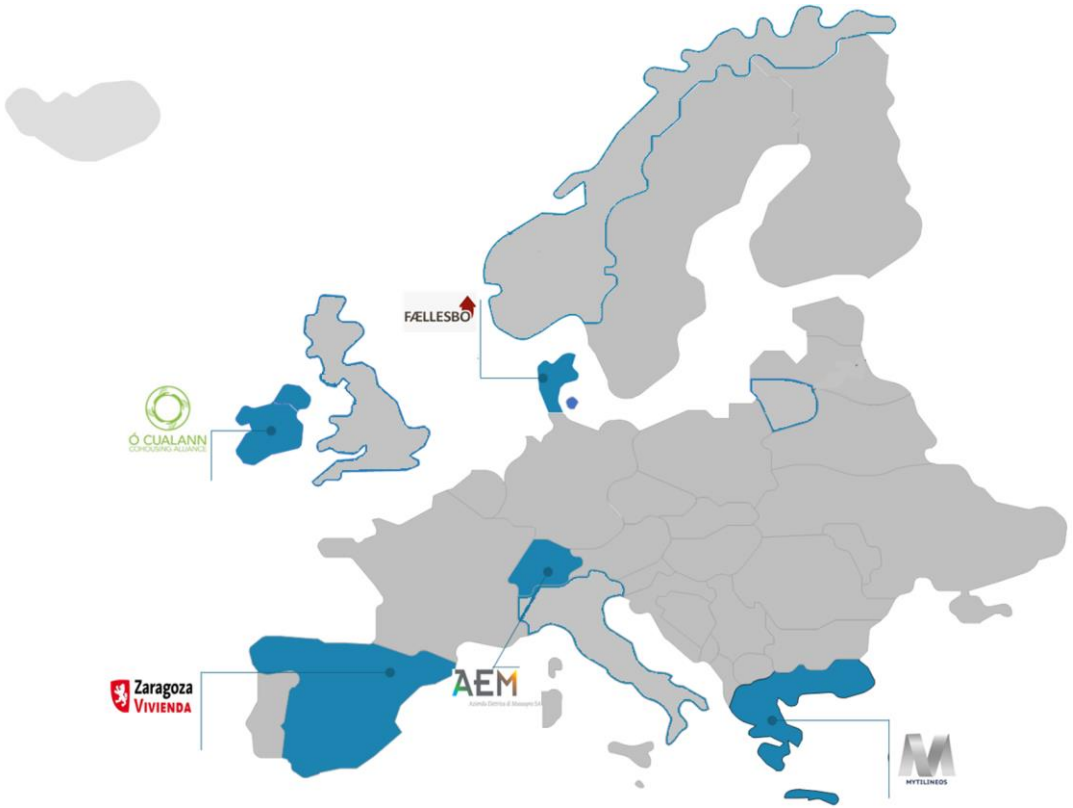
CHRONICLE "in a nutshell"

