



# Digital Power

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Is this the energy system's game-changer?

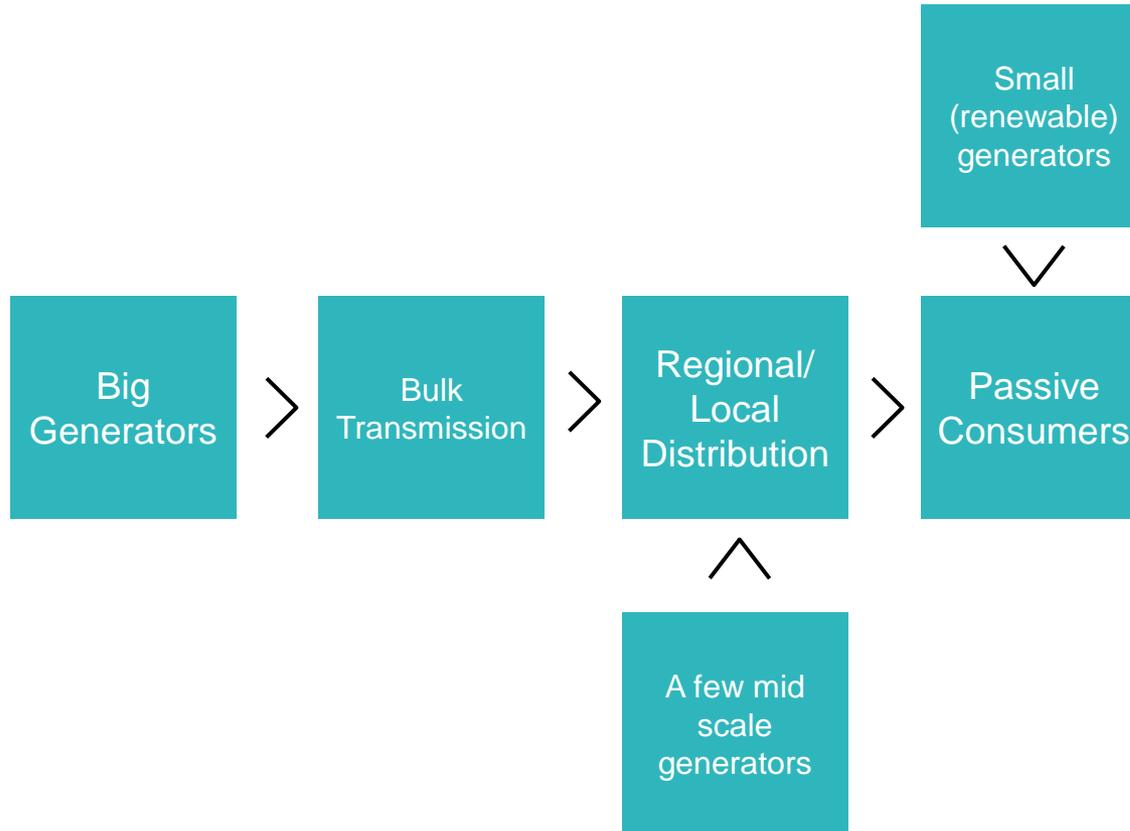


# Transformation, challenge, opportunity

## Contents

- Today's world
- What's driving change
- Tomorrow's world
- What gets unleashed for consumers and other infrastructures

