

The Planned Community Residential Development Concept as a Commercial Realization of the Microgrid

Panagiotis Moutis, Dr Spyros Skarvelis-Kazakos (UoG)

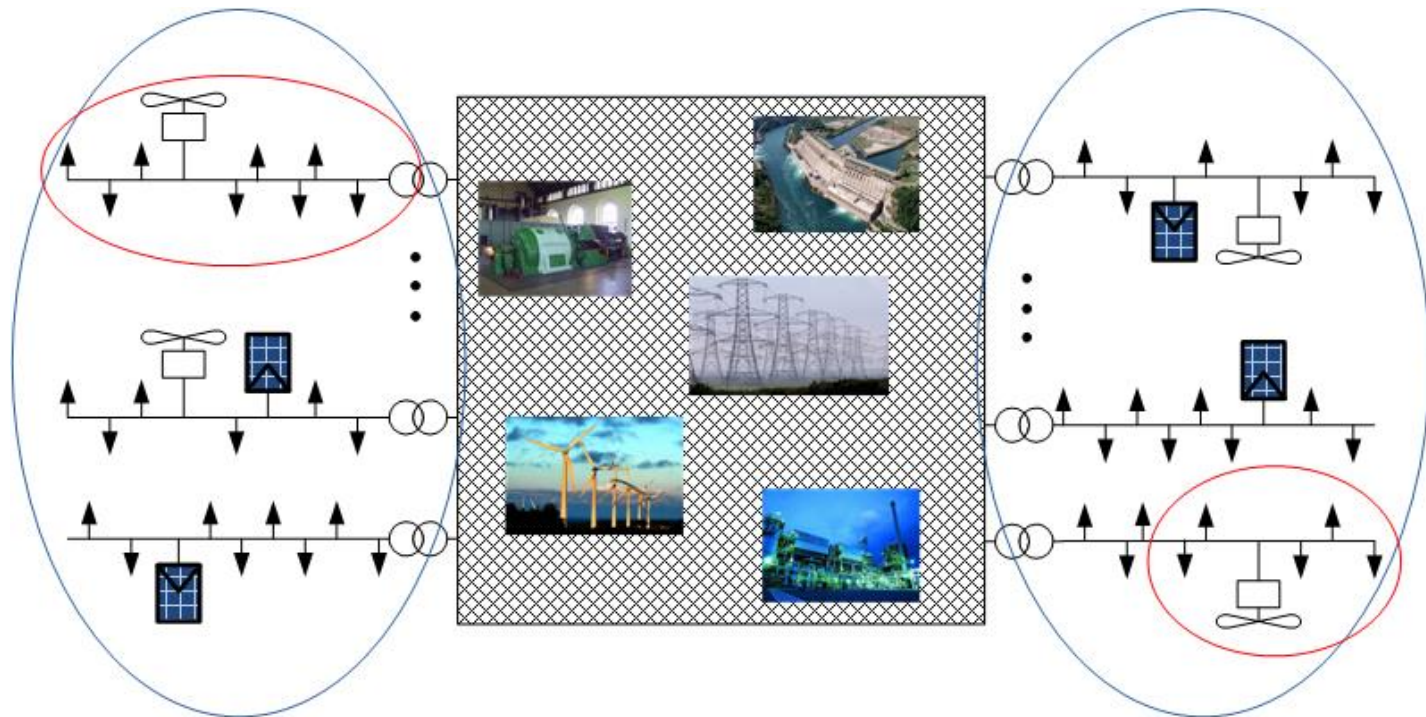
Dr Maria Brucoli (Arup)





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What is a Microgrid (MG)?