Consortium



18 Partners | 8 Countries | 42 Months | 4.95M €

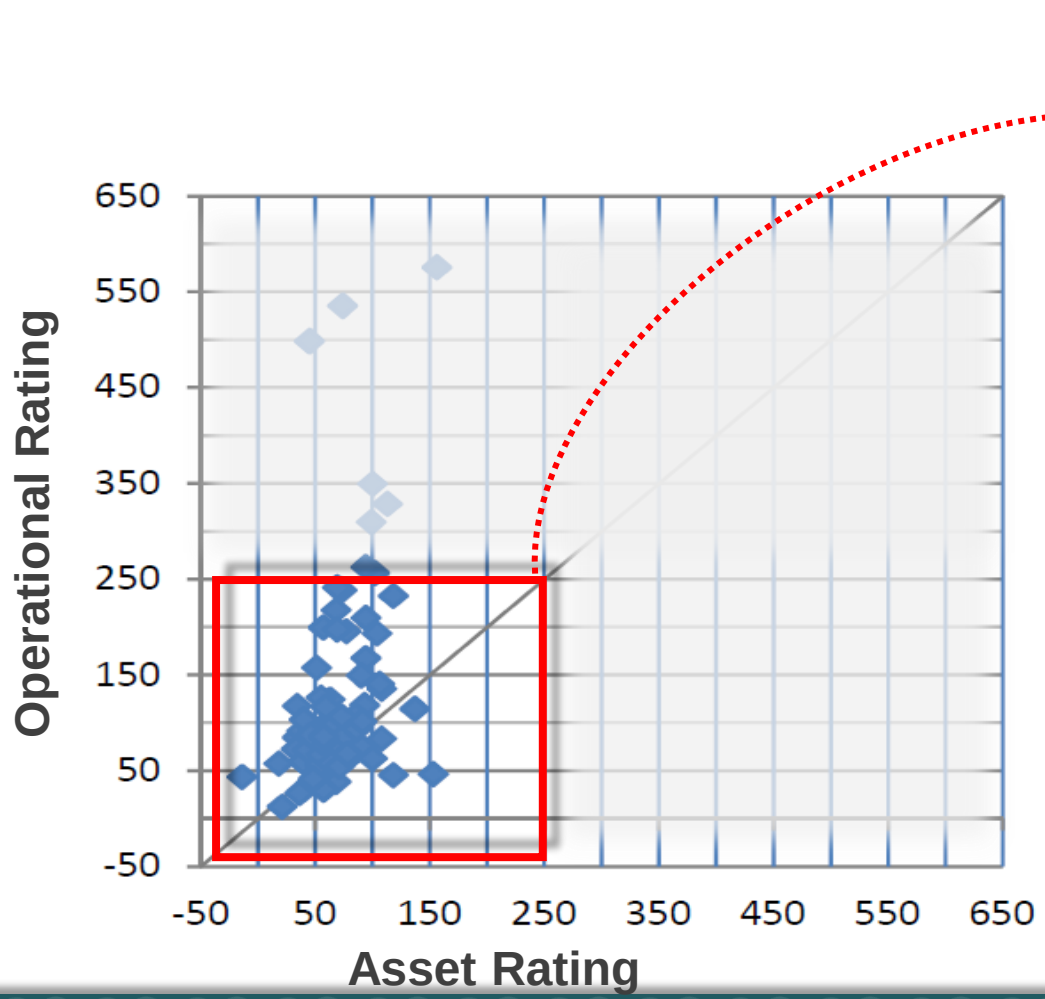
Demonstration Sites

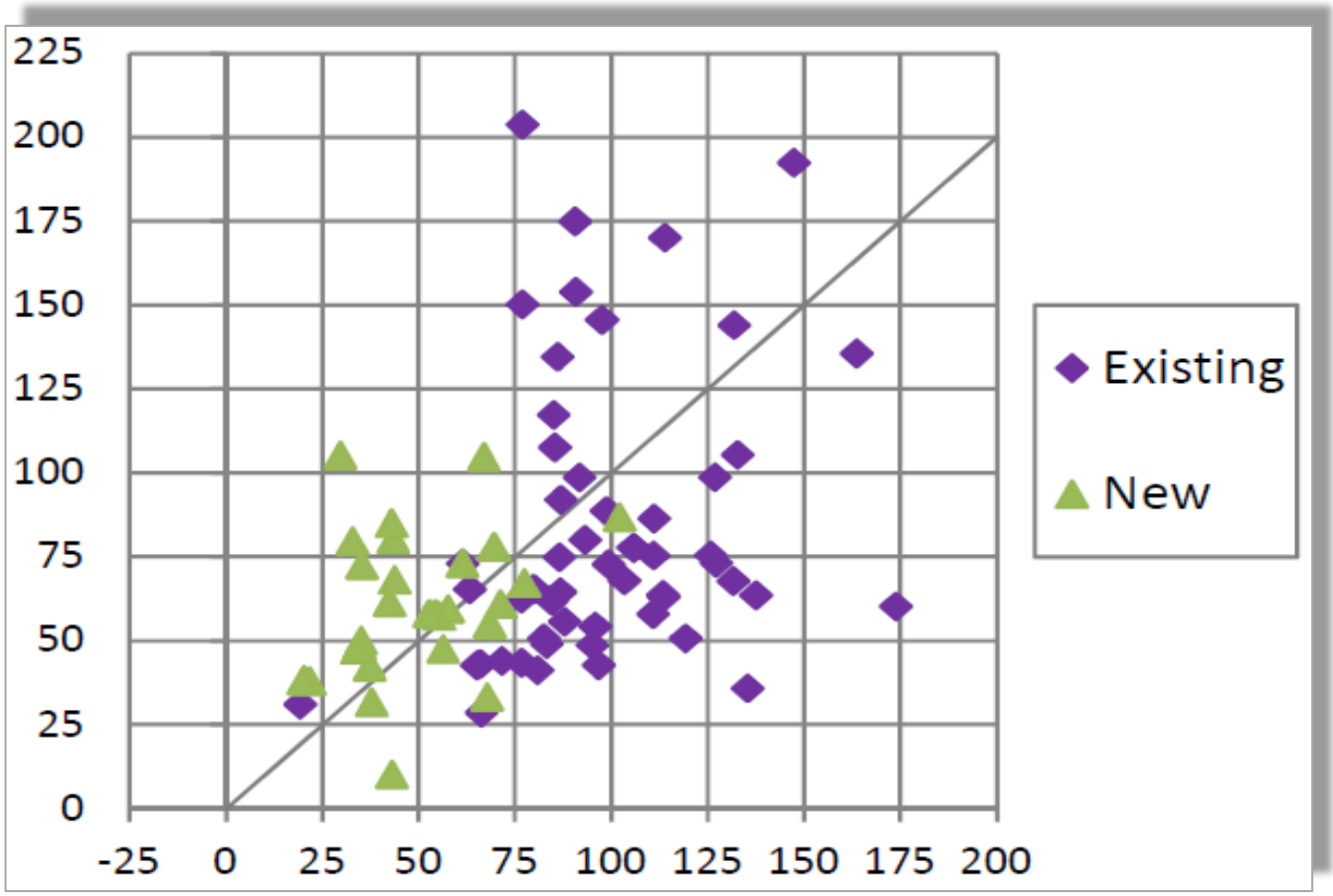


5 Full Scale Pilots | 2 Pre-Validation Sites | ~250 Dwellings | ~24 Months

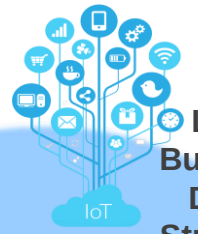
CHRONICLE Main Challenge :

Reducing the "performance gap"

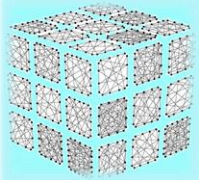




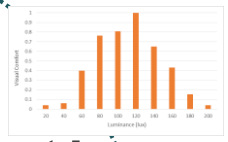
Holistic Performance Framework



Live Building Data Streams

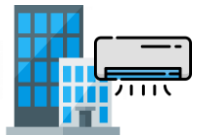


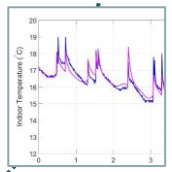
BIM Based Common Data Model



Human Centric

- Occupancy
- Thermal Comfort
- Visual Comfort
- Acoustic Comfort
- IAQ
- Social LCA

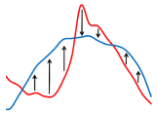




Building/Asset Modelling

Energy Performance

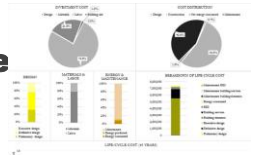
- Data-Driven OR
- BIM-Based AR
- Dynamic Assessment
- Intuitive EPCs



Flexibility

- Human Centric
- Dynamic Flex Profiles
- Highly Granular Flex Profiles
- Multi-purpose Flex Profiles

Operational Performance



SRI+

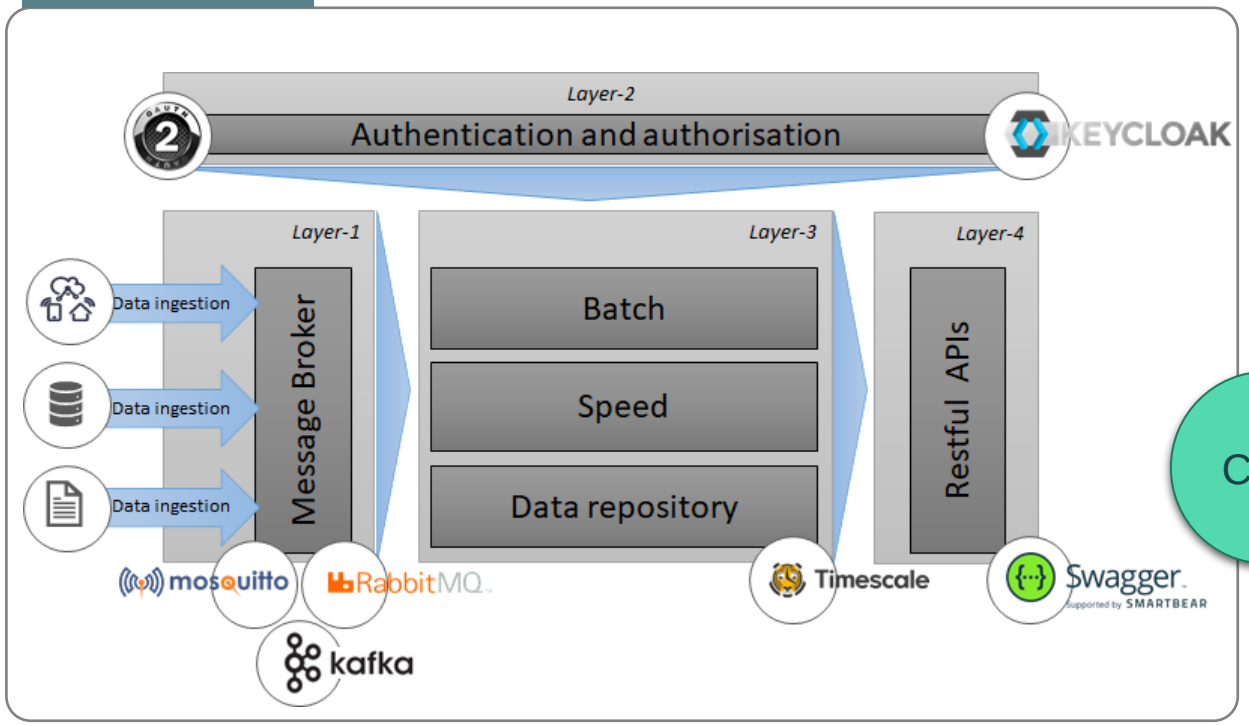
- Automated Self-Assessment
  - *BIM-to-SRI*
  - *Dynamic Weighting*
- Outcome-Based SRI

