Strategic Investment Options Study for further growth in DG in the South West

Methodology to assess distributed generation and demand growth scenarios to 2030





Western Power Distribution – Workshop 15th September 2015

WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

regensw
delivering sustainable energy

Context : Growth of DG and grid constraints

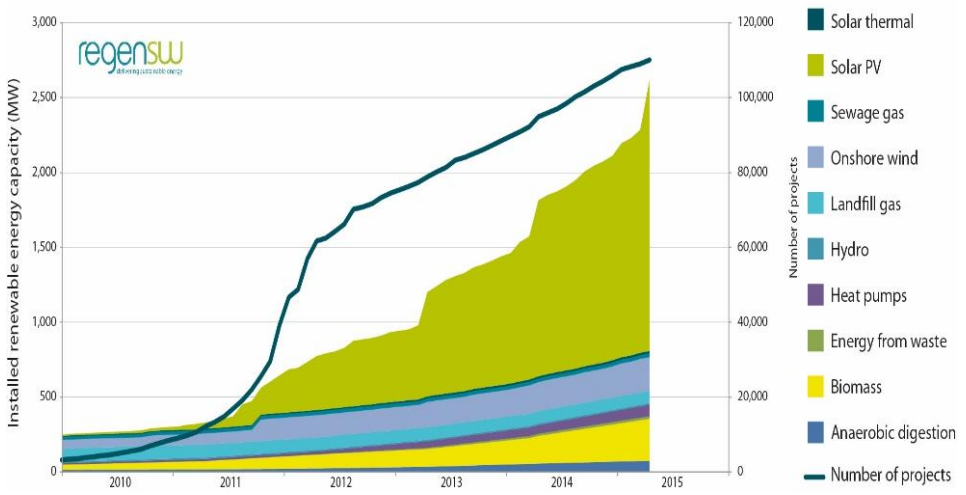
Rapid growth of renewable energy across all WPD licence areas

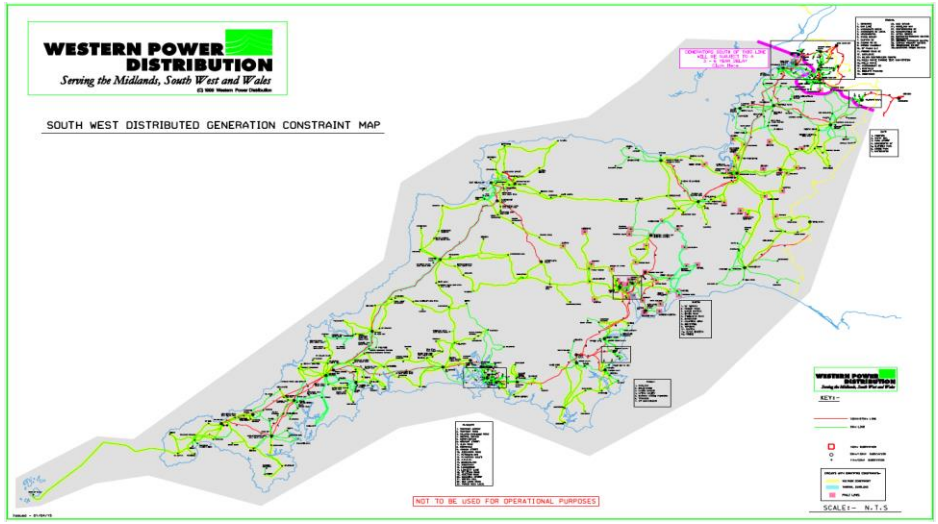
Solar PV and FIT installations highest in south west

Anticipated growth of demand – electric vehicles, heat pumps and new housing not yet materialised

Connected capacity and capacity agreements now at limit

Constraints across network but especially “F” route Bridgewater GSP to Seabank GSP





regensw
delivering sustainable energy

Grid constraint mitigation and solutions

Queue management/capacity recovery

Alternative connection agreements – timed and soft-intertrip

Active Network Management(ANM)

Consortia/grid collaboration

Current mitigation measures

Smart solutions eg Demand side response (sunshine tariff)

New demand – e.g. electric vehicles

Energy storage solutions

Future or more progressive solutions

Strategic Grid Investment Options

regensw
delivering sustainable energy

Strategic (Anticipatory) Grid Investment

Ofgem - Consultation for Quicker and Efficient Connections (awaiting response)

Opens potential options for strategic or anticipatory grid investment

Key Challenges

- Predicting future DG growth and demand over the longer term
- Identifying most effective investment opportunities
- Ensuring “least risk” investment
- Build and evidence business case

*“Earlier this year, Ofgem through its Quicker and Efficient Connections consultation, set out **options for enabling more anticipatory investment**, which could help speed up connection times by creating capacity earlier and sought views on other ways of improving the connection process.”*