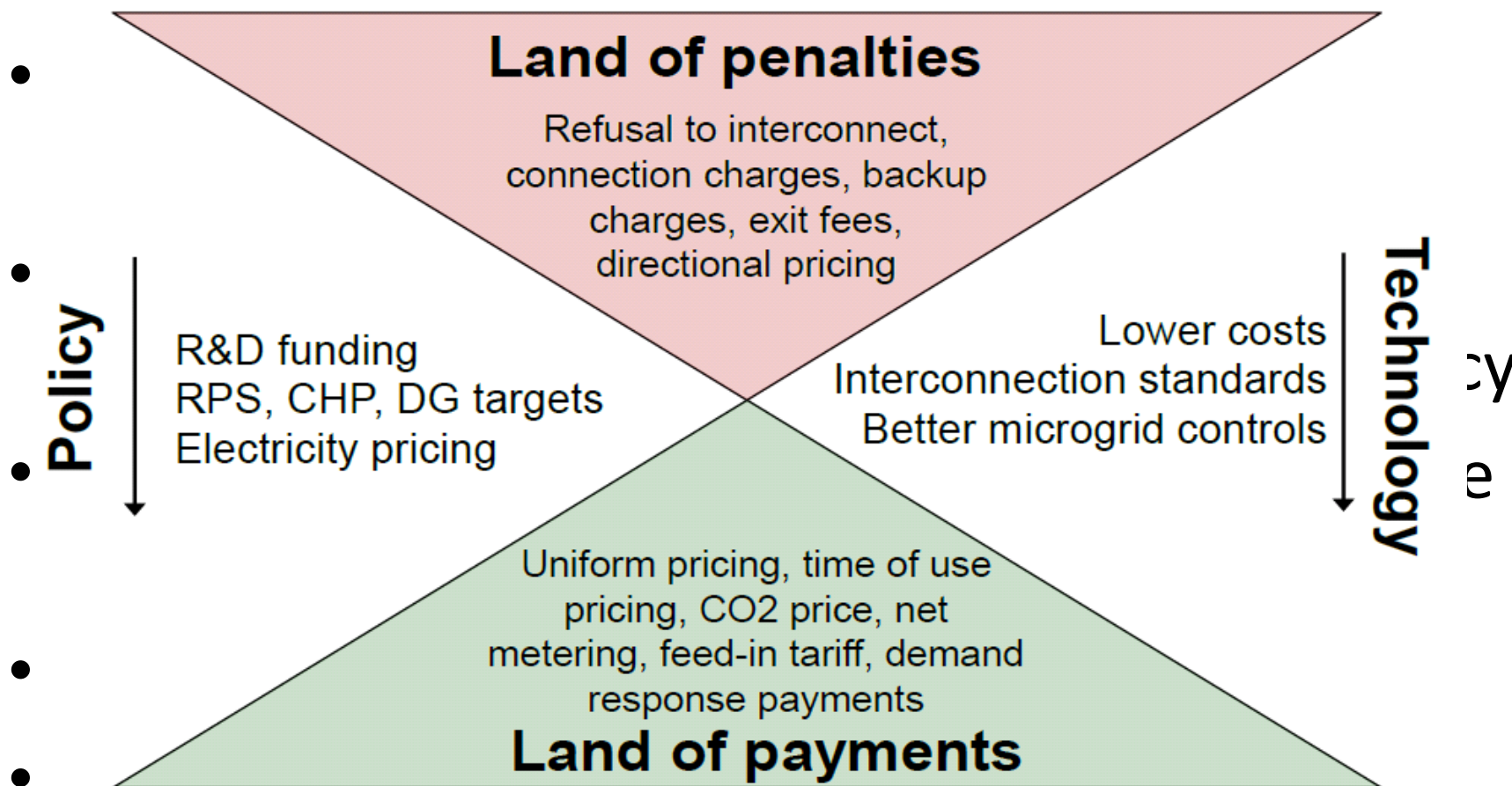
-  : Distribution network (DN)
-  : MG examples (physical connection among actors through the DN)

The MG Story so far

- Firstly approached late '90s, early '00s
- Employed to facilitate a bottom-up management of distribution networks & distributed generation
- Large number of publications on the topic, but...
- Only few applications of commercial nature/goals
- Research funding bodies a bit quiet on the topic

Why?..