Common Data Environment

IoT Ecosystem - Distributed Data Management

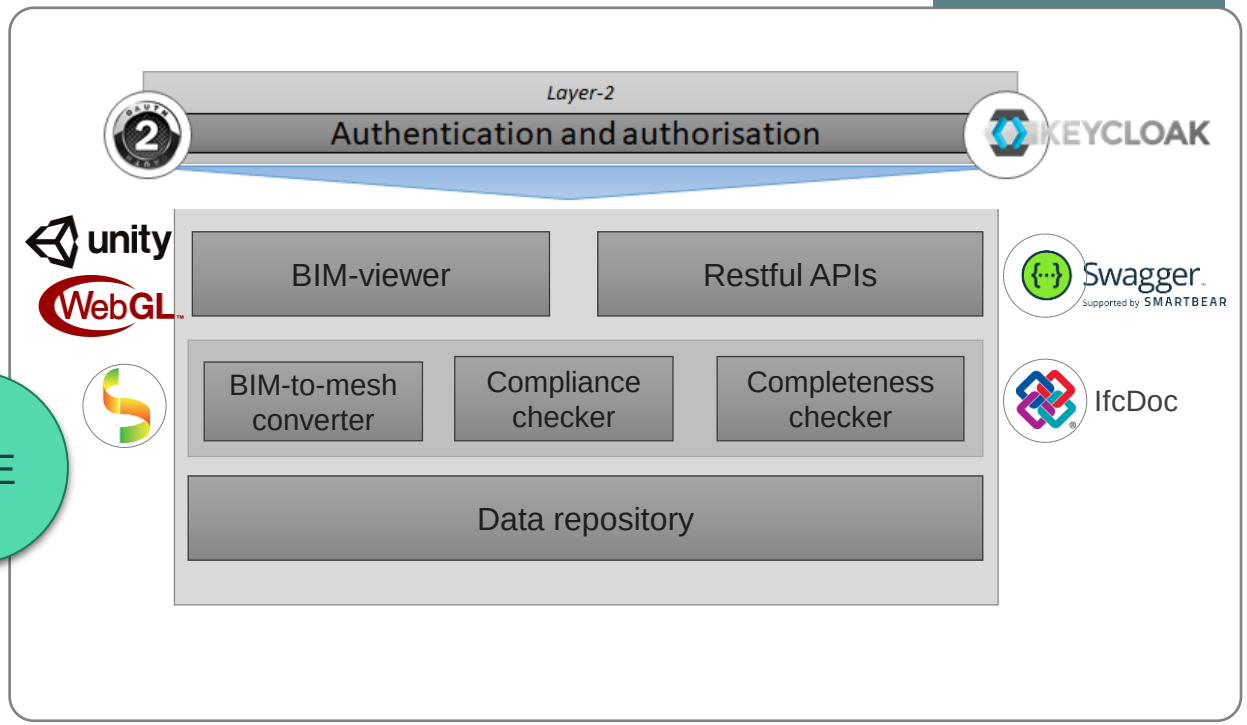
openBIM fused with IoT data

IoT data management



CDE

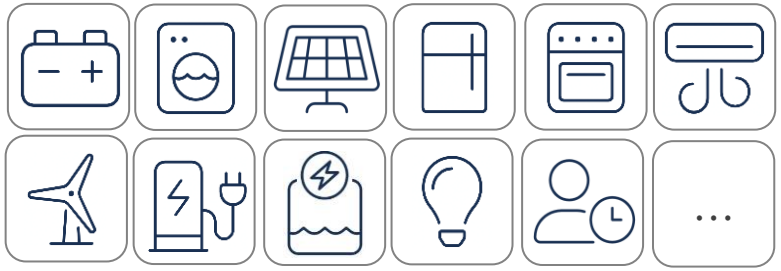
BIM data management



Data Driven Digital Twinning

CHRONICLE

Virtual Replicas



Performance Enhancement and Optimisation Services

- Energy Savings
- Peak load Reduction
- Building-to-Grid Flex

ETL tools and Co-simulation

- BIM-to-BEP
- ML-to-obXML
- Physics-based co-sim

Performance Monitoring and Assessment Services

- Dynamic EPC
- SRI Rating
- Comfort KPIs

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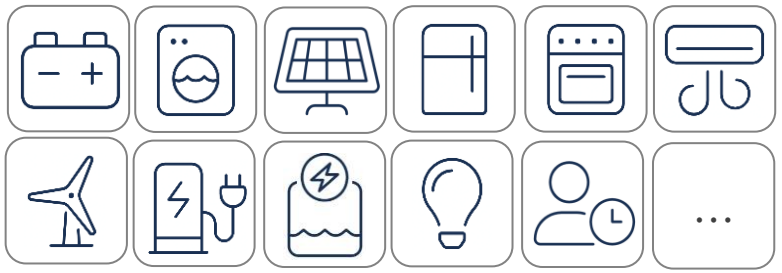
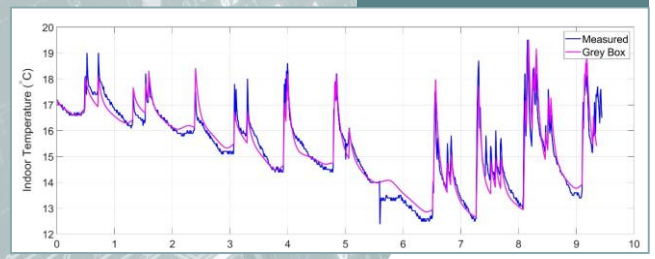
Data Driven Digital Twinning

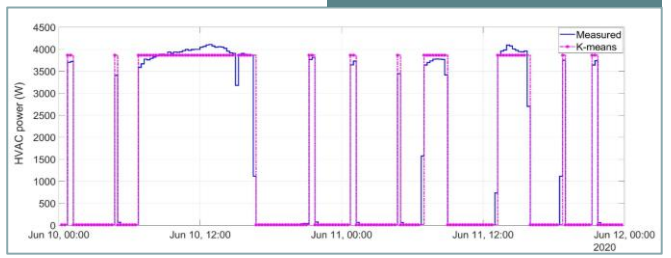
Virtual Replicas



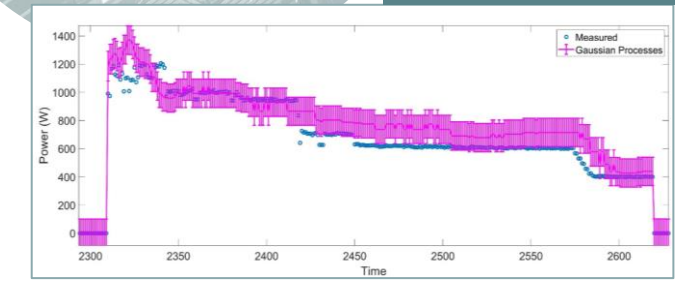
ML building thermal model

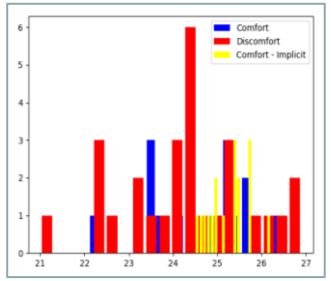


ML HVAC model (non-inverter)

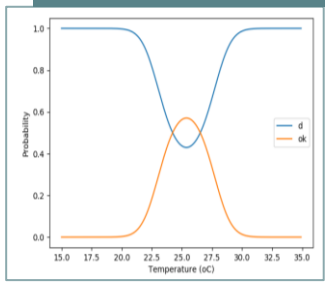


ML HVAC model (inverter)