Amber Rudd to ECC Select Committee Sept 2015

Strategic Investment Options Study

regensw
delivering sustainable energy

Strategic Investment Options Study

To facilitate the development of an efficient, coordinated and economical distribution system in the South West by:

1) **assessing the potential growth in DG by type, general location and year against potential demand changes**
2) identifying thermal, voltage and fault level constraints that result
3) assessing options for reinforcement
4) providing recommendations for 'low regret' investment

Options Study Goal

A small number of key investment proposals which will unlock max DG capacity

Likely to focus on the 132 kV network & 33 kV interface

Strongly evidenced

"Least" risk/regret

Backed by a robust business case

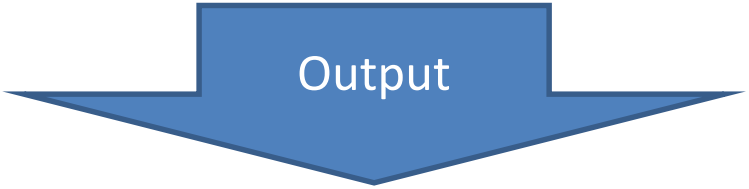
regensw
delivering sustainable energy

Methodology to assess future DG and demand growth scenarios

WPD has asked Regen SW to develop a methodology to assess and evidence future distributed generation and demand growth scenarios over the longer term.

This would provide a scenario based analysis of:

- Annual growth projections over the period 2015-2030
- By technology type/group
- Mapped to 132kV/33kV Bulk Supply Point “areas”
- Tool/model to enable sensitivity analysis and progress tracking



Dataset to help identify future grid constraints and investment options

regensw
delivering sustainable energy

Proposed technology types (for discussion)

Existing DG technologies
Solar PV >5MW “Large ground mounted”
Solar PV >100kW <5 MW “ground mounted”
Solar PV>4kW<100kW “commercial scale”
Solar PV<4kW domestic scale
Wind <0.5MW Small scale and domestic
Wind >0.5MW Large scale
Anaerobic Digestion – Electricity production
CHP
Hydro
Energy from waste
Emerging and New Technologies
Offshore wind/floating wind
Geothermal
Tidal stream
Wave Energy
Tidal range

Demand technologies
Demand technologies types
Electric vehicles
Heat pumps (domestic)
Heat pumps (communal/commercial)
Energy storage (domestic/own use)
Energy storage large scale
Residential demand
Commercial demand

Technologies or scale of technologies which will have different growth drivers and impacts

regensw
delivering sustainable energy

Methodology – Geographic mapping and scope

Geographic Scope:
South West Licence Area

Basis of DG and demand mapping 37 Bulk Supply Point “areas”

regensw
delivering sustainable energy

Assessment Methodology Overview – 3 stage approach: Current, Near Term and Long Term

Stage 1
Current baseline

Current data

Use and validate existing DG capacity and demand data to set baseline

Analysis by:

1) Technology type
2) BSP Areas
3) GIS mapping
4) Historic growth trend

Stage 2
Pipeline Projection
Near term (to 2020)

Pipeline Projection

DG projects w/connection agreement and in planning system

Growth estimate for small scale FIT and new projects

Demand projection

Constraints/ factors:

1) Grid constraints
2) Policy - RO/CFD/FIT Cap and subsidy
3) Planning system
4) Technology (TRL)

Stage 3
Growth scenarios
Longer term (to 2030)

Long Term Energy Potential

- Resource Assessment
- Viable resource
- Geographic/Spatial Constraints
- Demographics
- New technology potential

Apply Future Energy Growth Scenarios factors:

1) Gone Green
2) Low Carbon Life
3) Low Progression
4) No Progression

Stage 2) Pipeline Projection to 2020

Larger Project Pipeline Data

Connection Agreements (Queue)
Planning Database
Industry, developer and technology insight

Growth Trend Data For FIT and Small scale installations

Industry, developer and technology insight

Potential Pipeline

Constrained Growth Factors (By Technology Type)

- Grid Constraints
- FIT/TO/CfD Policy Caps and milestones
- Planning Constraints
- Technology readiness

Constrained Growth Pipeline

Annual growth projection to 2020

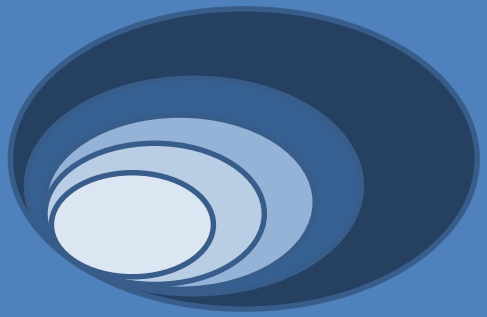
By Technology Type
By BSP Area

Near term analysis assumes current technology and business models ie:

Existing technology/innovation
Current policy environment
Limited/demo scale energy storage
Limited ANM

Stage 3) Growth Scenarios to 2035

Long term analysis of south west energy and demand potential



Resource Assessment
Technical Resource Assessment
Physical/Spatial/geographic factors
Proximity
Planning factors
Demographic Factors

