Validation of a Flexibility Assessment Methodology for Demand Response in Buildings

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Ryan Institute
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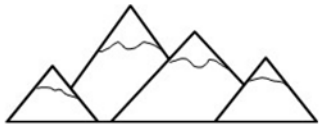
4 - Step Methodology

Step 1

System & Load Identification



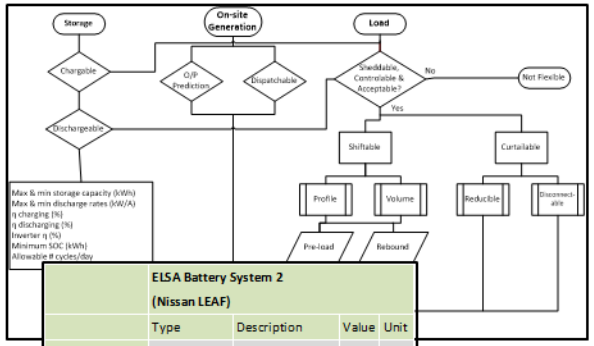
Avalanche of Data

ISO 50002 Adapted:

Data Collection [5.4] & Site Visit[5.6]

Step 2

Analysis: Flexibility Characterisation



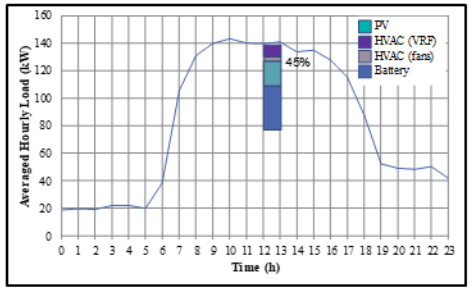
ELSA Battery System 2 (Nissan LEAF)			
	Type	Description	Value	Unit
Specifications	No. of Batteries		
	Capacity	No du sic Ch	
	Max Charge Rate	At ch	
	Max Discharge Rate	At ve	
	Min Charge Rate	At ch	
	Min Discharge Rate	At ve	
	Min Stage of Charge (SOC)	N/	

HVAC System – AHUs		
	Type	Description
Specifications	Ventilation (Some Heating & Cooling)	AHU01, AHU 02, AHU 03, AHU 05
	Fan Size	Supply and Extract fans in each
		AHU01
		AHU 02
		AHU 03
		AHU 05
Communications	BMS	

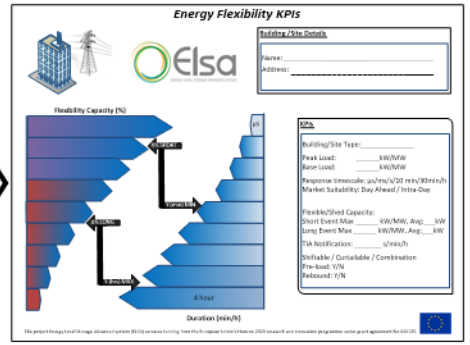
Analysis [5.7]

Steps 3 & 4

3: Scenario Modelling



4: KPI Label



Reporting [5.8]

Use Cases

Specific use cases required to validate flexibility for selected sources in buildings

- **Peak shaving** - reducing grid import of electricity during periods of peak consumption

  Implemented: Commercial building, Paris & Cluster of buildings, Terni

- **Intra-day Grid Request** – market based programme which requires building to respond to a grid request intra-day within a short timeframe

  Implemented: Commercial building, Sunderland

- **CO_2 minimisation** - incentivise electricity use or reduction in times of high or low renewable generation on the grid