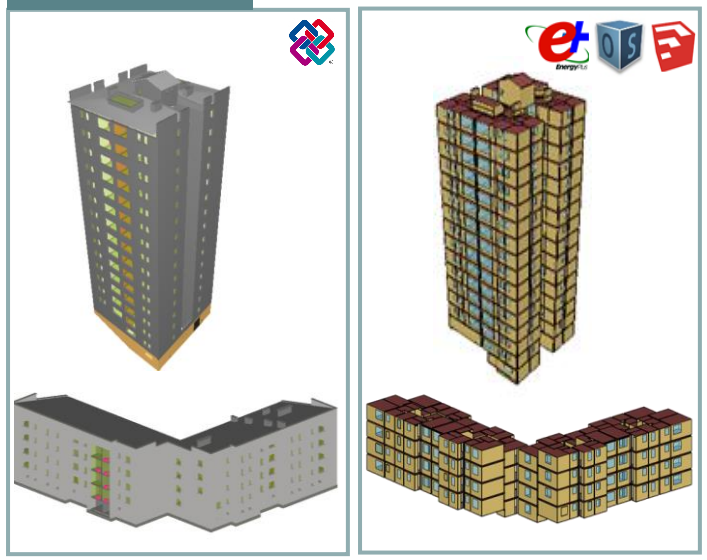


ML thermal comfort model

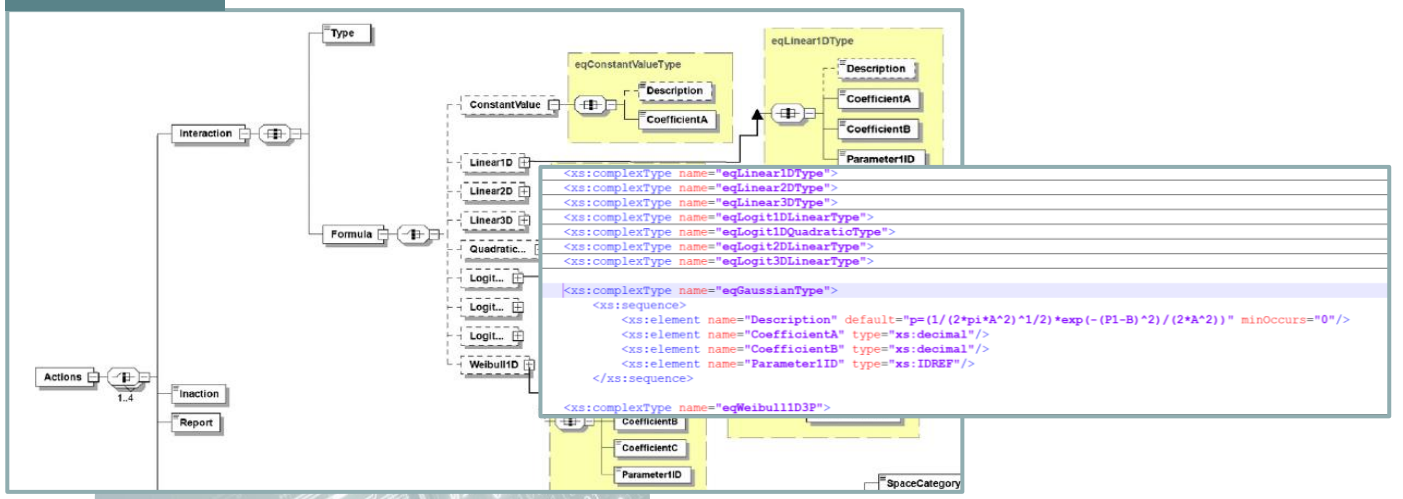


Data Driven Digital Twinning

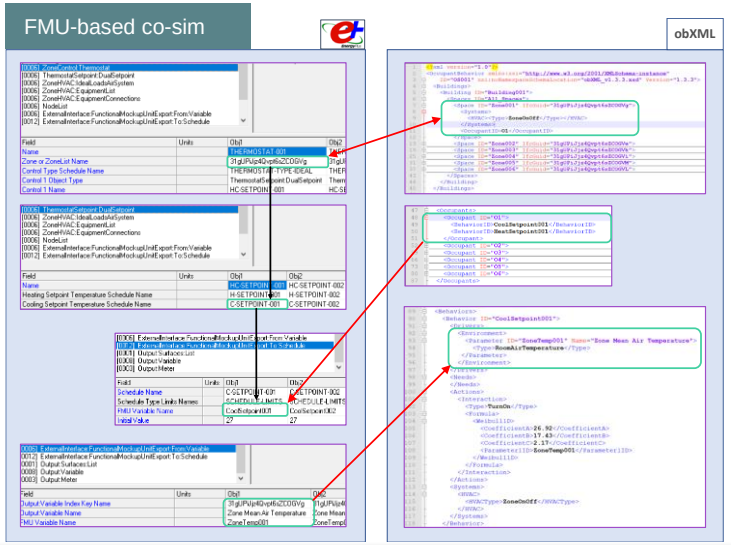
IFC-to-IDF generator



obXML generator



FMU-based co-sim



ETL tools and Co-simulation

BIM-to-BEP

ML-to-obXML

Physics-based co-sim

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Data Driven Digital Twinning

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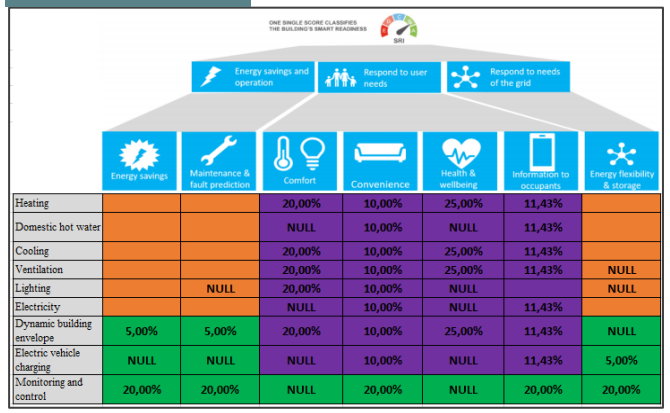
SRI methodology

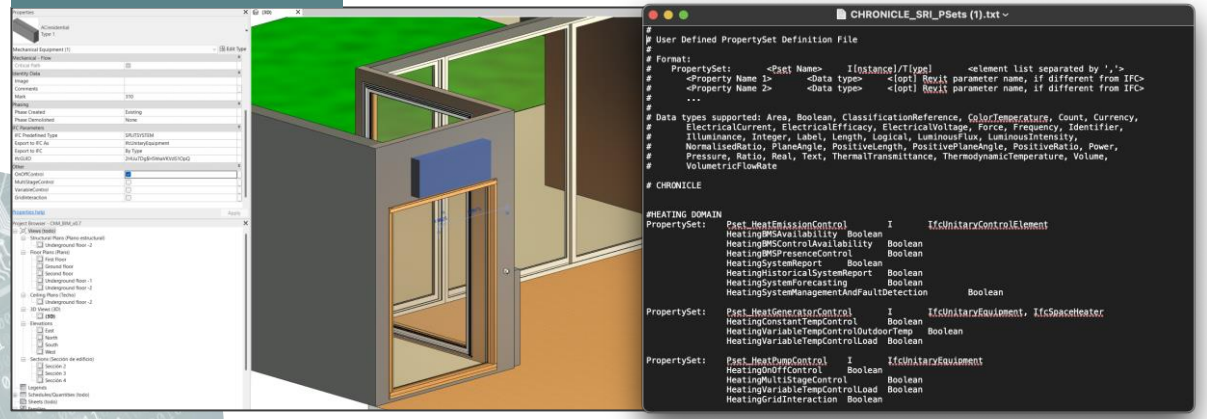


Heating			20,00%	10,00%	25,00%	11,43%	
Domestic hot water			NULL	10,00%	NULL	11,43%	
Cooling			20,00%	10,00%	25,00%	11,43%	
Ventilation			20,00%	10,00%	25,00%	11,43%	NULL
Lighting		NULL	20,00%	10,00%	NULL		NULL
Electricity			NULL	10,00%	NULL	11,43%	
Dynamic building envelope	5,00%	5,00%	20,00%	10,00%	25,00%	11,43%	NULL
Electric vehicle charging	NULL	NULL	NULL	10,00%	NULL	11,43%	5,00%
Monitoring and control	20,00%	20,00%	NULL	20,00%	NULL	20,00%	20,00%