Energy Potential

Future Energy Scenarios (FES)

- Consumer Power
- Gone Green Scenario
- No Progression scenario
- Slow Progression scenario

Future South West Growth Scenarios

Annual growth projection to 2030

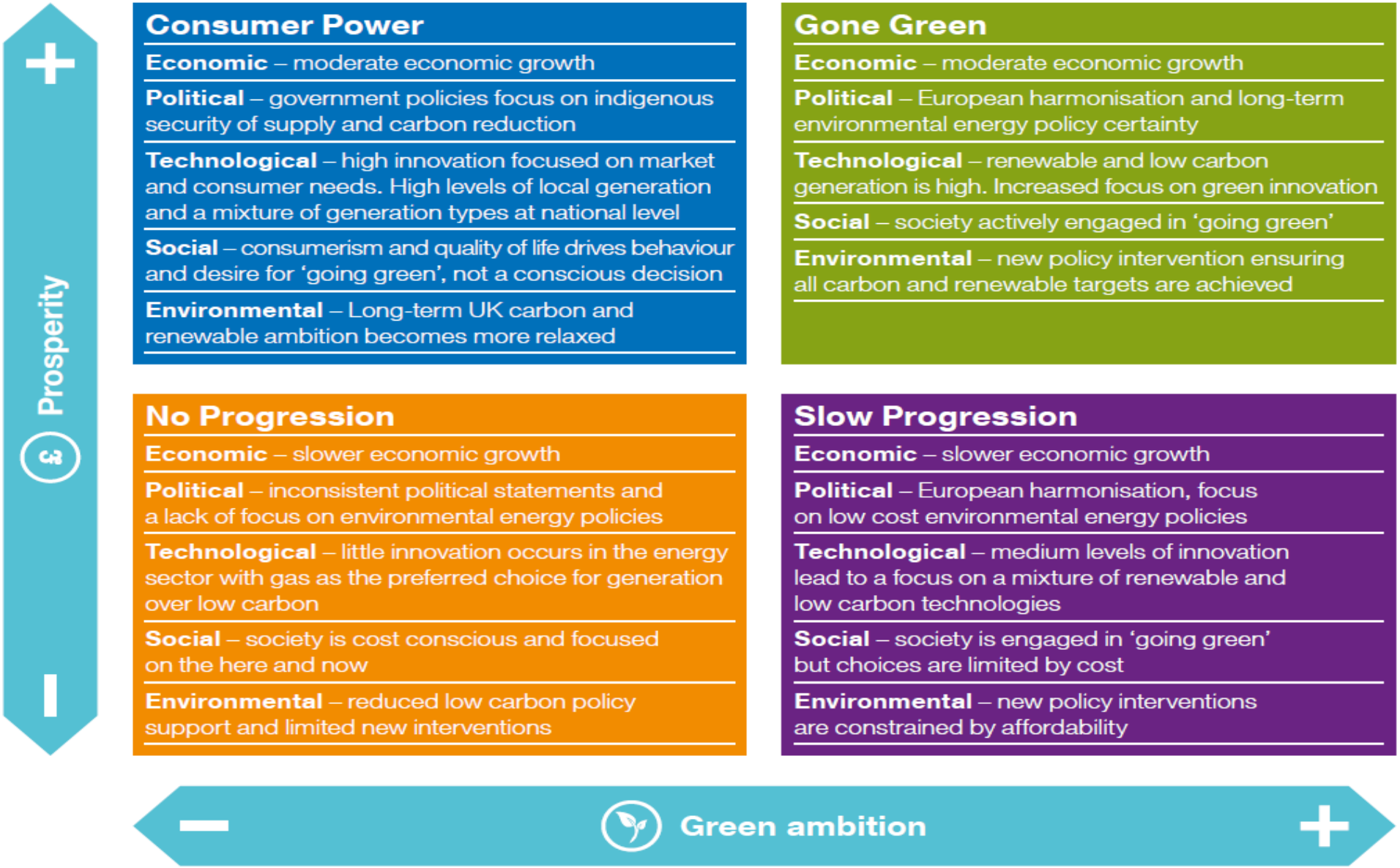
By Scenario
By Technology Type
By BSP Area

Scenario analysis includes impact of new technology innovation and changes to business models eg:

New technology/innovation – marine energy, storage
New business models – community, Local Supply Co's
Demand growth eg electric vehicles
Future energy cost scenarios eg grid parity

Future Energy Scenarios Overview

Figure 1
Here are the political, economic, social, technological and environmental factors accounted for in our four 2015 Future Energy Scenarios



FES Growth Scenarios Key figures 2015

No Progression	2014	2020	2030
Power			
Annual demand, TWh	339	335	333
Peak demand, GW	60.4	60.5	60.8
Total installed capacity, GW	87	93	101
Low carbon capacity, GW	31	43	48
Interconnector capacity, GW	3.8	6.0	9.8
Decarbonisation			
Renewable energy, %	~7	~10	~11
Reduction of GHG emissions, %	30	49	52