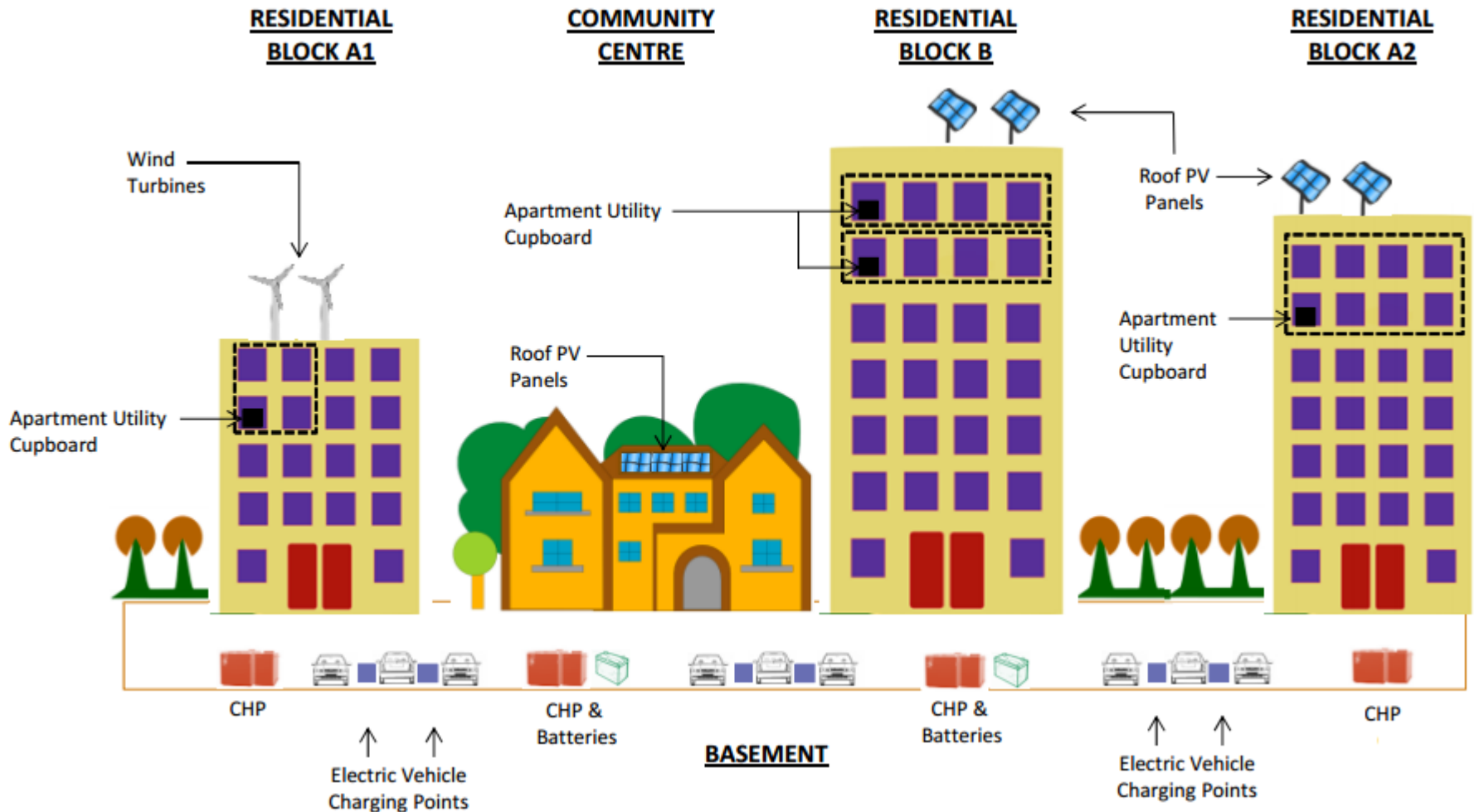
Reduced interest in MG?



As from "International Microgrid Assessment: Governance, Incentives, and Experience (IMAGINE)", Romankiewicz et al.

JUST WANT TO BE NOTICED...

Planned Communities (PC)



MG concept for PC management

- PCs possibly decentralized => resilience issues
- Sustainability requirements covered through locally installed RES-based generation
- MG realization as of design, not only retrofitted
- Short-Term Operating Reserve (STOR) capacity available through storage (for UK)