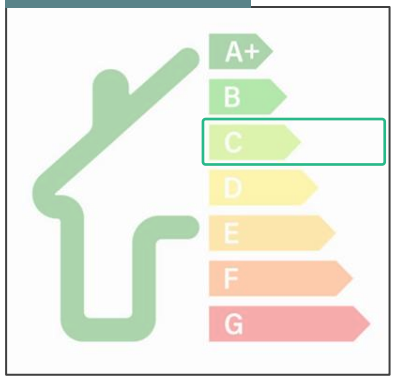
DD SRI weights re-adjustment

3-key functionalities	Energy savings and operation	Energy flexibility	Respond to user needs			Energy savings and operation	Respond to user needs
Impact criteria/Technical domain	Energy efficiency	Energy flexibility and storage	Comfort	Convenience	Health, well-being and accessibility	Maintenance and fault prediction	Information to occupants
Heating	$\left(\frac{Q_{heat}}{Q_{total}}+\frac{Q_{heat}^{nominal}}{Q_{total}^{nominal}}\right)/2$	$\left(\frac{Q_{heat}}{Q_{total}}+\frac{Q_{heat}^{nominal}}{Q_{total}^{nominal}}\right)/2$	0,33	0,20	0,33	$\left(\frac{Q_{heat}}{Q_{total}}+\frac{Q_{heat}^{nominal}}{Q_{total}^{nominal}}\right)/2$	0,20
Domestic hot water	$\left(\frac{Q_{DHW}}{Q_{total}}+\frac{Q_{DHW}^{nominal}}{Q_{total}^{nominal}}\right)/2$	$\left(\frac{Q_{DHW}}{Q_{total}}+\frac{Q_{DHW}^{nominal}}{Q_{total}^{nominal}}\right)/2$	0	0,20	0	$\left(\frac{Q_{DHW}}{Q_{total}}+\frac{Q_{DHW}^{nominal}}{Q_{total}^{nominal}}\right)/2$	0,20
Cooling	$\left(\frac{Q_{cool}}{Q_{total}}+\frac{Q_{cool}^{nominal}}{Q_{total}^{nominal}}\right)/2$	$\left(\frac{Q_{cool}}{Q_{total}}+\frac{Q_{cool}^{nominal}}{Q_{total}^{nominal}}\right)/2$	0,33	0,20	0,33	$\left(\frac{Q_{cool}}{Q_{total}}+\frac{Q_{cool}^{nominal}}{Q_{total}^{nominal}}\right)/2$	0,20
Ventilation	$\left(\frac{Q_{vent}}{Q_{total}}+\frac{Q_{vent}^{nominal}}{Q_{total}^{nominal}}\right)/2$	0	0,33	0,20	0,33	$\left(\frac{Q_{vent}}{Q_{total}}+\frac{Q_{vent}^{nominal}}{Q_{total}^{nominal}}\right)/2$	0,20
Lighting	0	0	0	0	0	0	0
Electricity	$\left(\frac{Q_{RES}}{Q_{total}}+\frac{Q_{RES}^{nominal}}{Q_{total}^{nominal}}\right)/2$	$\left(\frac{Q_{RES}}{Q_{total}}+\frac{Q_{RES}^{nominal}}{Q_{total}^{nominal}}\right)/2$	0	0,20	0	$\left(\frac{Q_{RES}}{Q_{total}}+\frac{Q_{RES}^{nominal}}{Q_{total}^{nominal}}\right)/2$	0,20
Dynamic building envelope	0	0	0	0	0	0	0
Electric vehicle charging	0	0	0	0	0	0	0
Monitoring and control	0	0	0	0	0	0	0

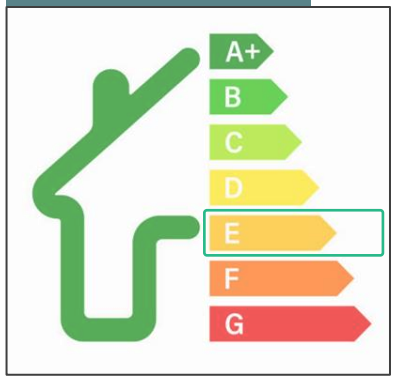
BIM-based SRI input collection



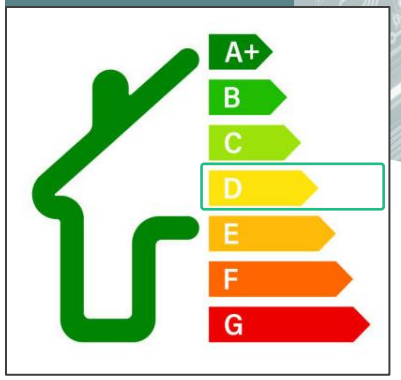
EPC Asset Rating



EPC Operational Rating



EPC Rating (DTs co-sim)



Performance Monitoring and Assessment Services

- Dynamic EPC
- SRI Rating
- Comfort KPIs

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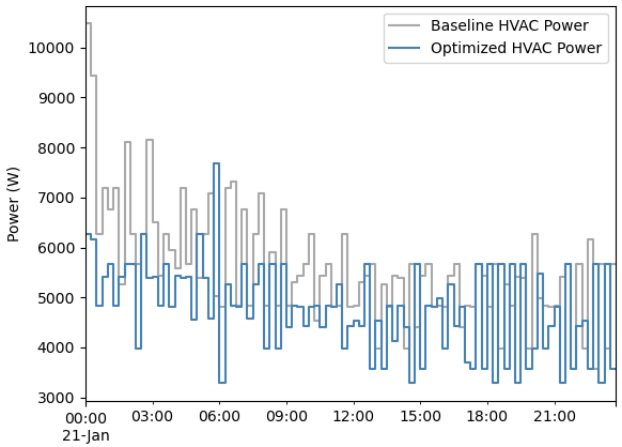
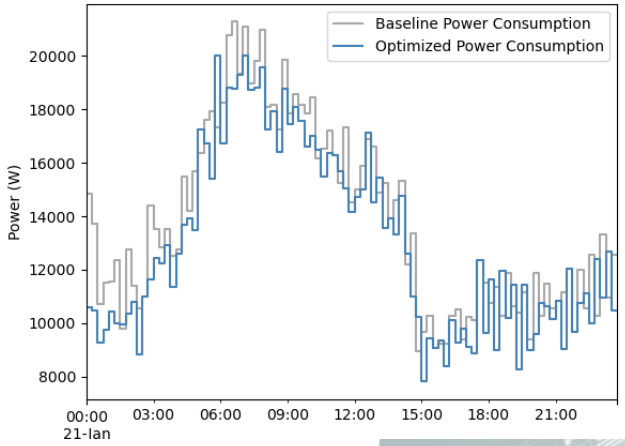
Data Driven Digital Twinning