Low economic growth
Lowest cost energy security
Lowest RE and low carbon
Lowest innovation
Traditional Gas/Oil dominate
Capacity by 2030:

- Solar 11.3 GW
- Onshore wind 13.9 GW
- Offshore Wind 13.4 GW

Consumer Power	2014	2020	2030
Power			
Annual demand, TWh	339	334	342
Peak demand, GW	60.4	60.7	62.6
Total installed capacity, GW	87	104	125
Low carbon capacity, GW	31	56	76
Interconnector capacity, GW	3.8	6.0	10.8
Decarbonisation			
Renewable energy, %	~7	~12	~19
Reduction of GHG emissions, %	30	52	57

High economic growth
High innovation and wealth
Consumer spending electric cars
Highest distributed RE
But overall modest RE growth
Capacity by 2030:

- Solar 29.1 GW
- Onshore wind 15.9 GW
- Offshore Wind 17.1 GW

FES Growth Scenarios Key figures 2015

Slow Progression	2014	2020	2030
Power			
Annual demand, TWh	339	335	332
Peak demand, GW	60.4	60.3	59.4
Total installed capacity, GW	87	96	117
Low carbon capacity, GW	31	48	74
Interconnector capacity, GW	3.8	8.4	14.2
Decarbonisation			
Renewable energy, %	~7	~13	~22
Reduction of GHG emissions, %	30	51	60

Lower economic growth
But higher RE target

Capacity by 2030:

- Solar 18.3 GW
- Onshore wind 16.3 GW
- Offshore Wind 23 GW

Gone Green	2014	2020	2030
Power			
Annual demand, TWh	339	329	362
Peak demand, GW	60.4	59.3	66.1
Total installed capacity, GW	87	96	136
Low carbon capacity, GW	31	53	98
Interconnector capacity, GW	3.8	10.8	17.7
Decarbonisation			
Renewable energy, %	~7	~15	~30
Reduction of GHG emissions, %	30	54	64

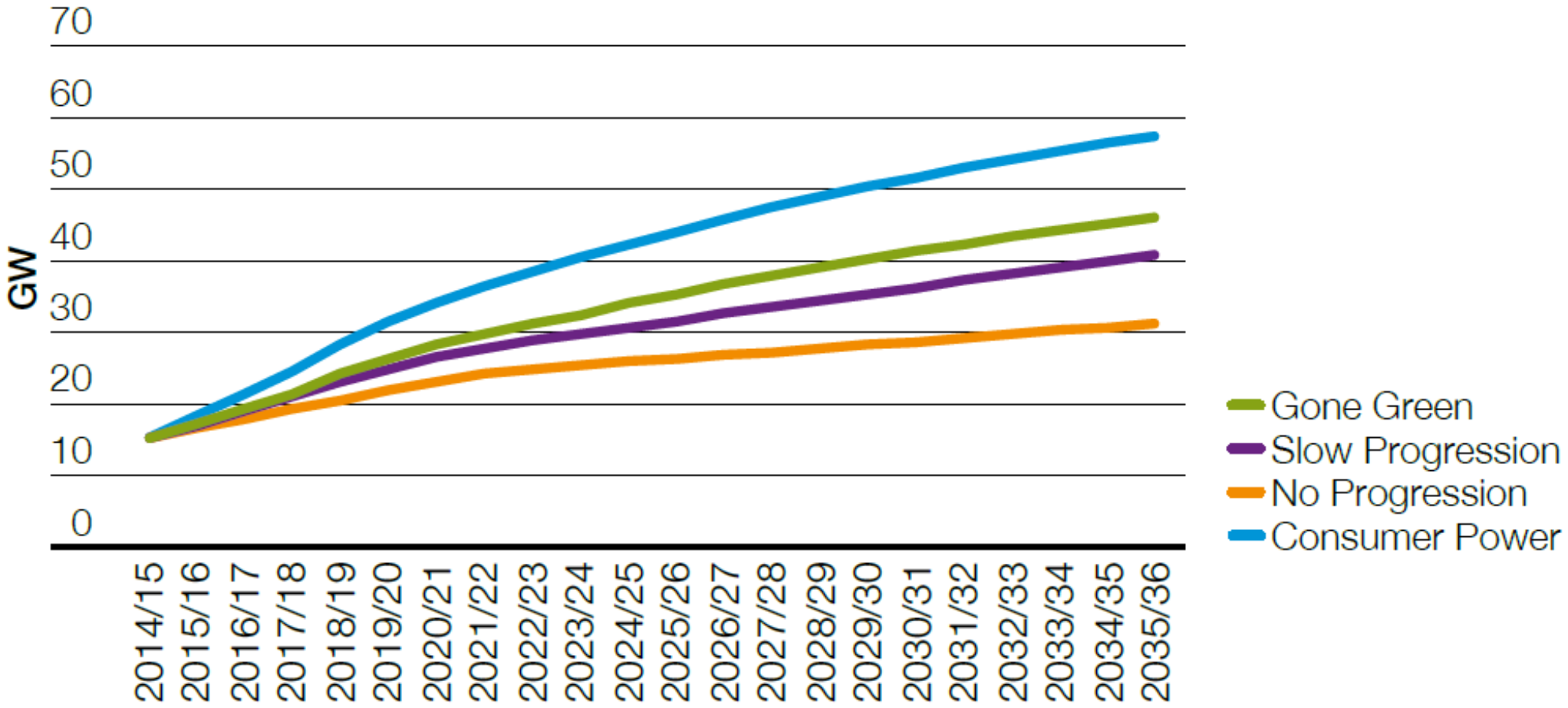
High economic growth
Higher commitment to RE
New Re technologies eg marine