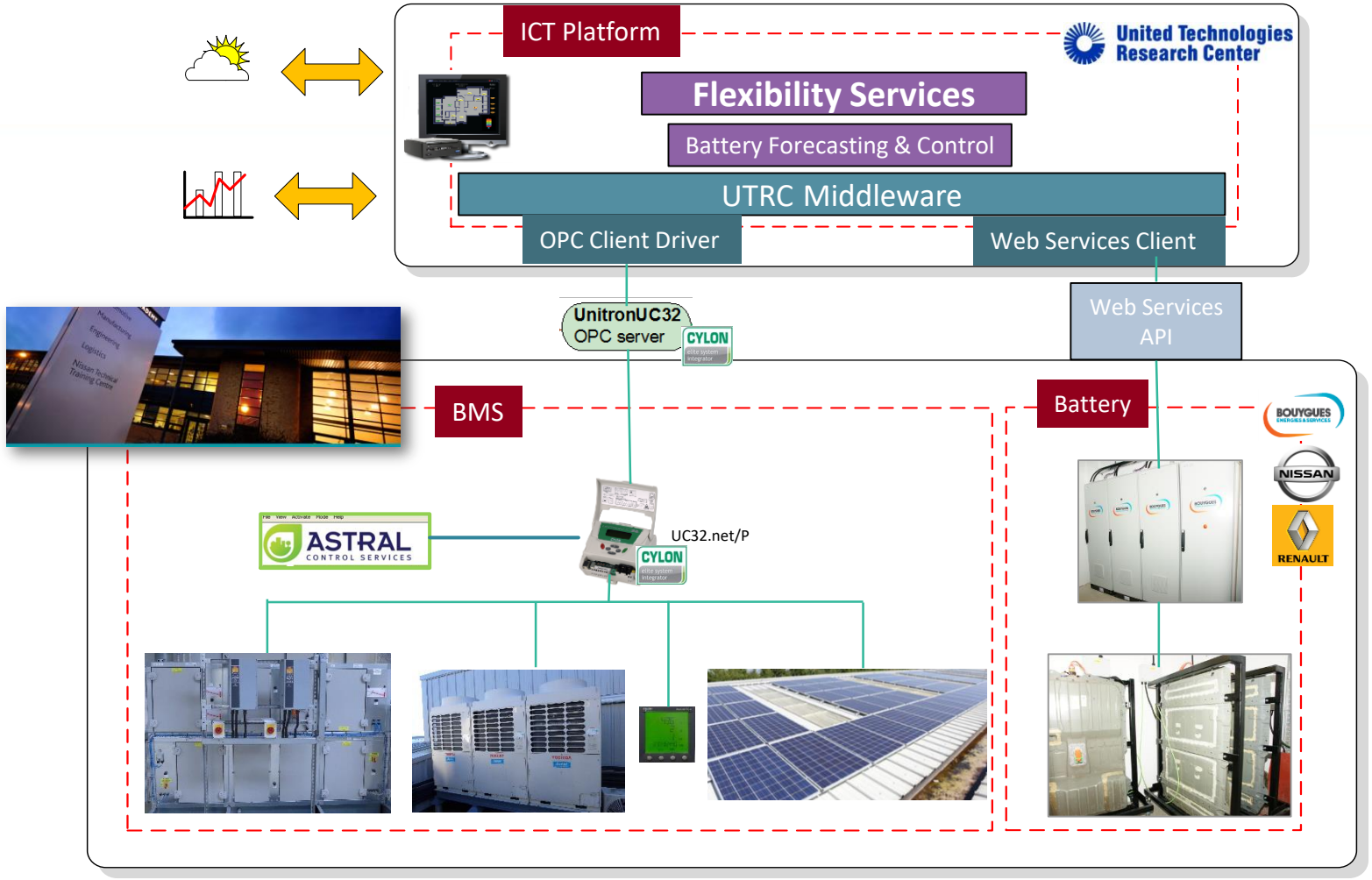
  Implemented: Aachen building

- **PV power smoothing** - mitigate PV generation variability

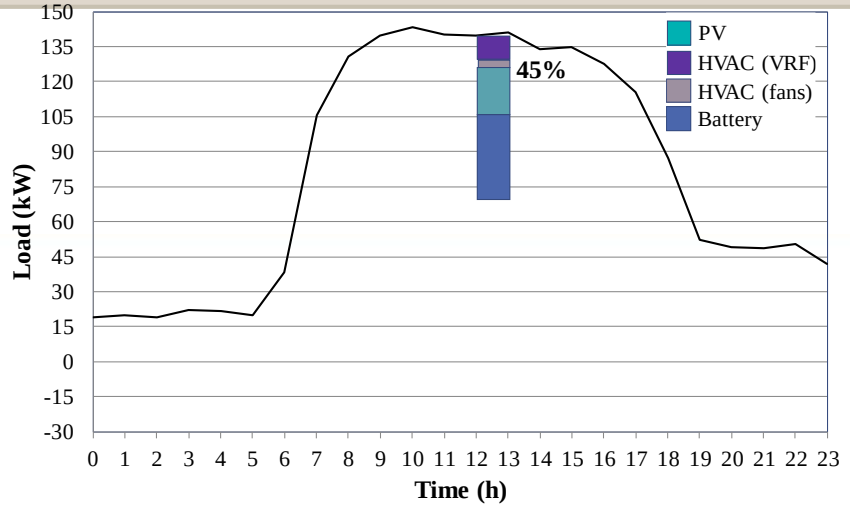
  Iimplemented: Kempten Residential District