Energy Savings





Performance Enhancement and Optimisation Services

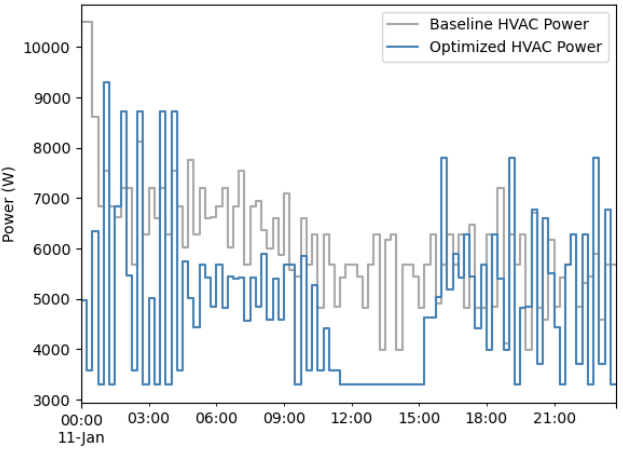
Energy Savings

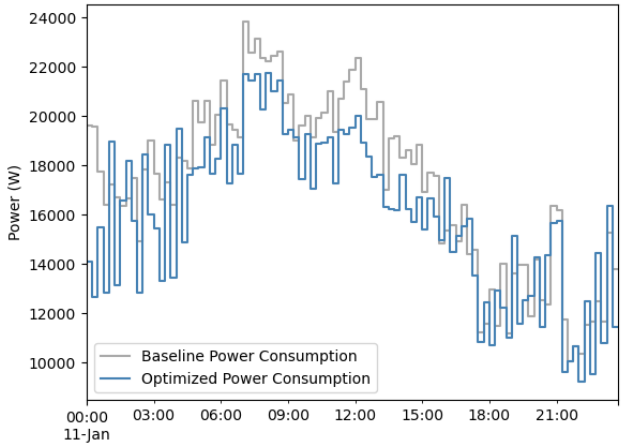
Peak load Reduction

Building-to-Grid Flex

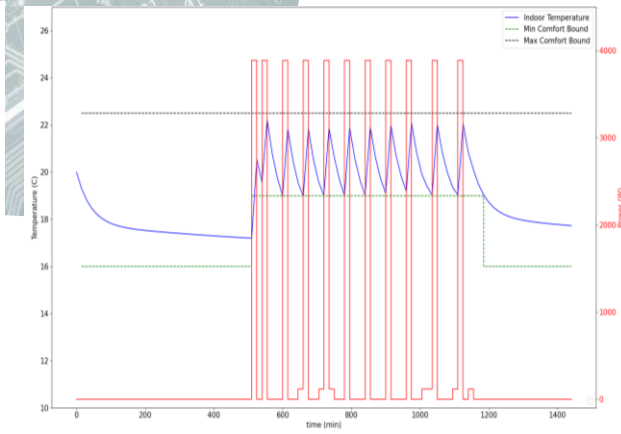
Human centric approach: thermal comfort bounds are not violated