Capacity by 2030:

- Solar 23.2 GW
- Onshore wind 18.7 GW
- Offshore Wind 29.3 GW

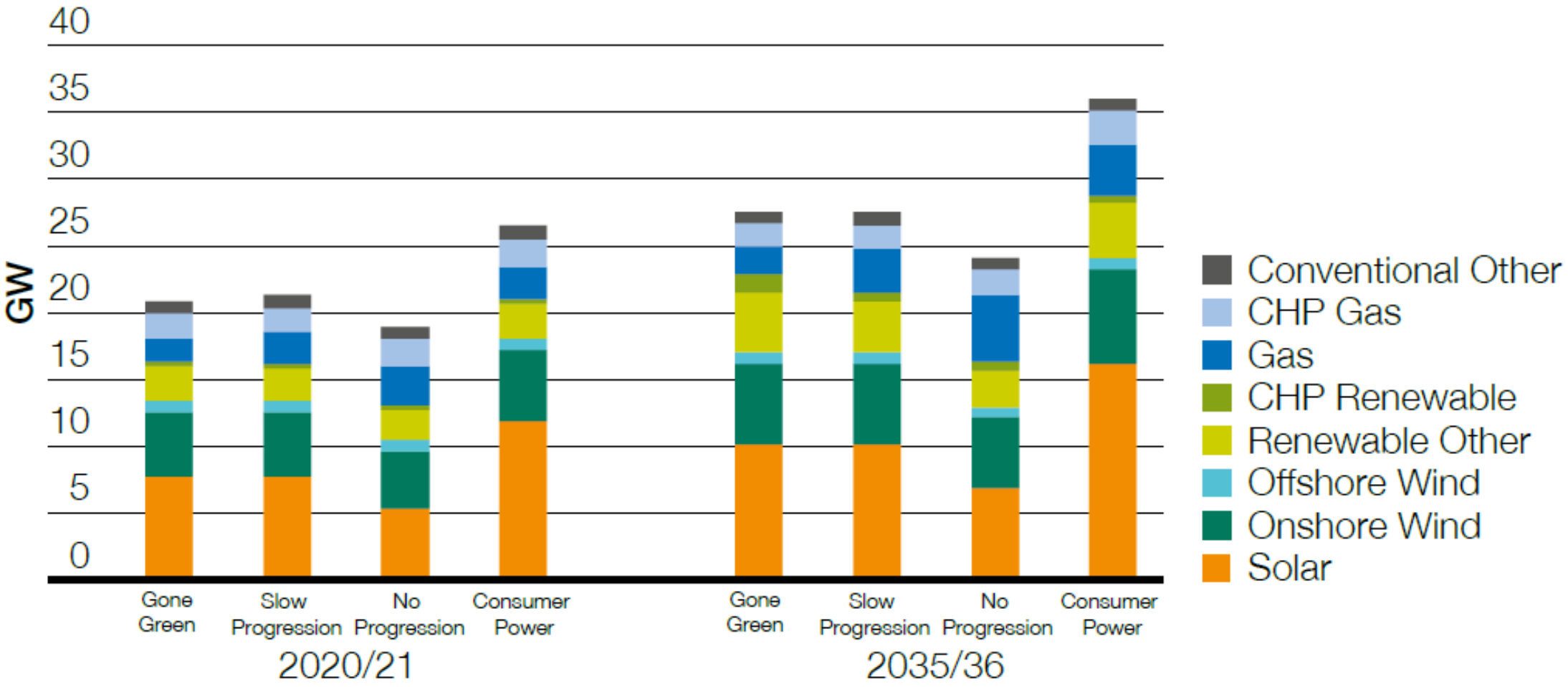
FES Scenarios for Micro and Distributed generation