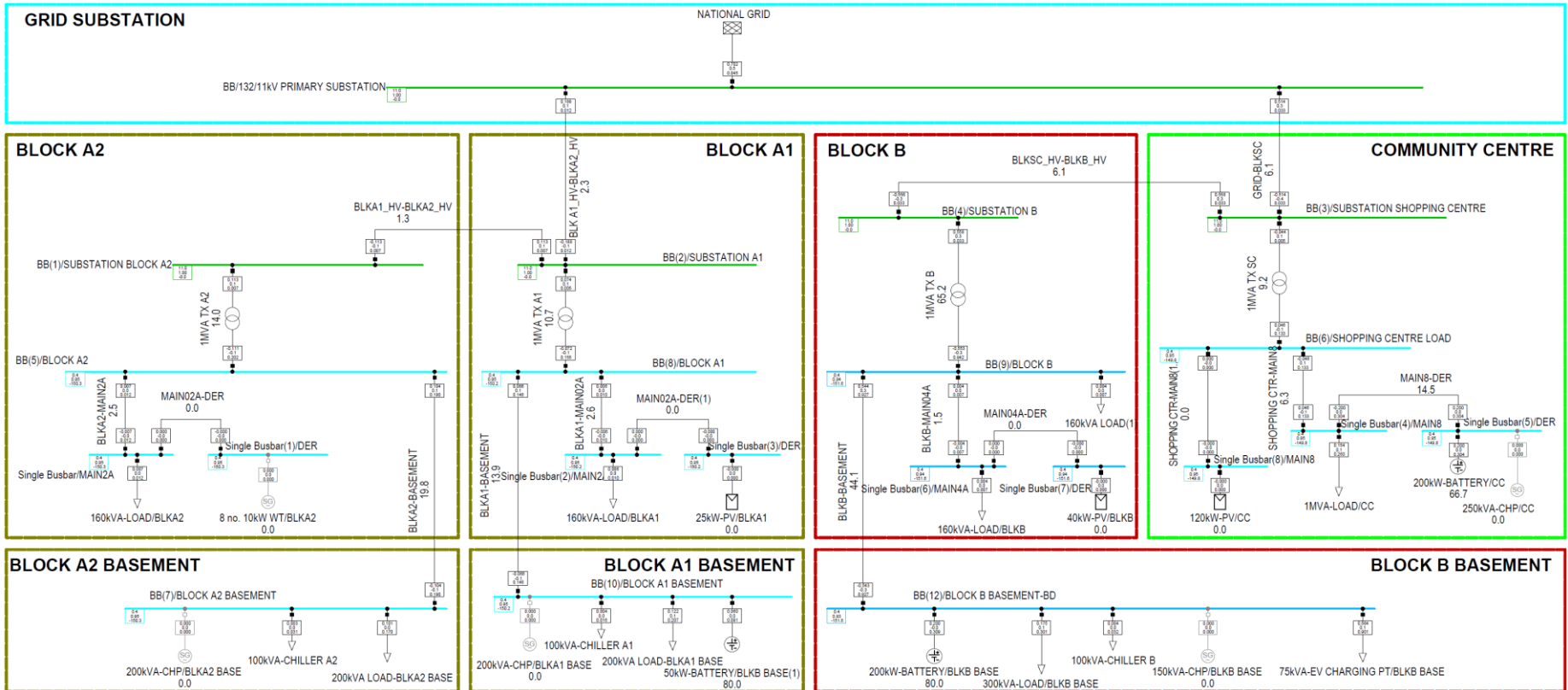
But what about load and RES uncertainty? Is it important?

Energy Balancing in Urban MGs

- *Prosumer* role will require storage to cater for forecast deviations ($\approx \pm 15-25\%$)
- Up/down adjustment \Rightarrow SOC $< 100\%$ regularly
- STOR option and Islanded operation \Rightarrow various installed capacity options

A case study for a 2.5MW PC
MG is examined

Case Study – The PC MG



– 250kVA CHP, 180kWp PV, 200kW battery converter

Battery Storage – Sensitivity Analysis

Variables

- Events: deficit down to 350kW, excess up to 200kW
- Levels of preferred SOC: 70%, 90%
- Capacities of total storage: 0.3, 0.65, 1.1, 1.5 MWh
- Loading of an average peak hour in summer/winter

Criterion of sensitivity: cost for covering the deficits and excesses in a timeframe of a year

Battery Storage – Results & Discussion

Installed Capacity (kWh)	Preferred SOC	
	90%	70%
300	16151 £	-
650	16029 £	14628 £
1100	17493 £	16580 £
1500	19056 £	18608 £

Not enough stored energy. Imbalances market?