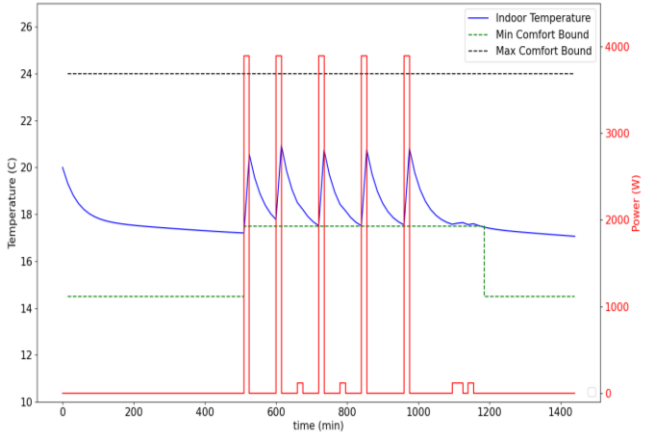
Peak Load Reduction



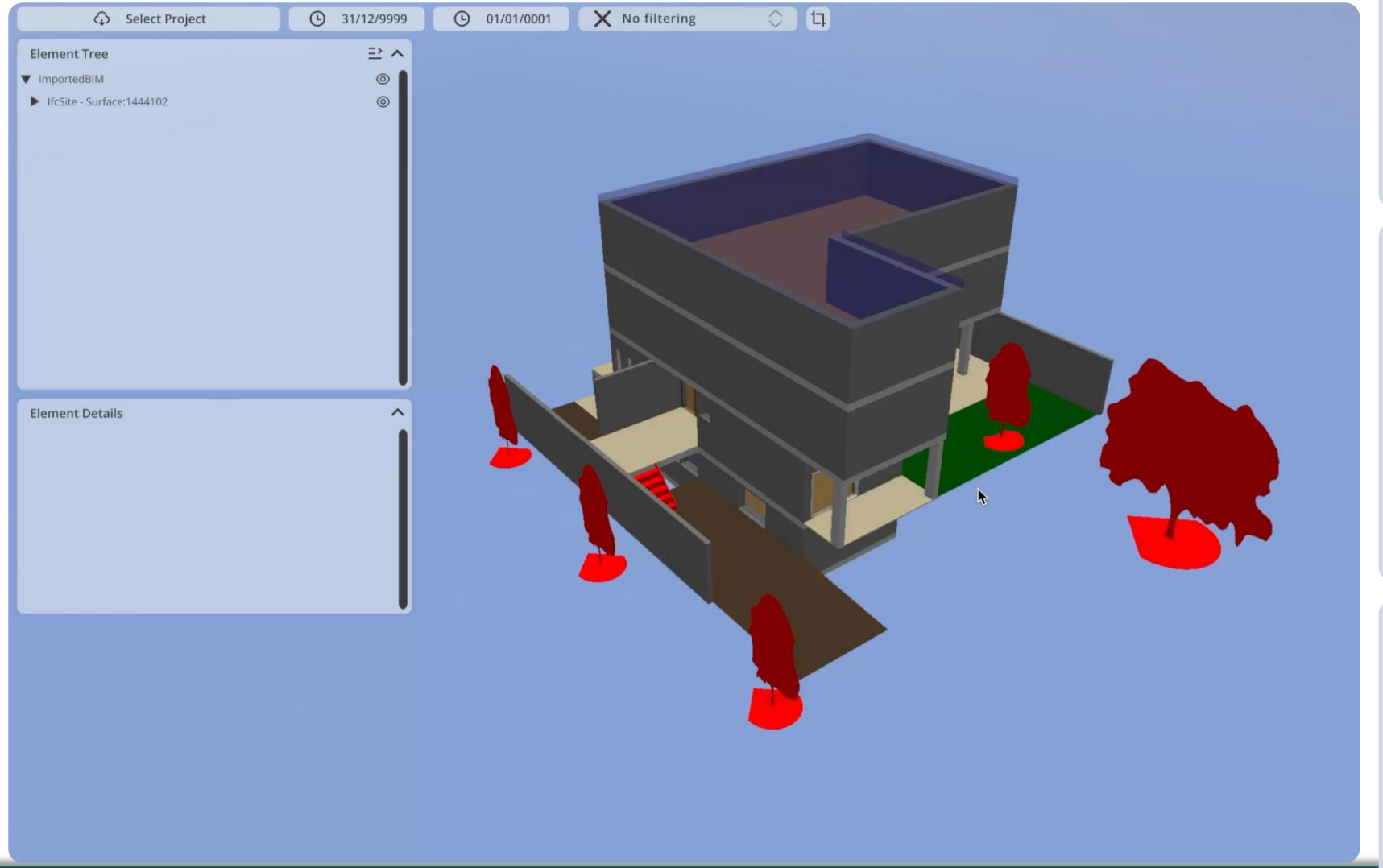


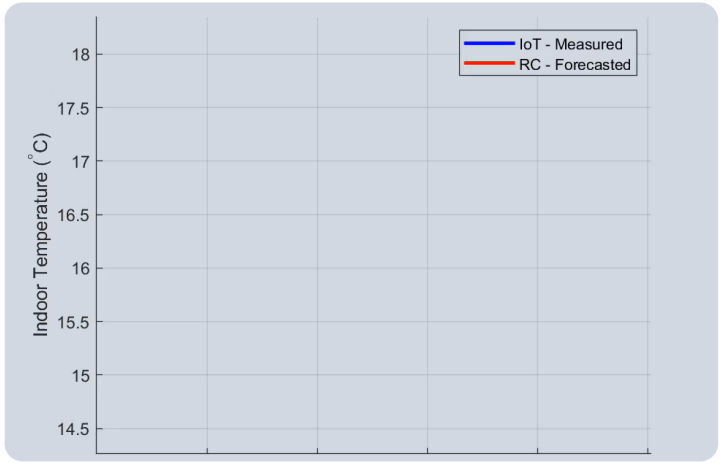
Building-to-Grid Flex

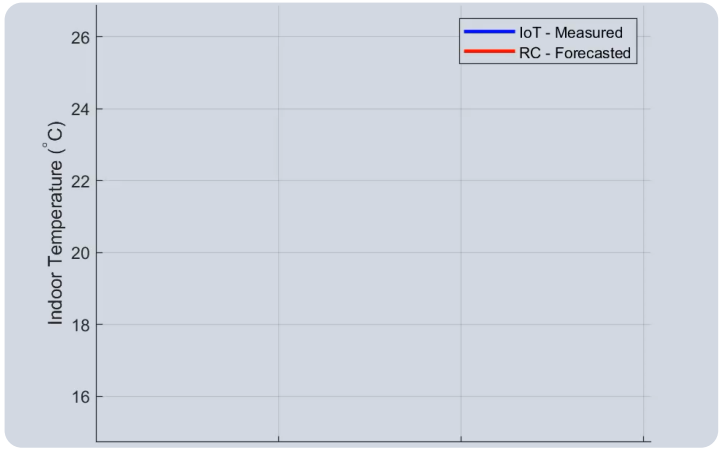


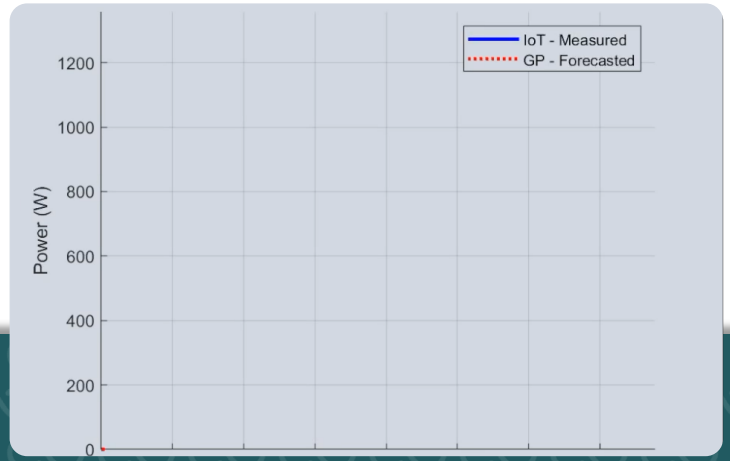


Intuitive Visualisation









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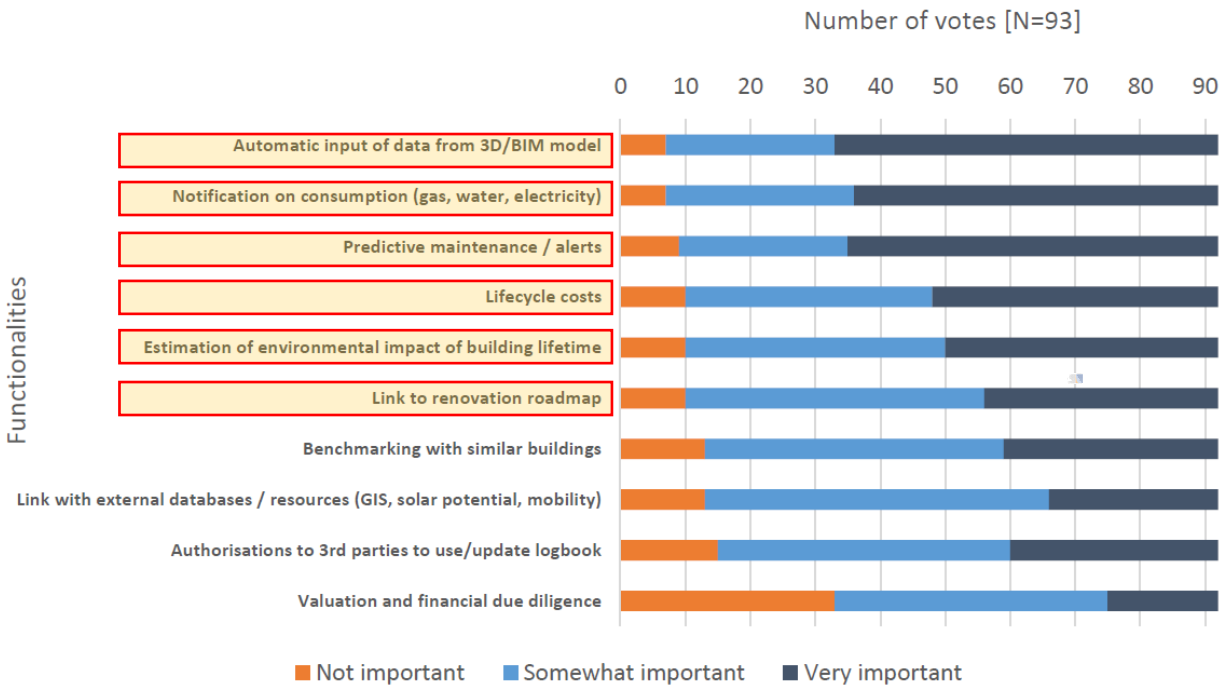
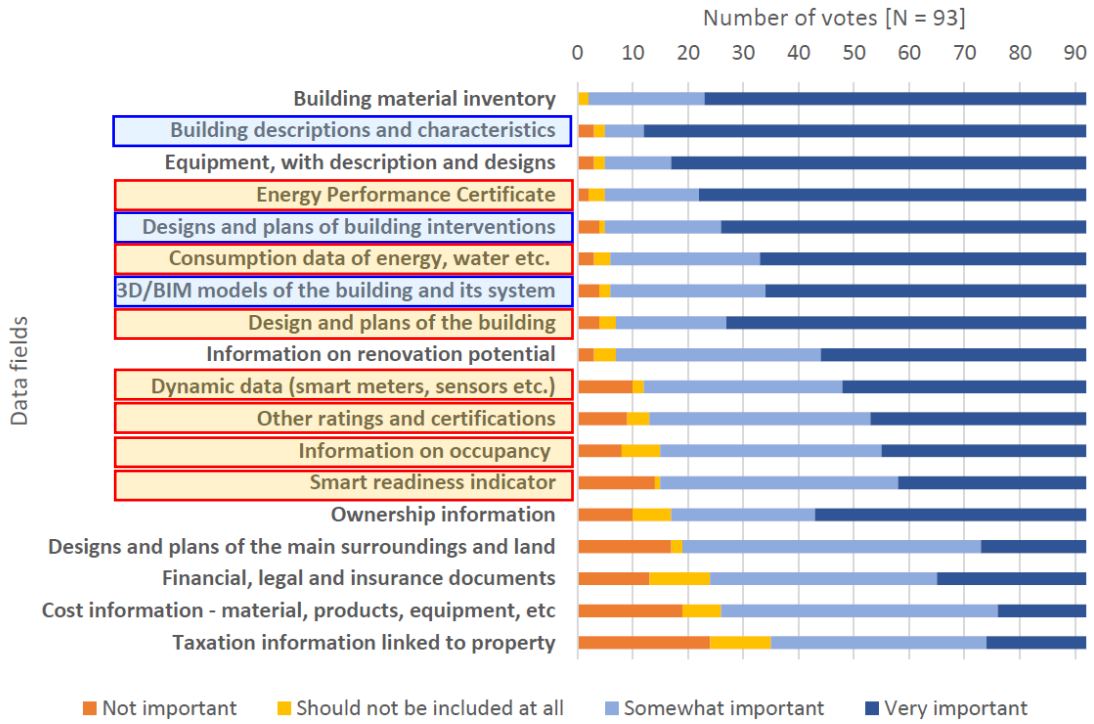
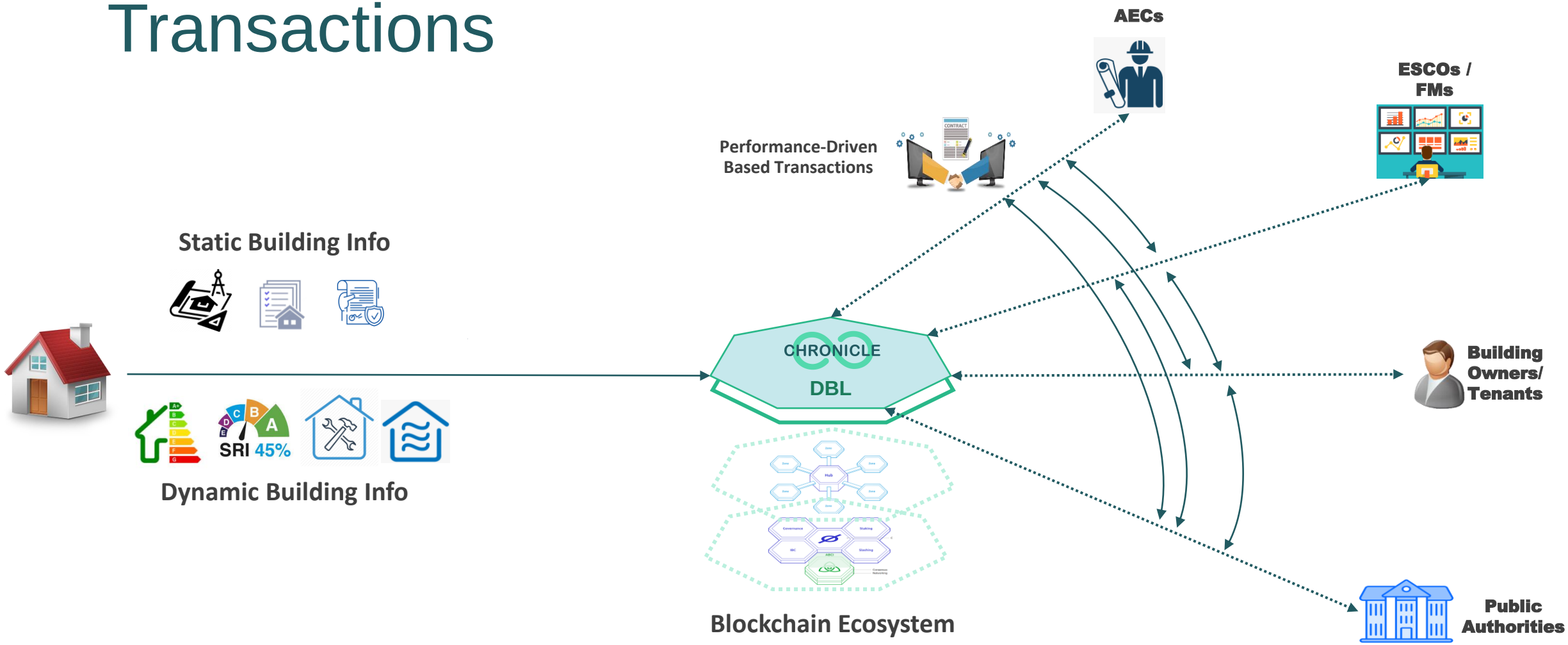
Digital Building Logbooks for Multi-actor Transactions