Figure 68
Distributed and micro-generation: installed capacity



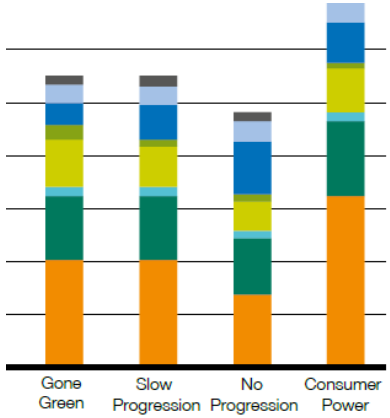
FES Scenarios for Micro and Distributed generation

Figure 69
Distributed generation: installed capacity



Applying FES to South West

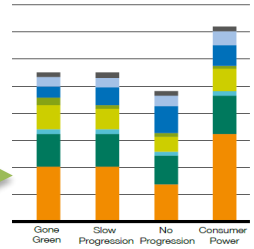
Top-down approach:



FES UK Scenarios

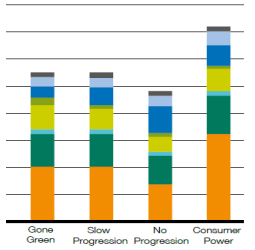
Convert to implied South West Capacity based on:

- Relative resource
- Geographic/demographic scale
- Current market share



FES SW Capacity

Validate



South West growth scenarios

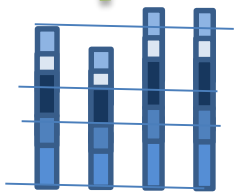
Bottom-up approach:

South West Energy Potential

Potential energy capacity
"Developable Capacity"
"Viable Build out rate per annum"

Apply SW growth factors

- Consumer Power
- Gone Green Scenario
- No Progression scenario
- Slow Progression scenario



SW capacity/growth scenarios By Technology BSP Area

Stage 3) Estimating potential South West DG energy capacity and a viable build out rate

