How do we build today the Wales we need tomorrow?

3rd May 2017

Cardiff

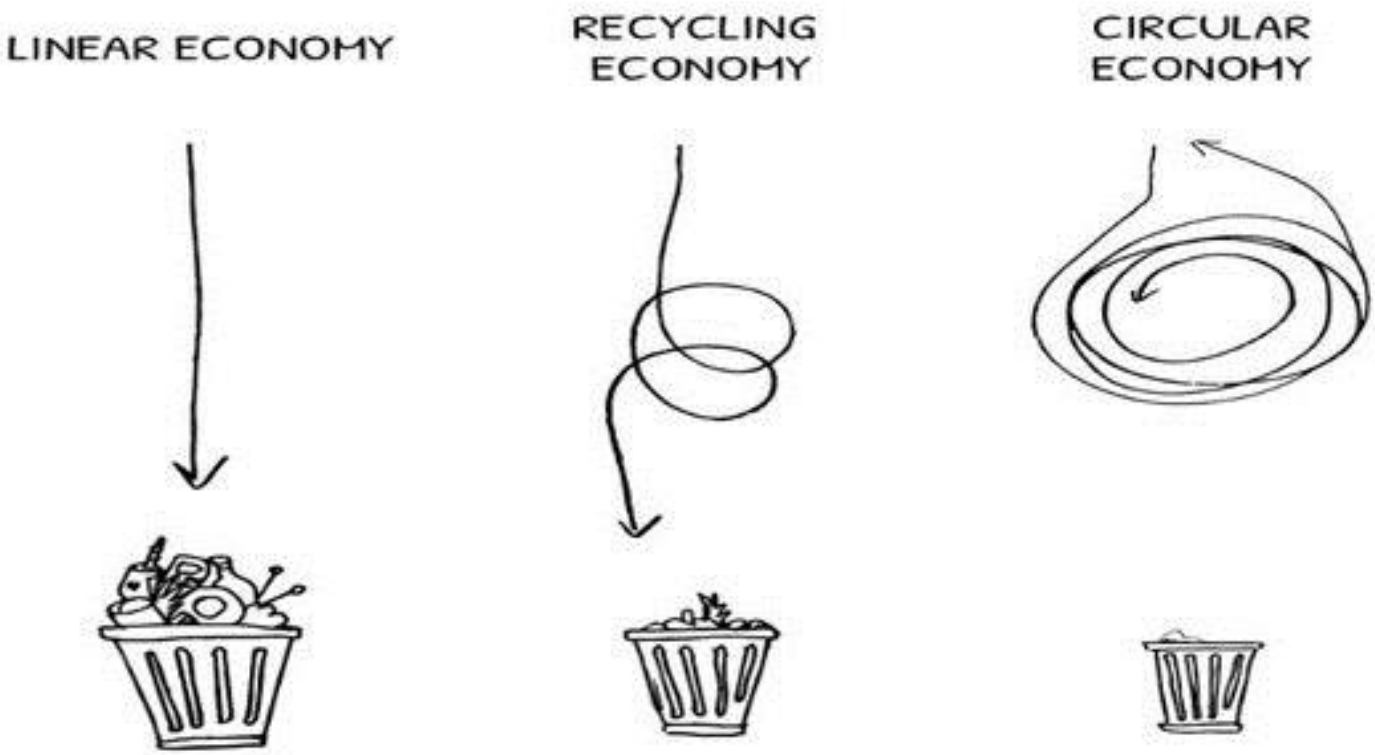
@CEWales

#circular economy

#builtenvironment

Delivering change

An opportunity…



Making the transition

Working in collaboration

- Welsh Government
- Amec Foster Wheeler
- Ecodesign Centre Wales
- Future Generations Commissioner for Wales
- David Cheshire, AECOM
- Lori Frater

Our approach

- Application by phase – highlighting connectivity and opportunities
- Each phase represented by own hierarchy reflecting key components
- No phase can work in isolation
- External links and cascades

Our approach – by project

- Guides decision making by a project example
- Demonstrates priorities
  - Value chains
  - Closed loop
  - Open loop
- Start of chain focuses on-site opportunities

Enablers

- Collaboration
- Rethinking incentives
- Leading by example & driving up scale
- Access to financing
- Early adoption

Priorities

- Design out waste at all stages
- Materials selection
- Products designed to be reused/remanufactured/reassembled
- Waste redefined as resource
- Working across the supply chain/across the sector

Critical materials

Demonstrators

- Addressing waste on average 2% project cost saved

  Enabling Zero Waste

- Value of steel reuse – savings 2-10% whole building & up to 25% savings on materials

  Ice Arena Wales

Pentrehafod Comprehensive, Swansea

Pentrehafod Comprehensive, Swansea

- Refurbishment not demolish & new build
- Materials management
- Reuse eg Gymnasium flooring as cladding
- Remanufacture
- Product leasing; eg lighting
- Legacy - Future use & reuse eg Altro XpressLay adhesive free vinyl