# Today – a top-down hierarchy (at least physically)



# It's not just renewables

1

## Communities

Real and virtual

2

## Demand participation

Cheap capacity

3

## Intermittent renewables

At all scales

4

## Electric heat and transport

Massive impact on demand

5

## Consumer tech

Disruptive and fast diffusing

6

## Big data

Unlocks massive new opportunities – and threats

7

## Changing consumer expectations

I want it now, without fail

8

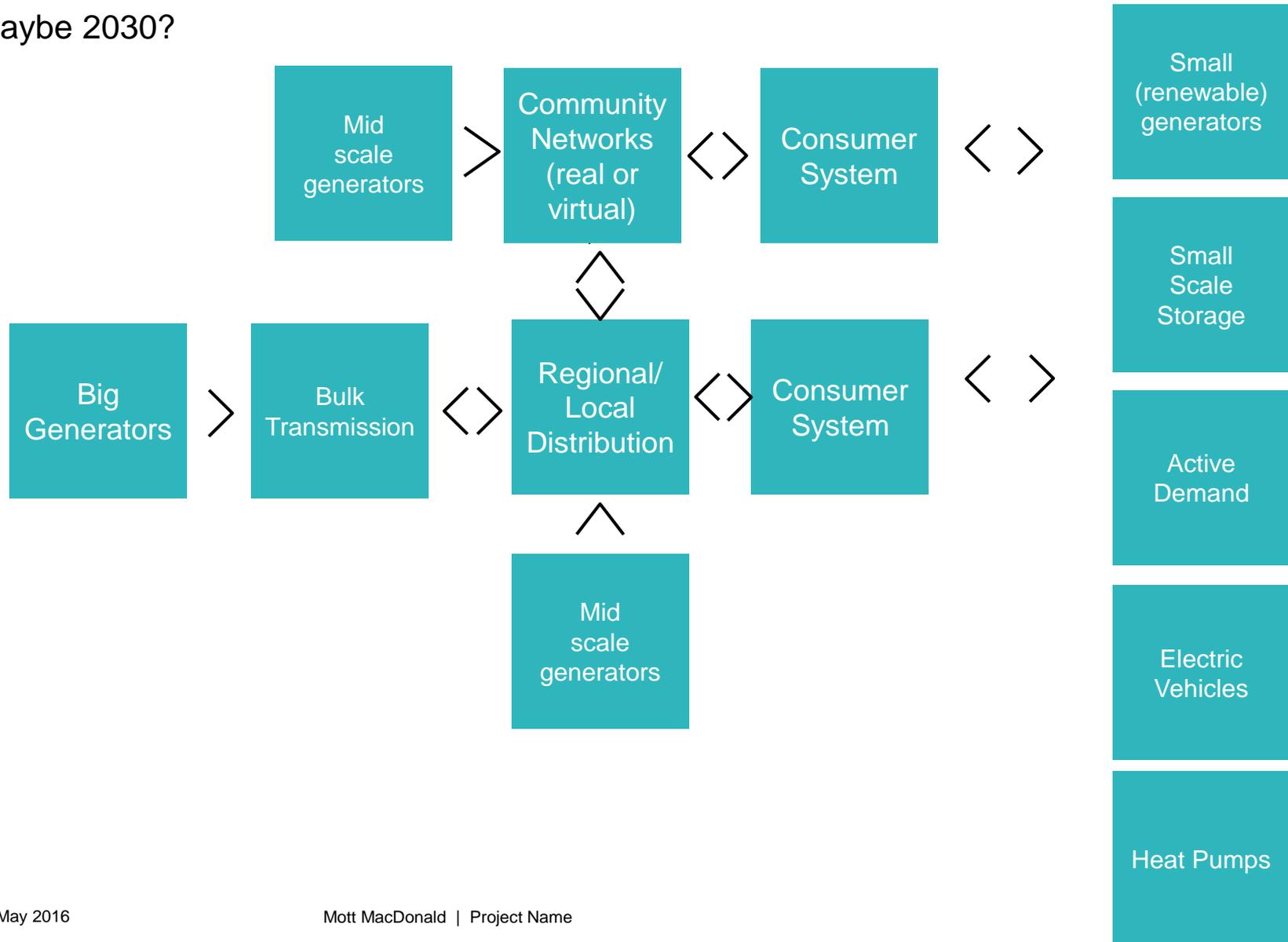
## Cross Vector interactions

Where power meets gas meets heat meets hydrogen meets?



# Future – a much more complex and active system

Maybe 2030?



# Upending a century of assumptions

***“From a consumer’s point of view, the solar on the rooftop is going to be the baseload. Centralised power stations will be increasingly used to provide peak demand”***

Stephen Holliday, National Grid, UK, 2015

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# We are writing a new playbook

**“This industry is going through a tremendous transformation. We used to have a pretty good idea of what future needs would be. We would build assets that would last decades and that would be sure to cover those needs. That world has ended. Our strategy is now centred around agility and flexibility, based on our inability to predict or prescribe what our customers are going to want”**

Stephen Holliday, National Grid, UK, 2015

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# Scale gets scary

10	10,000	0	0
Frequency control devices	Distribution network automatic controls	Smart Cities	Automatic controls in homes
600,000	900,000	60+	15million
Frequency control devices	Distribution network automatic controls	Smart Cities	Automatic controls in homes

# Opportunity and challenge

## **We can**

- Reduce costs by:
  - Finding new solutions to old and new problems
  - Maximising asset usage
  - Minimising carbon
- Empower innovators to plug and play
- Empower consumers to participate
- Improve resilience