Experimental Set-up

ICT platform architecture for use case demonstration experiments



Results – Sunderland Pilot Site



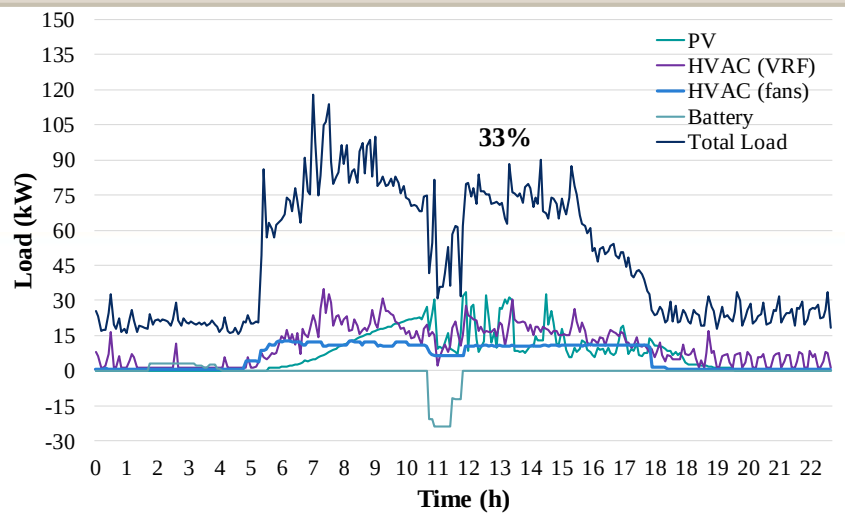
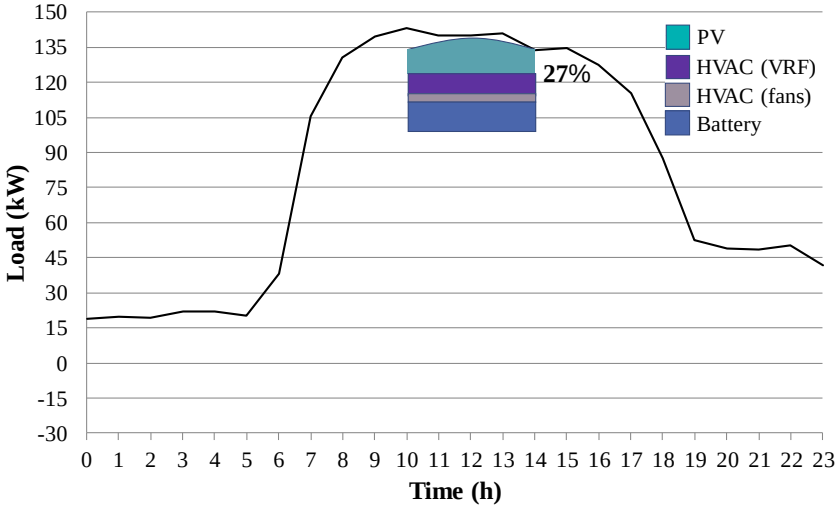


Figure 1. One-hour Scenario Model (on left) and Validation Results (on right)



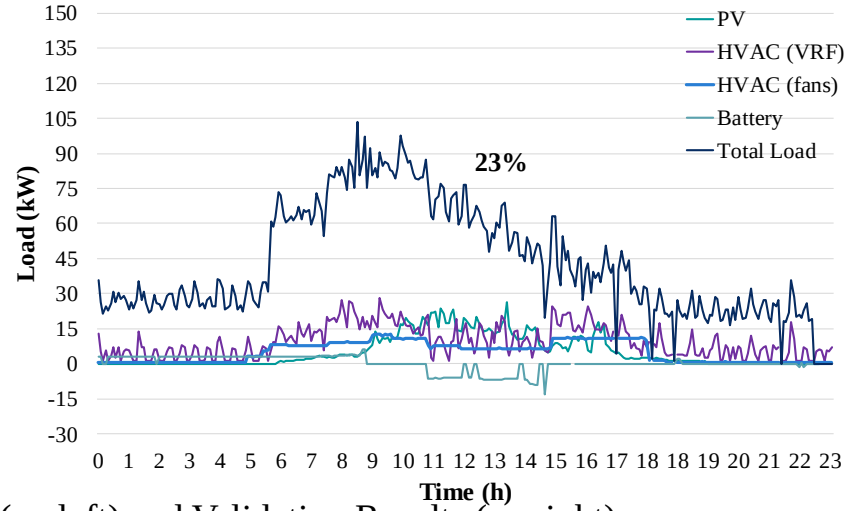


Figure 2. Four-hour Scenario Model (on left) and Validation Results (on right)

Results – Multiple Buildings

Pilot Site Location	Type	Sources	Use Case	Use Case Flexibility (%)		
				Predicted	Actual	Error
Sunderland, UK	Building	F^{RES}, F^{S}, F^{L}	Intra-day Grid Request	45% (36%)	33%	26% (9%)
Terni, IT	Cluster of Buildings	F^{RES}, F^{S}	Peak Shaving	90%	81%	10%
Paris, FR	Building	F^{S}	Peak Shaving	9%	7%	22%
Aachen, DE	Building	F^{L}	CO_2 Min	3%	3%	-
Kempten, DE	Residential District	F^{RES}, F^{S}	PV Power Smoothing	103%	106%	3%

F^{RES} = Renewable Energy System Flexibility (PV), F^{S}= Storage Flexibility (Battery), F^{L} = Load Flexibility;

Conclusions

Standardised 4-step flexibility assessment process developed, demonstrated & validated

Practical impact:

- *Reduces complexity and cost*
- *Enables contract negotiations*
- *Ease of implementation*
- *Accuracy*
- *Scalability*

Societal impact:

- *operationalise building flexibility to a wider spectrum of society*

Acknowledgements

ANNEX 67

International Energy Agency's (IEA) Energy in Buildings and Communities (EBC) Annex 67 'Energy Flexible Buildings'

Sustainable Energy Authority of Ireland

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

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