You don't have to do any of this, survival is not mandatory

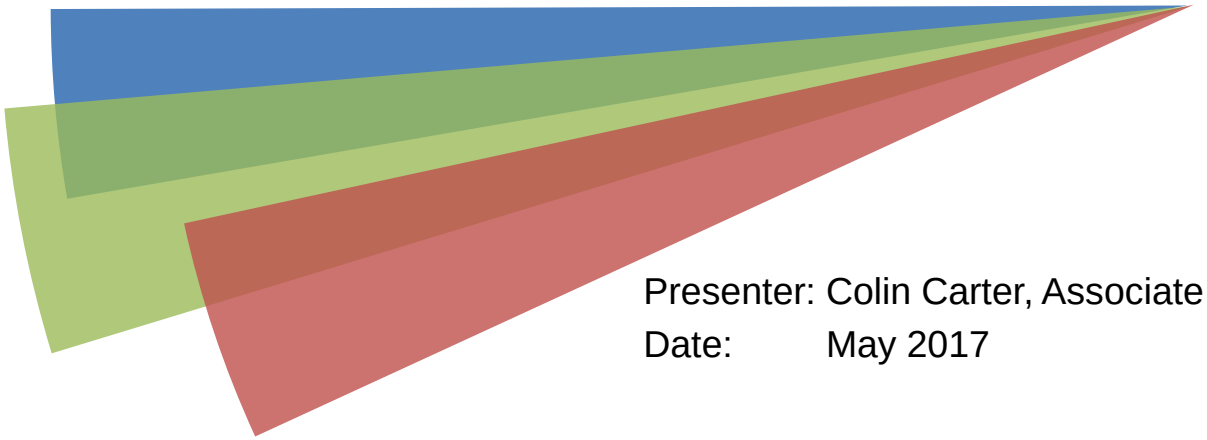
Walter R. Stahel

amec
foster
wheeler

The Economic Opportunity

Circular Economy in the Built Environment in Wales: Economic estimate and methodology

- Safety Moment
- Amec Foster Wheeler Environment & Infrastructure Europe
- The Size of the Economic opportunity
- The Built Environment in Wales
- Conclusions

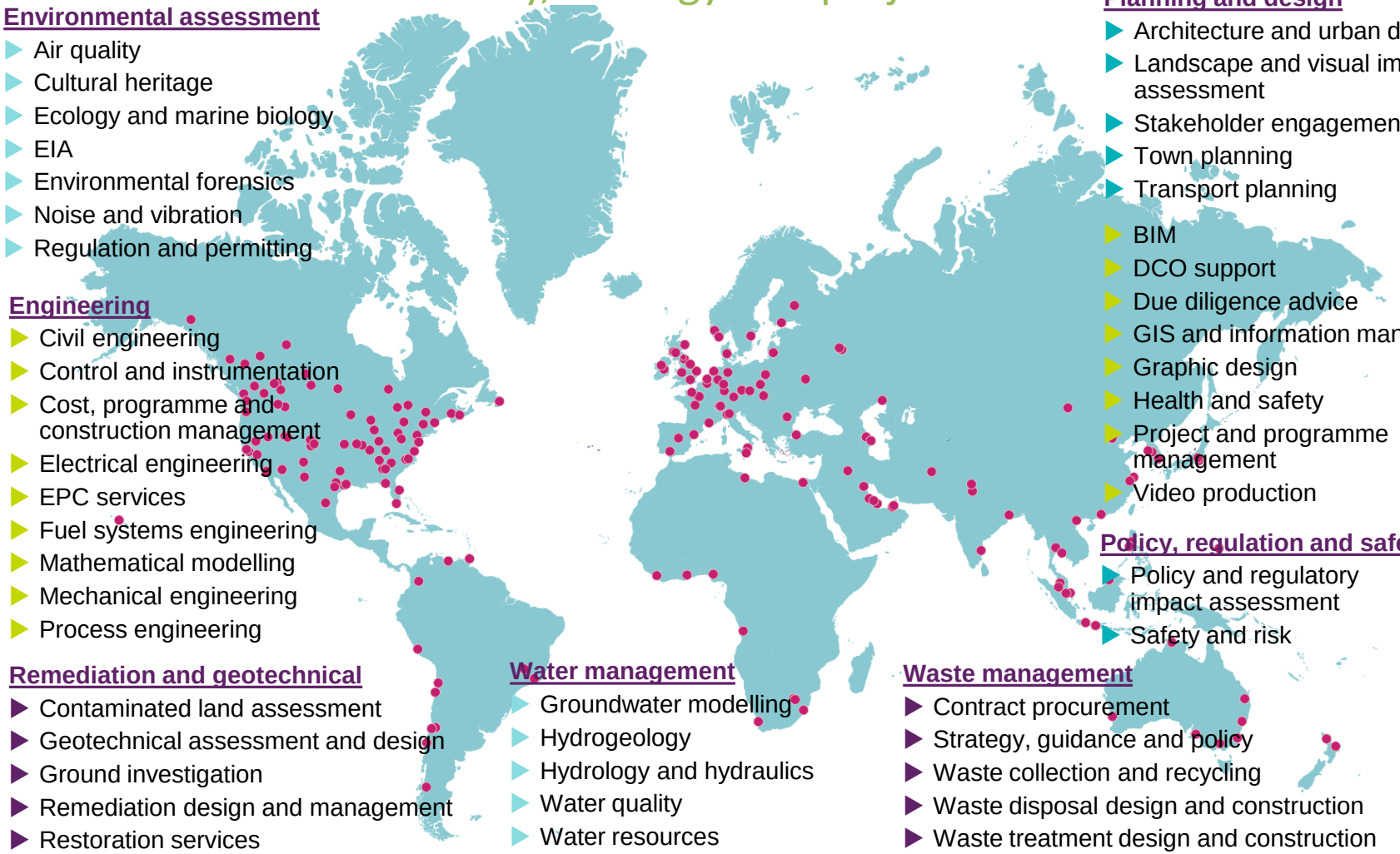


Presenter: Colin Carter, Associate Director, Policy and Economics Unit

Date: May 2017

Environment & Infrastructure Europe

Global consultancy, strategy and project services



Environmental assessment
- Air quality
- Cultural heritage
- Ecology and marine biology
- EIA
- Environmental forensics
- Noise and vibration
- Regulation and permitting

Engineering
- Civil engineering
- Control and instrumentation
- Cost, programme and construction management
- Electrical engineering
- EPC services
- Fuel systems engineering
- Mathematical modelling
- Mechanical engineering
- Process engineering

Remediation and geotechnical
- Contaminated land assessment
- Geotechnical assessment and design
- Ground investigation
- Remediation design and management
- Restoration services

Water management
- Groundwater modelling
- Hydrogeology
- Hydrology and hydraulics
- Water quality
- Water resources
- Water security and resilience

Waste management
- Contract procurement
- Strategy, guidance and policy
- Waste collection and recycling
- Waste disposal design and construction
- Waste treatment design and construction