1) Availability of natural resource

2) Technically viable resource

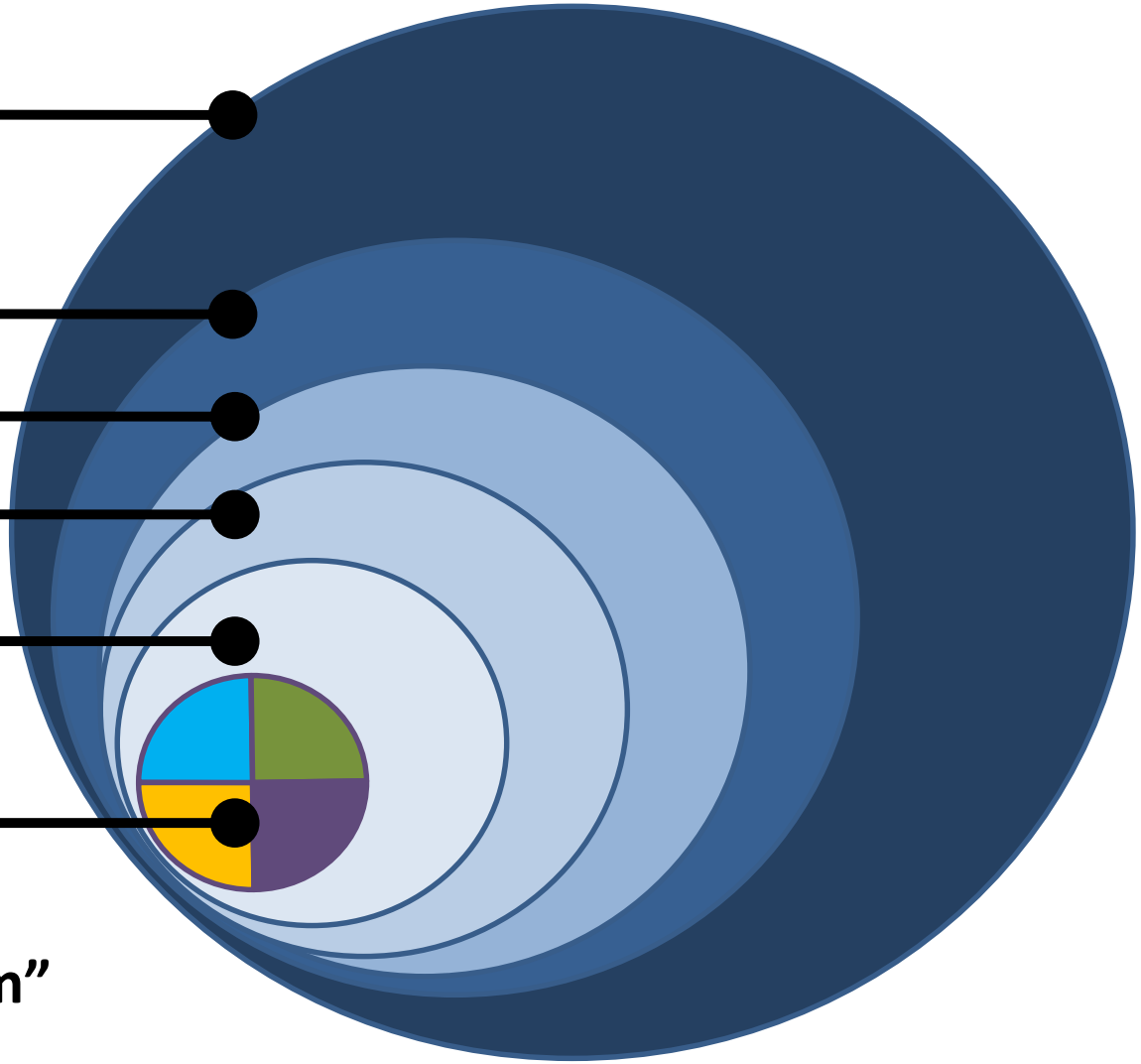
3) Physical geographic factors

4) Planning constraints

5) Access to grid

6) Technology specific factors

Potential energy capacity
"Developable Capacity"
"Viable Build out rate per annum"



Stage 3) Estimating potential South West DG energy capacity. Example: ground mounted PV

Energy potential assessment

Solar radiation

Total land space available

South facing land space

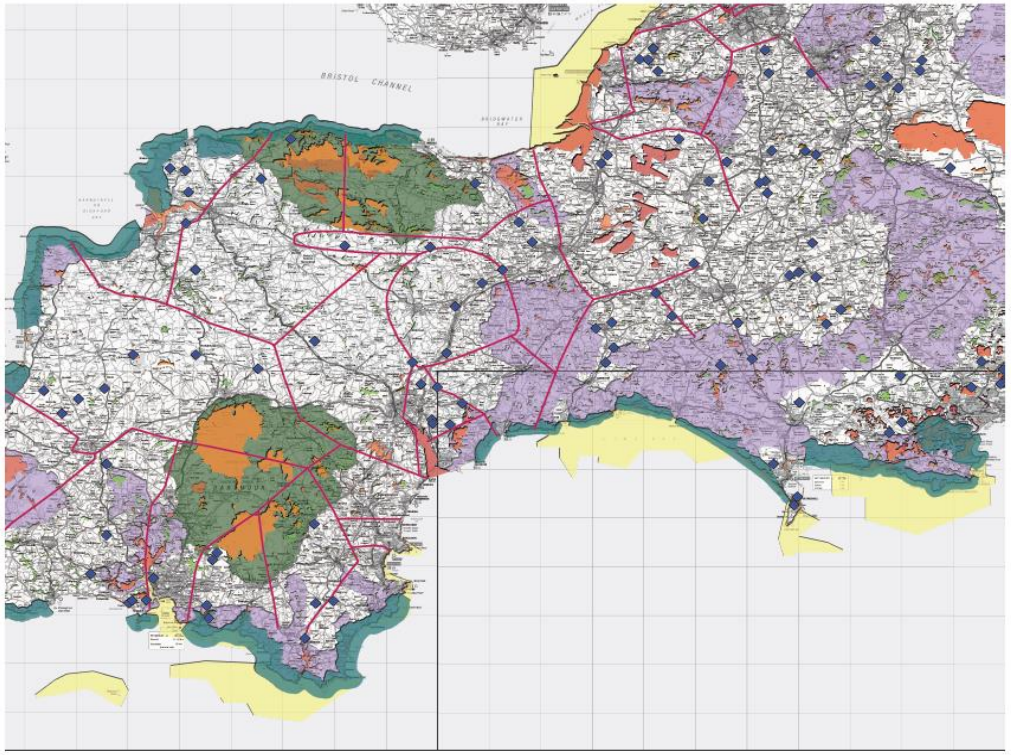
Practical land space available e.g. brown field, low grade agricultural