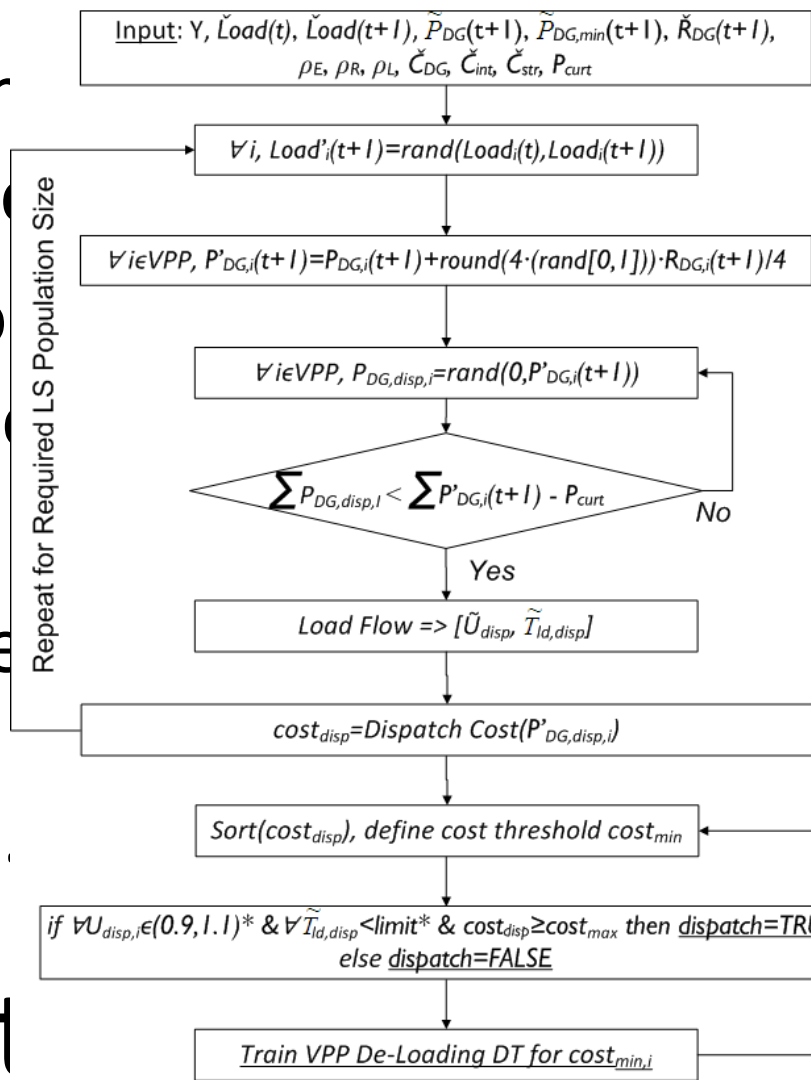
Excess cannot be absorbed => curtailed...

- Best option: 650kWh at SOC=70%
- SOC=70% yields least costs for all capacities
- For SOC=90%, best storage capacity is 650kWh

A usability factor or rule for capacity be extracted?