Planning and design
- Architecture and urban design
- Landscape and visual impact assessment
- Stakeholder engagement
- Town planning
- Transport planning

- BIM
- DCO support
- Due diligence advice
- GIS and information management
- Graphic design
- Health and safety
- Project and programme management
- Video production

Policy, regulation and safety
- Policy and regulatory impact assessment
- Safety and risk

● **Principal office location**

Environment & Infrastructure Europe

Customers and Work Areas

NORTHUMBRIAN WATER living water
e·on
EUROPEAN COMMISSION
CYNGOR SIR YNYS MÔN ISLE OF ANGLESEY COUNTY COUNCIL
Scottish Water Trusted to serve Scotland
Ford
NU·GEN
nationalgrid
DEPARTMENT OF DEFENSE UNITED STATES OF AMERICA
nlwa north london waste authority
THE CROWN ESTATE
VATTENFALL
Homes & Communities Agency
Environment Agency
Viridor
eDF ENERGY
Ministry of Defence
bp
EATON Powering Business Worldwide
Dŵr Cymru Welsh Water
Department for Environment Food & Rural Affairs
Heathrow Making every journey better
STATES OF GUERNSEY

Size of Economic Opportunity

Headline estimate for the effect of the Circular Economy on the Built Environment in Wales

Introducing Circular Economy (CE) measures in the built environment in Wales has the potential to lead to a £1bn impact on GDP by 2035

The £1bn:

- includes savings from recycling - and goes substantially beyond them
- includes the benefits for all sectors of the economy from measures introduced in the built environment
- excludes the costs of energy and carbon
- assumes CE measures are adopted elsewhere, not just in Wales
- is estimated in today's monetary terms without the effects of inflation
- Implies a ~£40m increase each year

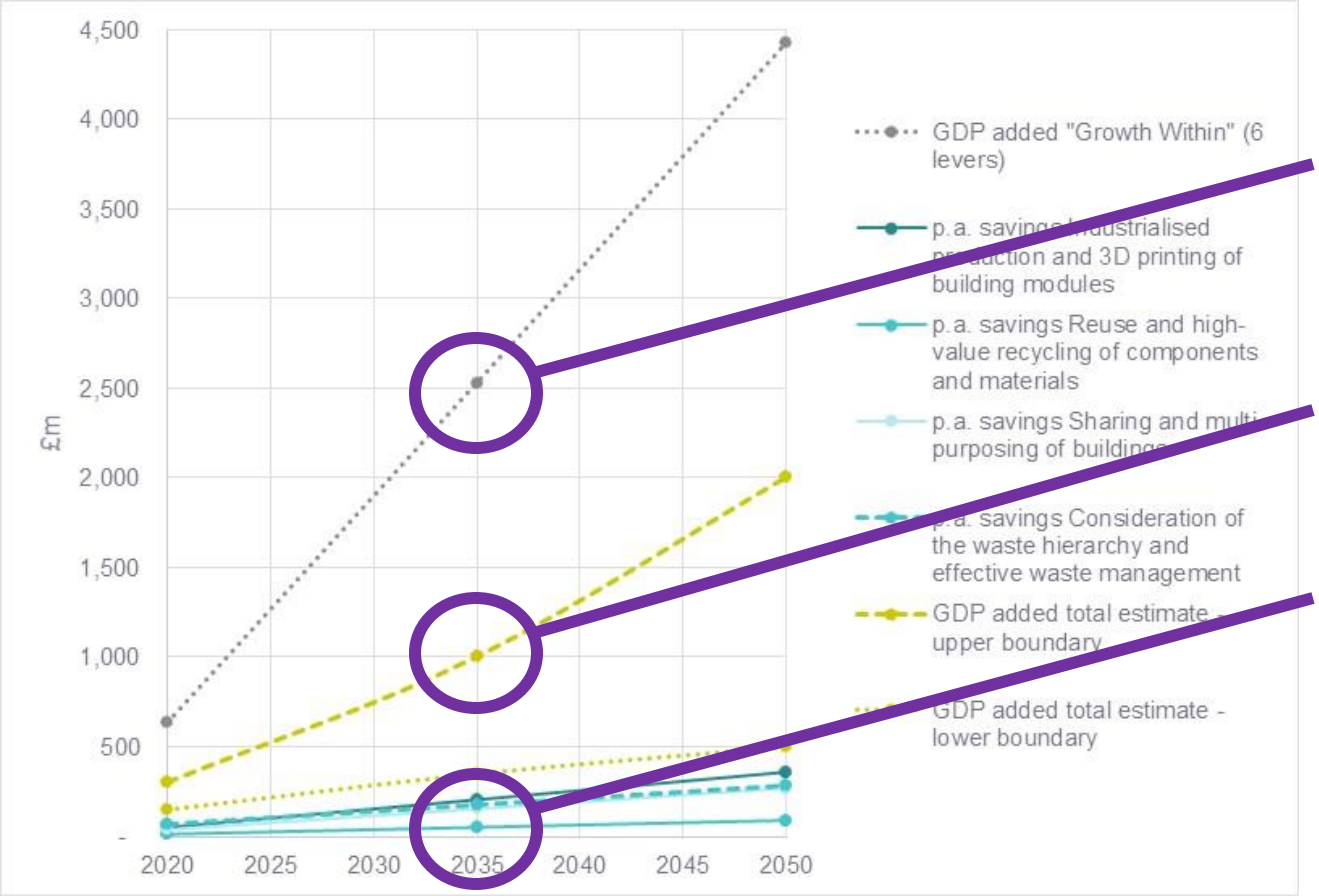
For comparison:

- £1bn is ~2% of the GDP of Wales (~£55bn)
- £3.5bn (of the £55bn GDP) arises in the construction sector
- £700m to £1.3bn was estimated as the potential for the CE for the manufacturing industry in Wales (WRAP, 2010)

Sources: Amec Foster Wheeler; ONS; WRAP

Size of Economic Opportunity

The £1bn main estimate is within a wide range



£2.5bn - Optimistic + includes energy

£1bn – Main estimate

£0.05bn Recycling only

Amec Foster Wheeler estimates based on sources listed, 2016.