## **We will have to**

- Ensure cybersecurity within a loosely governed complex system with fragmented ownership
- Protect consumer privacy
- Ensure the system can cold start if it has to
- Find ways to be agile, noting the big assets take a decade or more to plan and build

# How might infrastructure be leveraged for profit in future?

## **Demand control**

Getting paid to provide system services

- Peak and valley smoothing
- Frequency response
- Voltage response
- Network capacity management

## **Peer to Peer trading**

Self generation

- Giving spare power to the local school
- Selling spare power directly to buyers

## **Storage**

Leveraging inherent storage opportunities

- As heat?
- As battery charging
- Purpose made storage devices

## **Design in**

Distributed solar and wind

District heating

Hydrogen networks

Smart metering

Smart controls

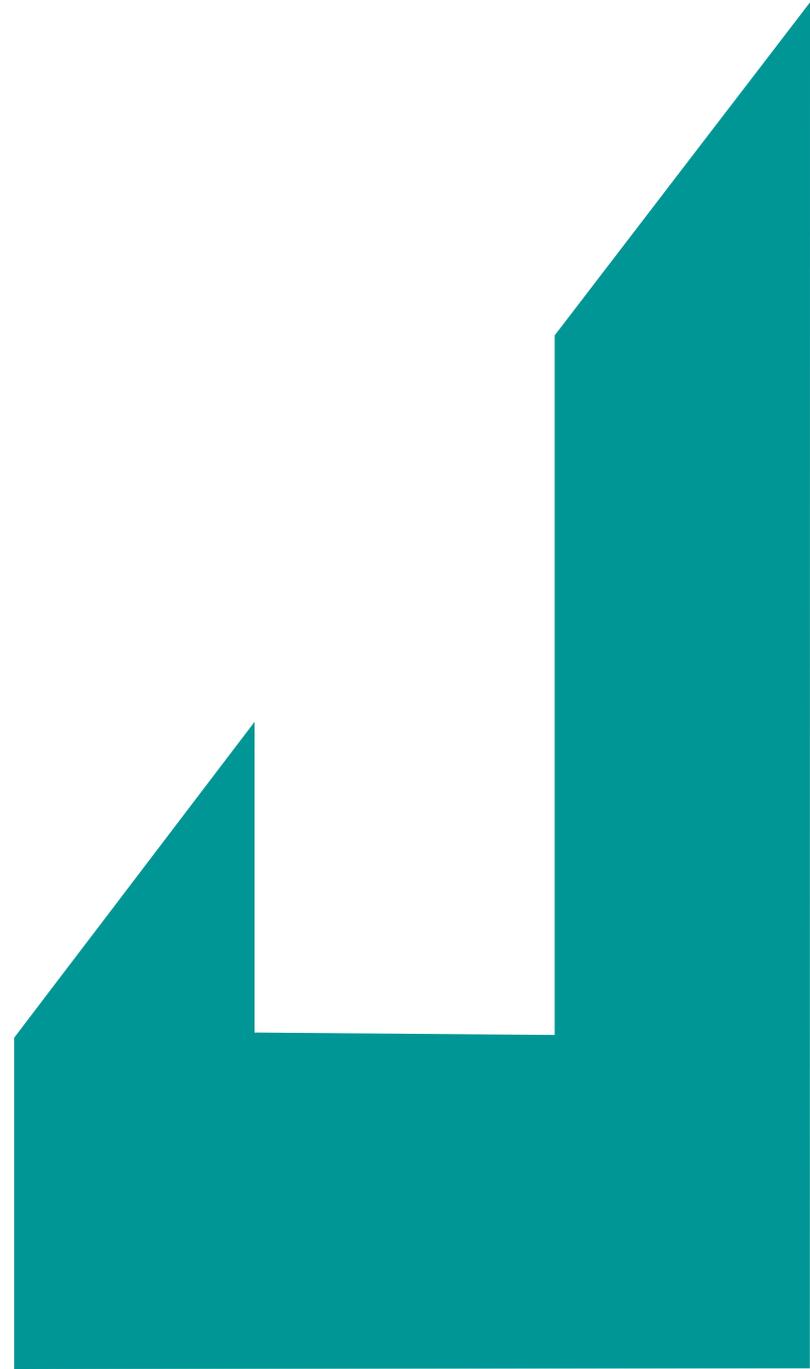
Internet of things

Backup/islanding

When?

We simply don't know.  
With fragmented  
ownerships and intense  
Silicon Valley interests  
something quite disruptive  
could happen quite  
quickly....or not.

Clustering could create  
localised test beds.





Thank you