Hour-to-hour Operation – Method

- Operating ahead of
- Deviation avoid the
- As from ahead re



Repeat for Required LS Population Size

a day-
generation
covered to
own hour-
pared

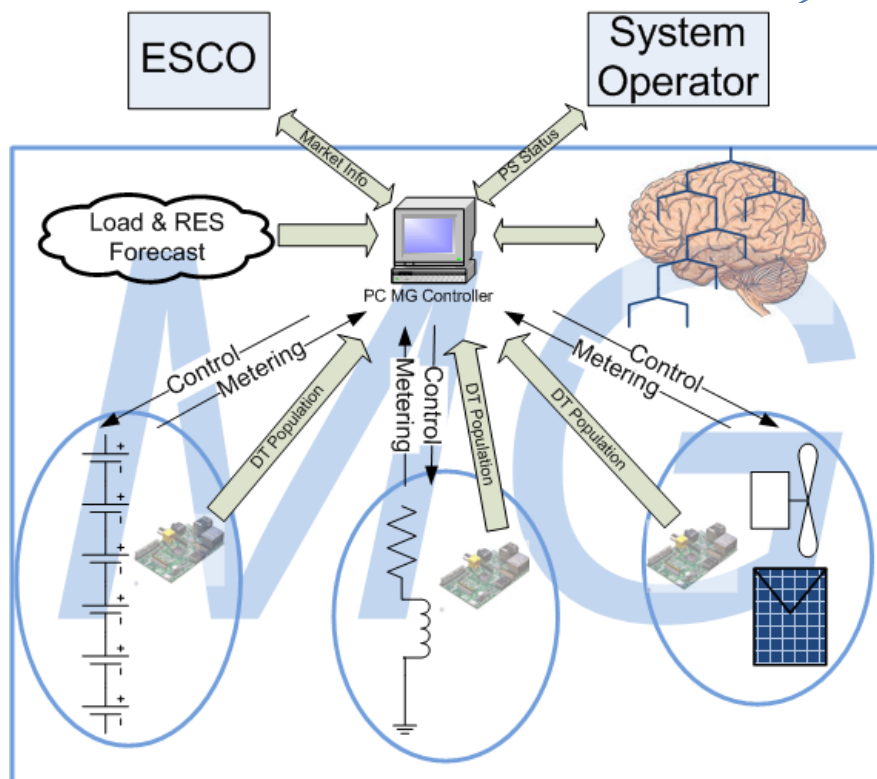
Tree on
reserves

Repeat for various cost_{min,i}

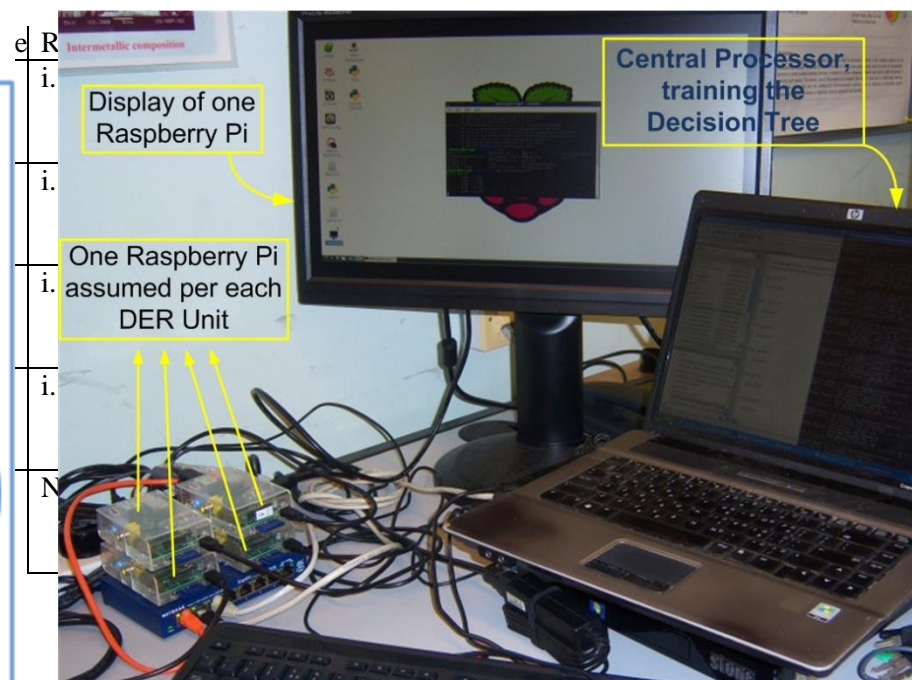
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Hour-to-hour Operation – Results