Size of Economic Opportunity

Main estimate reflects top-down and bottom-up approaches

Top-down estimate of £2.5bn is based on a top down study for all of Europe which characterises six drivers

1. Industrial production and 3D-printing
2. Energy generation and use
3. Shared residential space
4. Shared and virtual office space
5. Modularity and durability
6. Urban planning

Amec Foster Wheeler estimates based on Growth Within: A Circular Economy Vision for a Competitive Europe. 2015. Ellen MacArthur Foundation

Main estimate of £1bn

- reflects a mid-point of top-down and bottom-up estimates with energy excluded
- requires a judgement of how Wales differs from European average

Amec Foster Wheeler estimates, 2016.

The lower estimates are bottom-up assessments of savings from case studies

- £210m from Industrialised production, 3D-printing & modularity
- £50m from high value reuse and recycling
- £150m from sharing and multi-purposing of buildings
- £180m from waste hierarchy and effective waste management

Amec Foster Wheeler estimates based on Delivering the Circular Economy – A Toolkit for Policymakers. 2015. Ellen MacArthur Foundation et al.

Enabling Zero Waste, Bryn Ivor Lodge care home case study. 2016. Construction Excellence Wales

note: The savings figures quoted here will have very approximately double the impact in terms of GDP effect

Size of Economic Opportunity

Assumptions for individual drivers of change

Industrialised production of modular building components

- 50% adoption (c.f. 5% in baseline), *leading to:*
- 15% material savings, 5% labour savings and 5% additional capex/opex savings.

3D printing:

- 25% adoption (c.f. 2% in baseline), *leading to:*
- 25% material savings, 40% labour savings and 10% additional capex/opex savings.

Reuse and high-value recycling:

- looping of materials increased to 15% by weight (c.f. 2% in baseline), *leading to:*
- 30% material cost savings, adding 5% additional labour costs.

Sharing and multi-purposing:

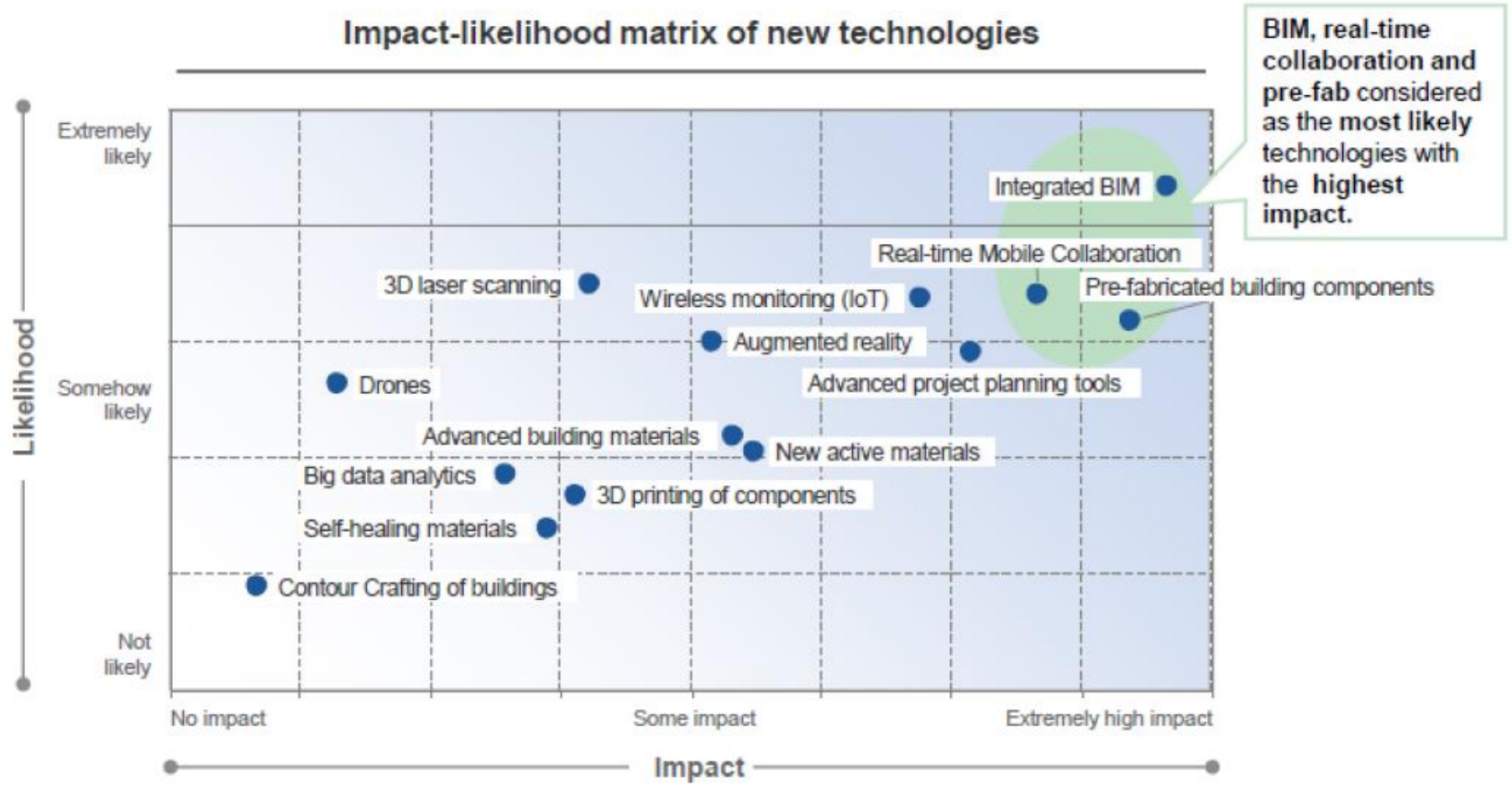
- Utilisation of buildings increased from 39% (current) to 63% (46% in baseline),
- A reduced demand of 39% (17% in baseline) of new buildings,
- Adopted in 25% of all new buildings, *leading to:*
- Overall reduced demand for new buildings by 9–10%.