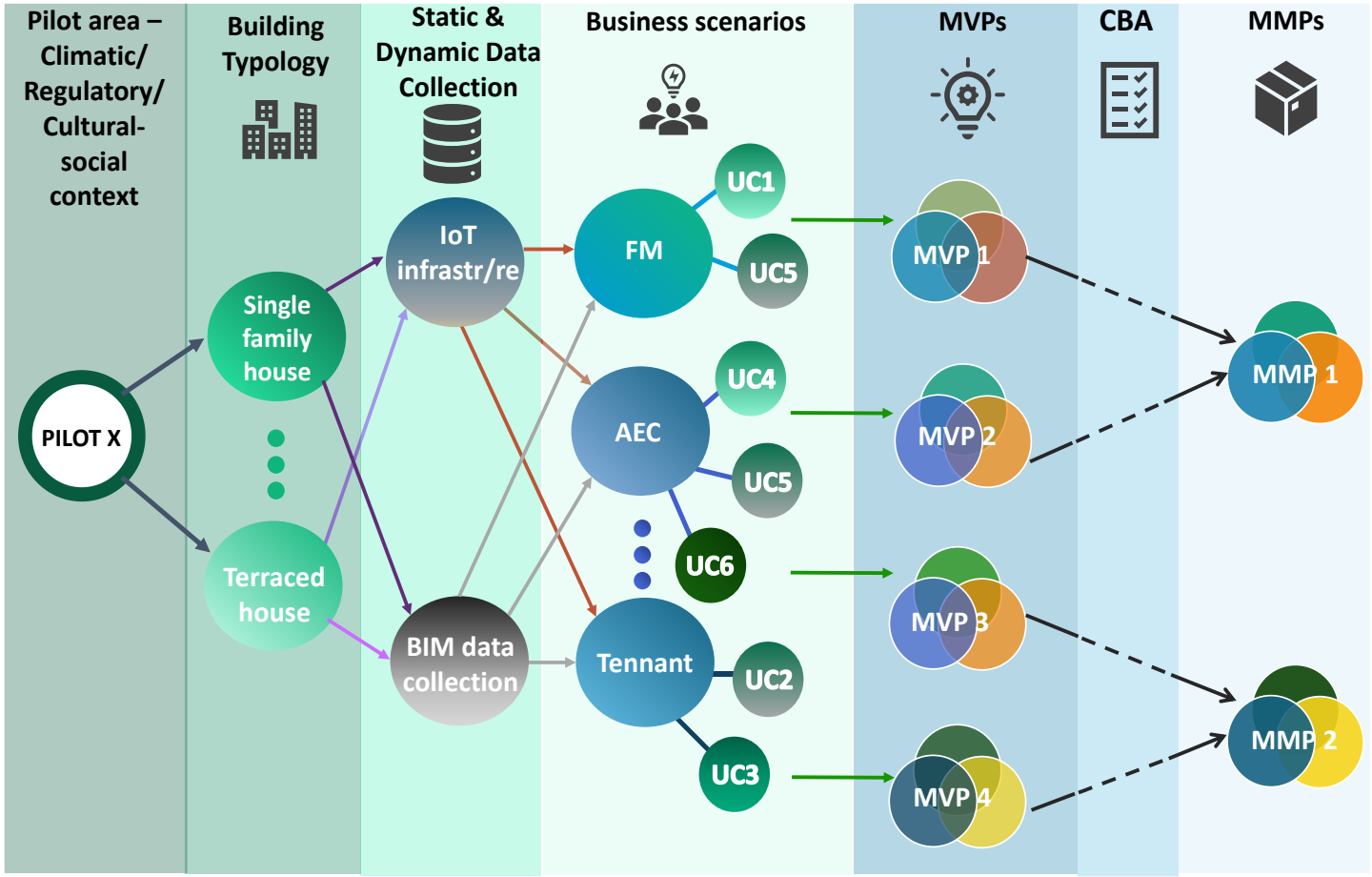




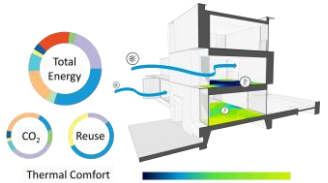
Digital Building Logbooks for Multi-actor Transactions



Co-creation of Innovative Business Models

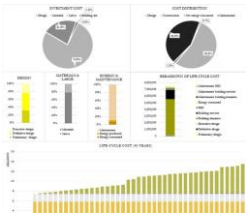


Sustainable Circular Design



EPCs for People

Use for Performance / Paid for Savings Schemes



Comfort-As-A-Service

Thank you!

Contact: Christos Malavazos

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Website: chronicle-project.eu