Available Distributed
Generation = 1.5MW

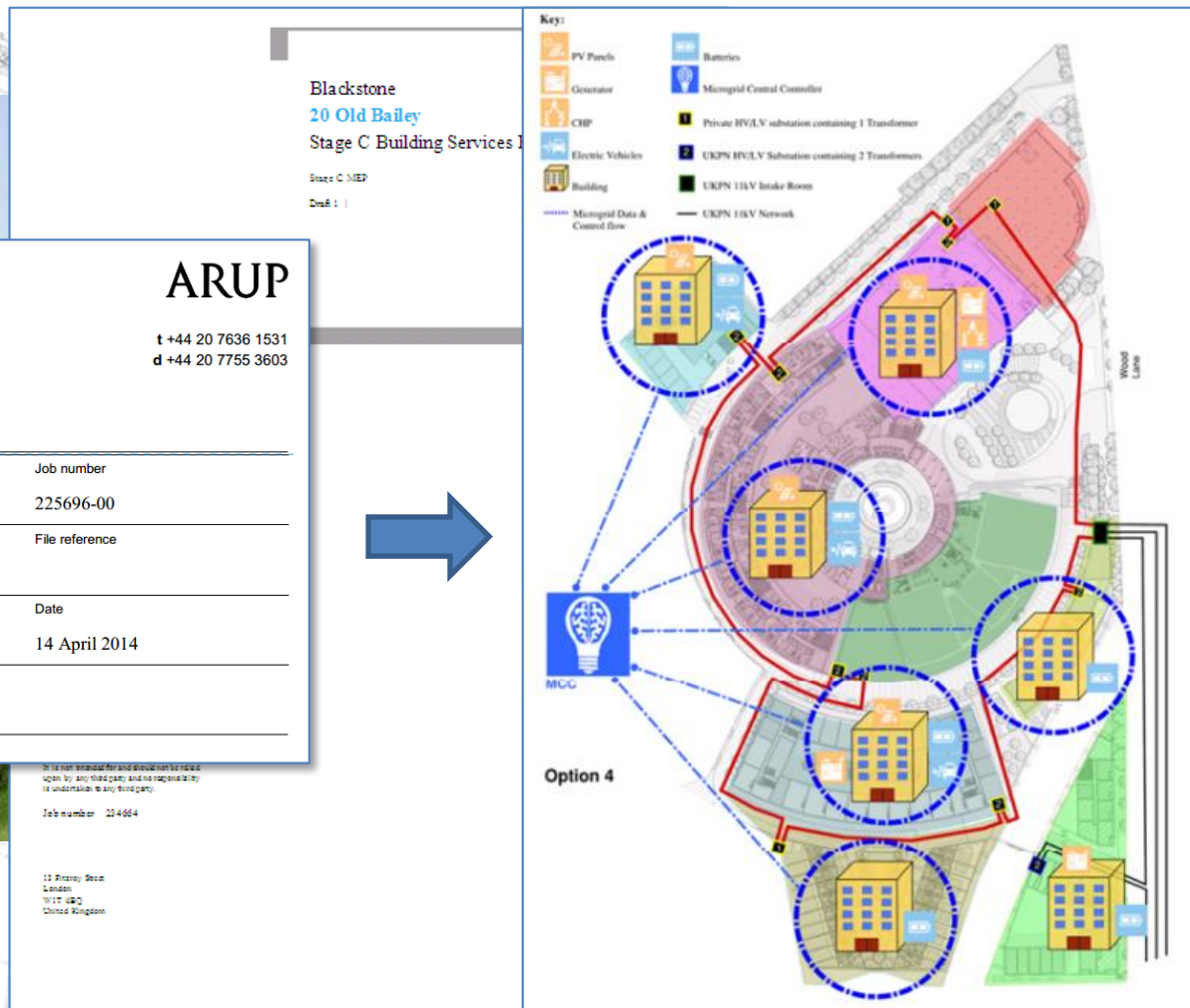


ids = 2.1 MW at the time of the islanding



NOTE: As the requested level of profitability increases, the methodology allows for more domestic load while curtails the community centre load.

The opportunities and how to materialize them



Technical Note

13 Fitzroy Street
London
W1T 4BQ
United Kingdom
www.arup.com



t +44 20 7636 1531
d +44 20 7755 3603

Project title TVC

Job number

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cc

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Prepared by Maria Brucoli, Joan Martos Garcia

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London
W1T 4BQ
United Kingdom

Conclusions & Further Work

- MG concept suitable for PC energy management
- Storage required to cover for imbalances
- In terms of storage each PC MG will most probably be a separate case study
- Acting as a *Prosumer* is a feasible target
- Further involvement of the PC MG to ancillary services will offer added value to residents

Thank you for your attention!..

For further information and
interest in collaboration contact:

S.Skarvelis-Kazakos@gre.ac.uk

Maria.Brucoli@arup.com