Note: Construction costs are: 35% material, 20% labour, 20% other and 25% overheads

Source: Delivering the Circular Economy – A Toolkit for Policymakers. 2015. Ellen MacArthur Foundation et al.

Potential impact of new technologies

Civil Engineering: the scope for change



Built Environment in Wales

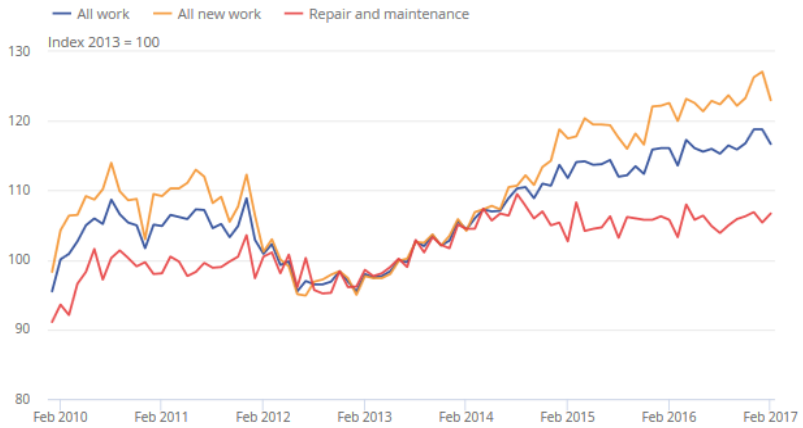
Infrastructure has high UK growth and dominant in Wales

Wales Infrastructure Investment Plan, 2012, Welsh Government

Infrastructure growth

- 7.1% growth in 2016-2020 (compared to 2.5% in UK)
- Jobs exceeds the 2008 peak (pre-recession) by 5% in 2020
- Major projects in Wales, e.g. in the power sector (nuclear; lagoon) and government sector (schools)
- UK growth concentrated in infrastructure

Construction Industry Training Board, Construction Skills Network Forecast 2016-20



Construction: Output and Employment – Office for National Statistics

Conclusions

The diversity of drivers of the CE underlies the wide range in the estimate of future potential, with change required across all of:

- construction techniques
- use of finished buildings, including existing stock
- networks of exchange at scales from local to international
- policy frameworks and types of intervention

However, opportunities for no regrets structural changes may already be clear, for example:

- CE infrastructure required for the large scale of infrastructure investment planned in Wales will have spin-off benefits at smaller scales and provide an [organisational] asset with value in the long term;

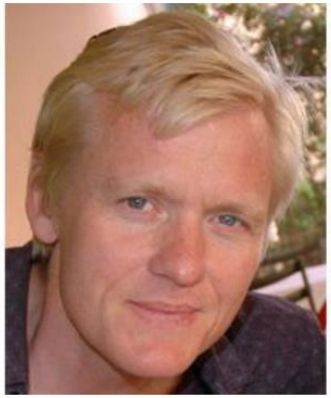
And, the opportunities may extend outside the traditional sector, for example:

- New export opportunities generated by global demand for new modular building practices and materials may be supplied using manufacturing experience in Wales.

Applying Circular Economy theory to a large mixed use project

Intelligence
Practice

Briefs built for expansion



16 July 2015

Words: Pierre Wassenaar

Region: United Kingdom
More: External management, Designing & building it

Read Later

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Is it possible to successfully marry today's needs and tomorrow's expectations in one building design?

Happy to be ephemeral: The shipping containers of the Hummingbird Cafe.