Practical distance from grid

Apply planning density assumptions

Lower assumptions or exclude – national parks, designated areas, AONBs etc

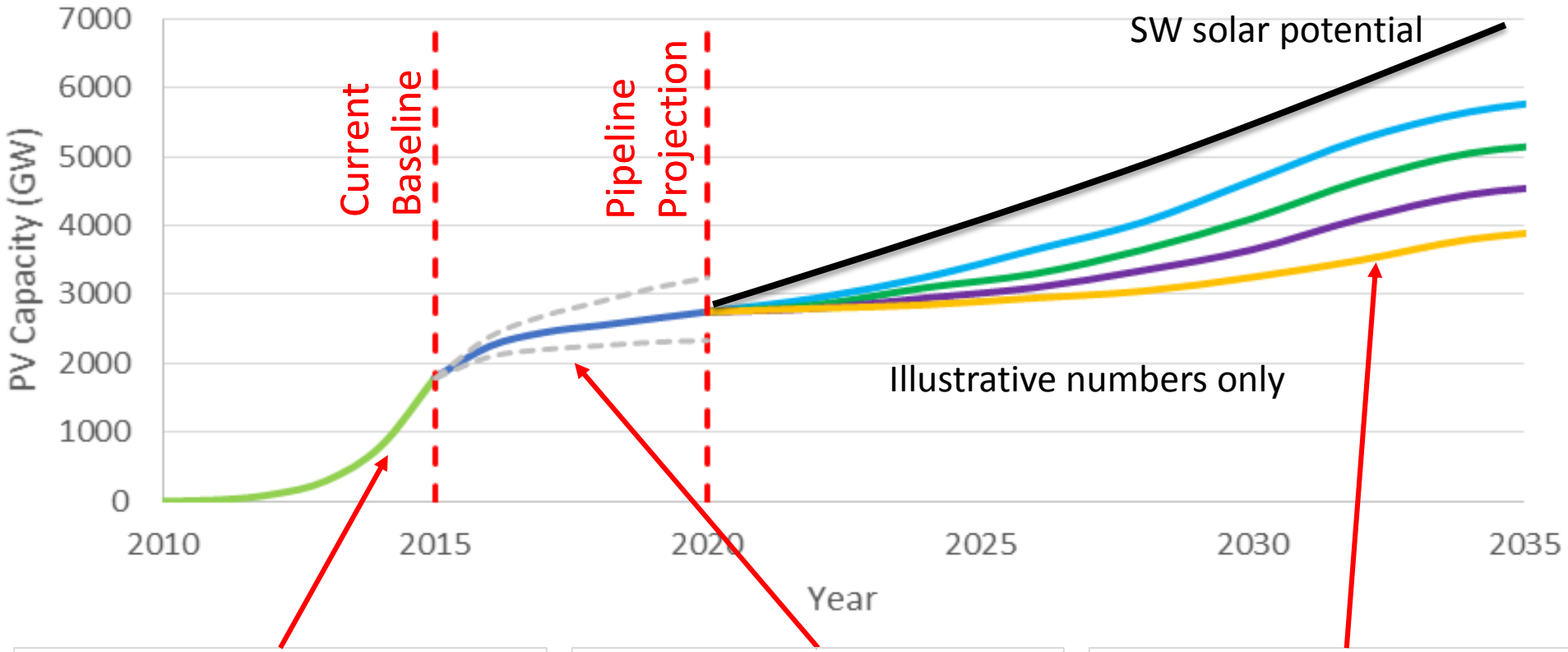
Build out/construction rate (industry insight)



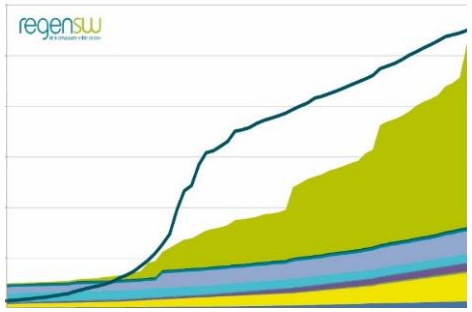
Potential energy capacity
"Developable Capacity"
"Viable Build out rate per annum"

Mapped by BSP Area

Stage 3) Estimating potential South West DG energy capacity. Example: ground mounted PV



Current Baseline - progress to date taken from extensive Regen SW DG project database

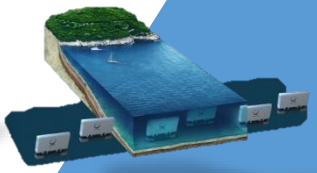


Pipeline Projection (to 2020) – current political climate results in slower growth. Large projects already in the planning / grid connection system are built. Uplift on additional smaller projects estimated. Error bounds included.

Growth Scenarios (to 2035) - progress picks up as installers regain market and build knowledge. Growth dependent on FES scenarios:

- **Consumer Power**
- **Gone Green**
- **Slow Progression**
- **No Progression**

Stage 3) Assessing potential new technology for example Wave Energy



2030

Cumulative Capacity
300 - 500 MW
(750 – 1200 GWh)

CAPEX
£1.2 – 2.0bn
Not adjusted for inflation or discounted

Commercial Expansion
- Expansion of first wave farms to create 2 or 3 full commercial projects of 100 MW plus

2025

Cumulative Capacity
50 - 100 MW
(130 – 260 GWh)

CAPEX
£250 – 500m
Not adjusted for inflation or discounted

First Wave Farms
- First commercial wave farm deployed
- 2 or 3 wave farms (10-30MW) to financial close or under construction

2020

Cumulative Capacity
15- 20 MW
(40 – 80 GWh)

CAPEX
£75 – 100m
Not adjusted for inflation or discounted

Success at Wave Hub
- 2 or 3 technologies – small array scale
- Further FaBTest deployments
- Collaboration with PRIMaRE

SOUTH WEST MARINE ENERGY PARK





@RegenSW

Regen SW, The Innovation Centre, Rennes Drive, Exeter, EX4 4RN
T +44 (0)1392 494399 **E** admin@regensw.co.uk **www.regensw.co.uk**

Registered in England No: 04554636

regensw
delivering sustainable energy