40

30

20

10

Ty Bryn Glas

Mount Pleasant

Alexandra Road

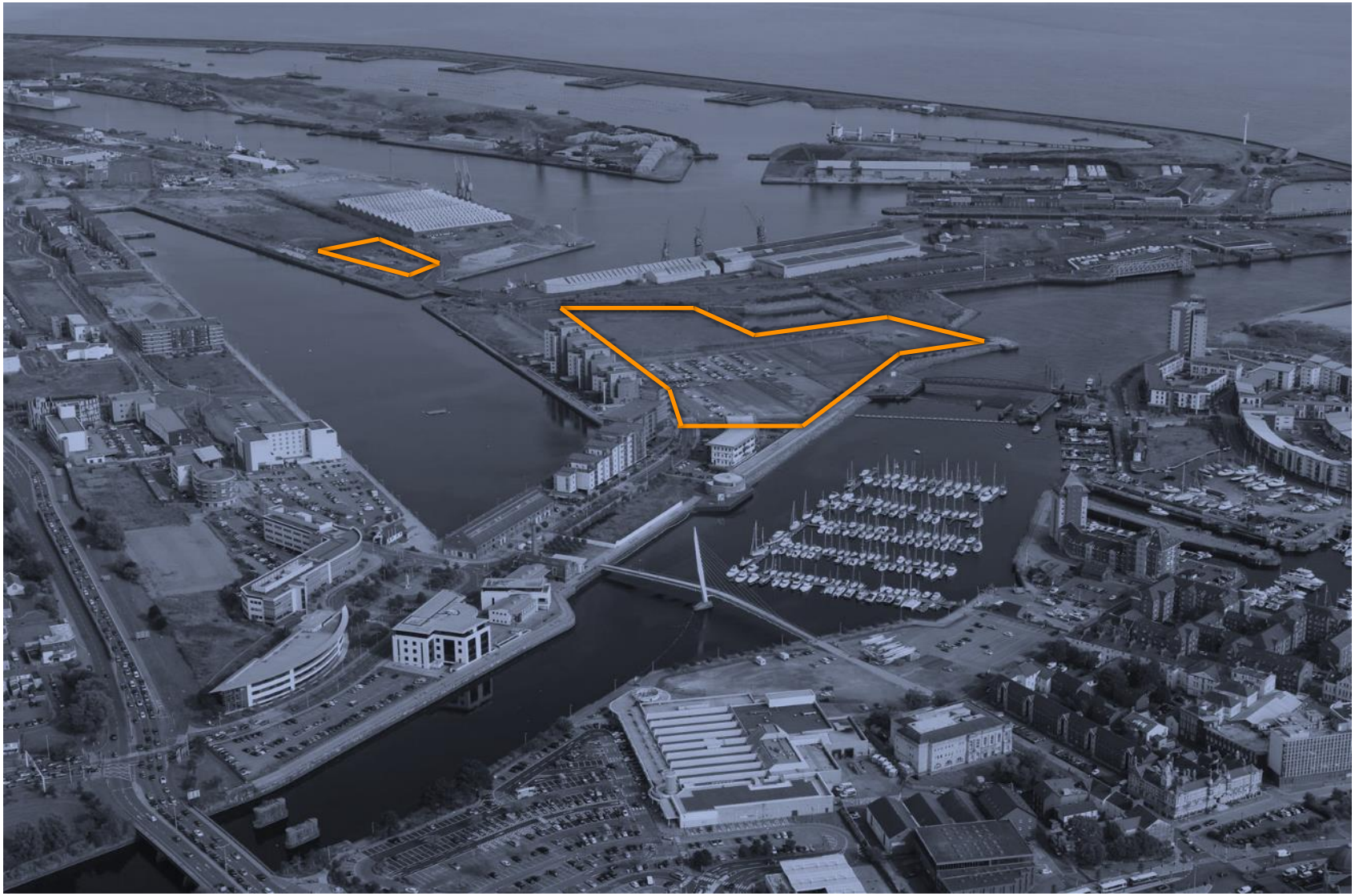
Dylan Thomas Centre

SA1

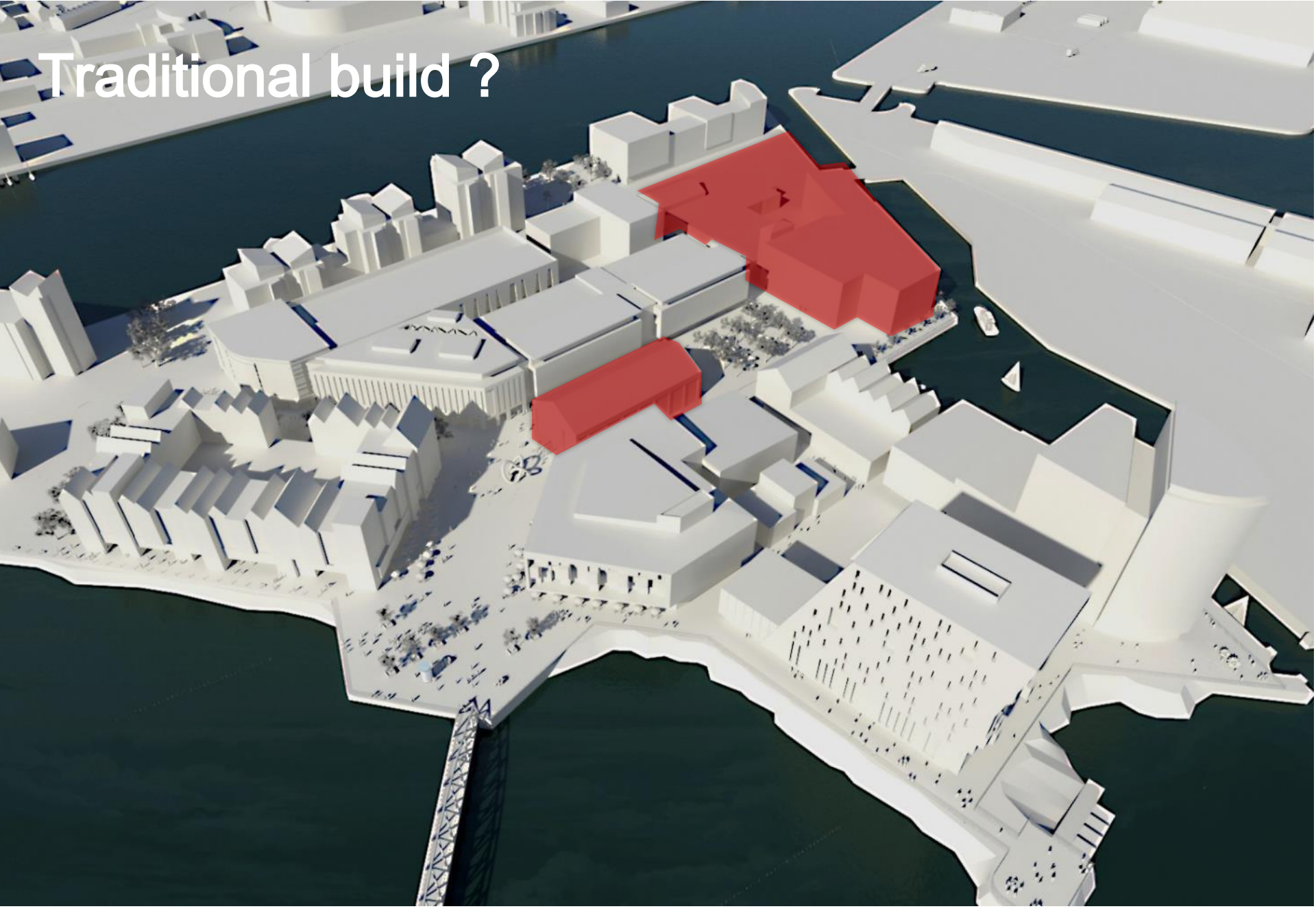
Swansea University Bay Campus

Campus

The site



Traditional build ?



Lessons from history

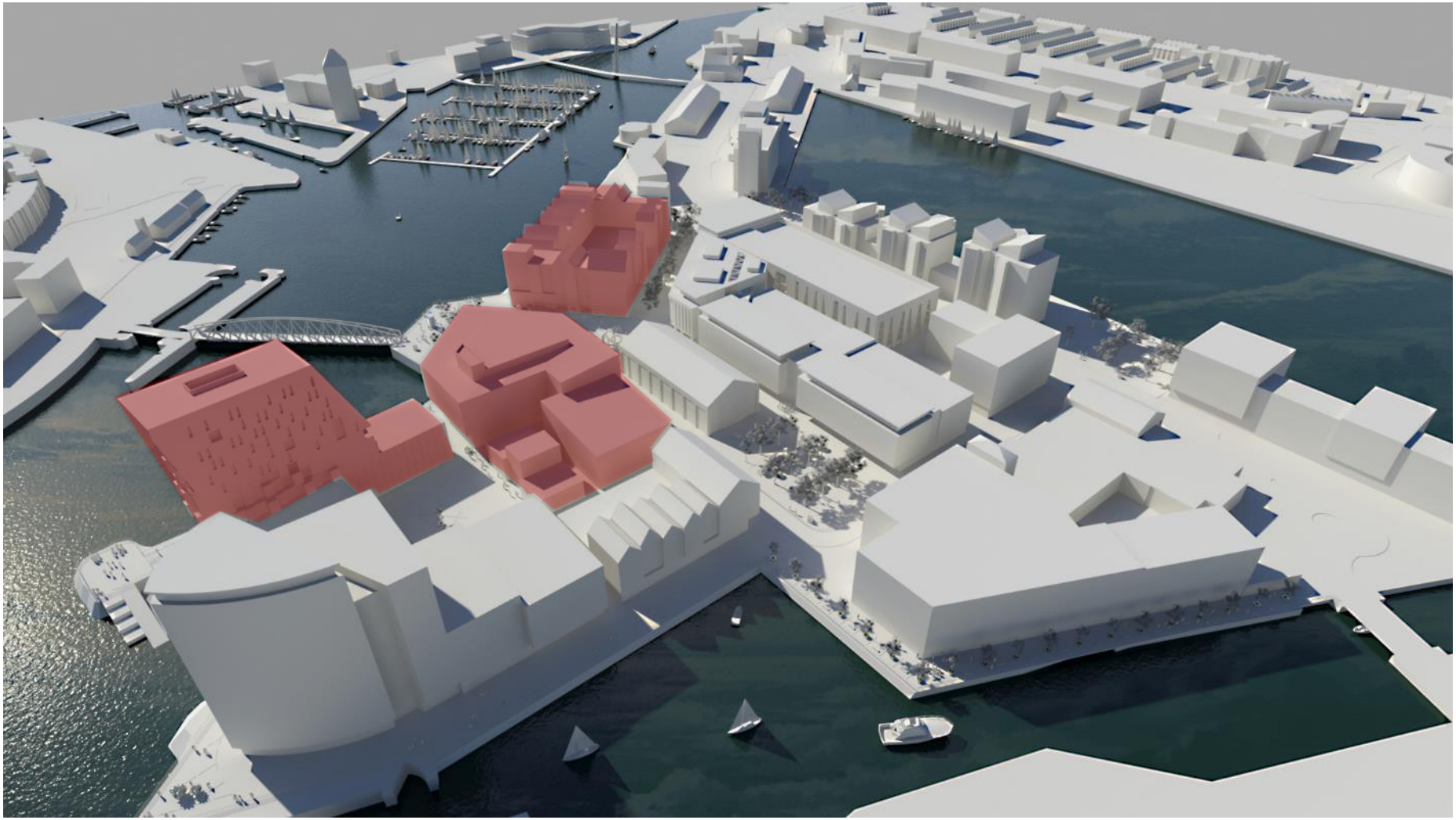
High Ceilings

Open Grid

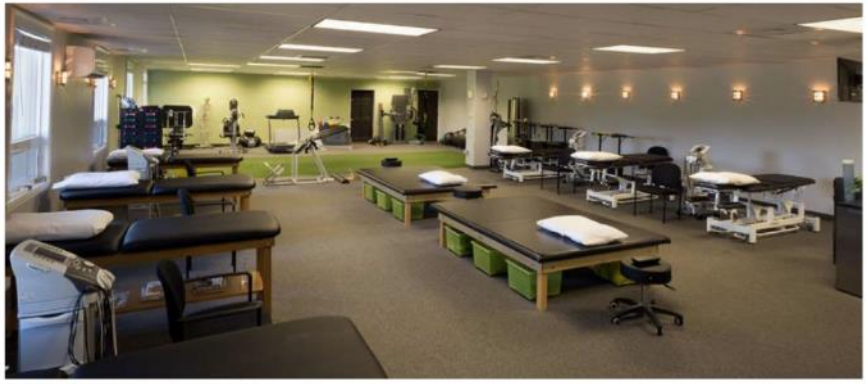
Regular Facade Openings

High quality long life materials.

Modular building?



Modular building?

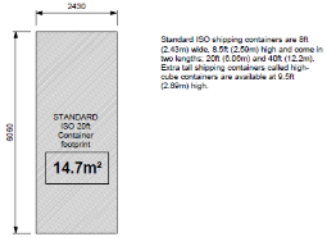


PHYSICAL THERAPY CENTRE, USA

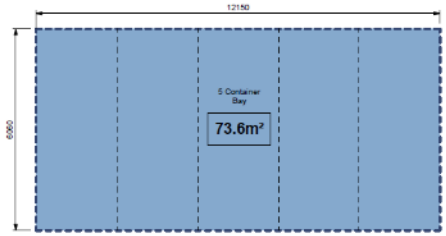
POCKET HOMES TYPICAL APARTMENT CONFIGURATION.
Source: https://www.pocketliving.com/homes/our-homes

IMPACT HUBS LONDON: ISLINGTON (TOP) AND WESTMINSTER (BOTTOM)

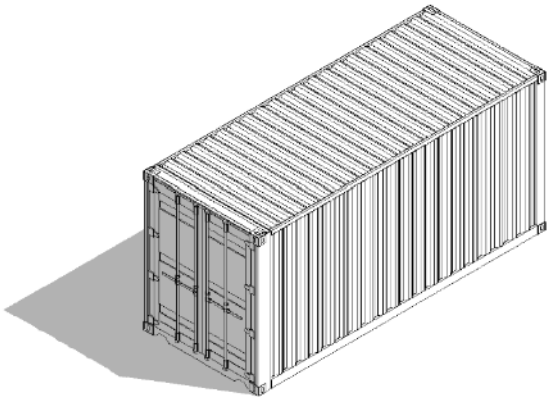
Modular Construction

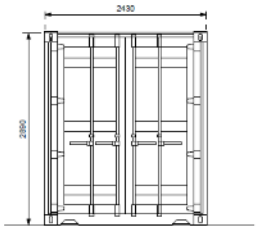


Standard ISO shipping containers are 8ft (2.43m) wide, 8.5ft (2.59m) high and come in two lengths: 20ft (6.06m) and 40ft (12.2m). Extra tall shipping containers called high-cube containers are available at 9.5ft (2.89m) high.

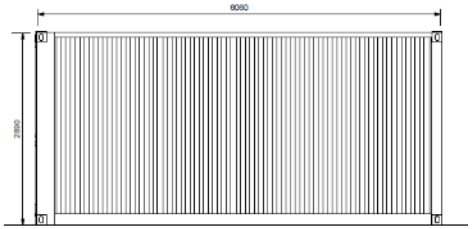


Container Info
1 : 100





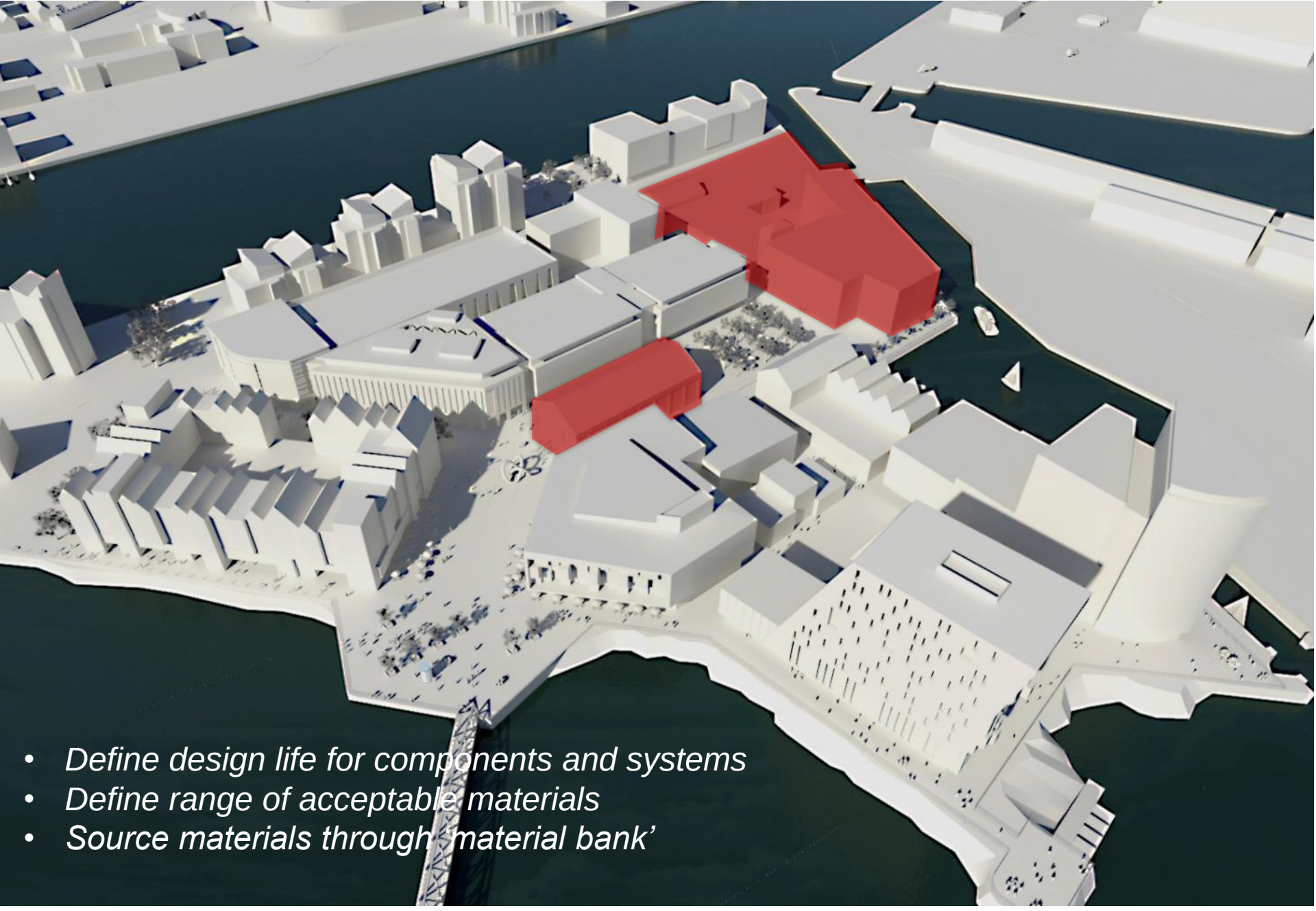
Container Door Elevation
1 : 50



Container Side Elevation
1 : 50

IF Carlsberg DID

Circular Economy



- *Define design life for components and systems*
- *Define range of acceptable materials*
- *Source materials through ‘material bank’*


Generous storey heights
Moduar grids
Separation of building layers
Dry, demountable façade assemblies
Slimline floors with softspots
Cardboard ducts?
Biocomposite plasterboard?


• Open book partnership arrangements with Contractor
• Leasing arrangements and service models for appropriate packages (lighting, carpets, furniture)

Reuse / relocate ?

Retain?

Relocate?

Repurpose?

Reclaim?

Remanufacture?

Recycle?

Materials Bank

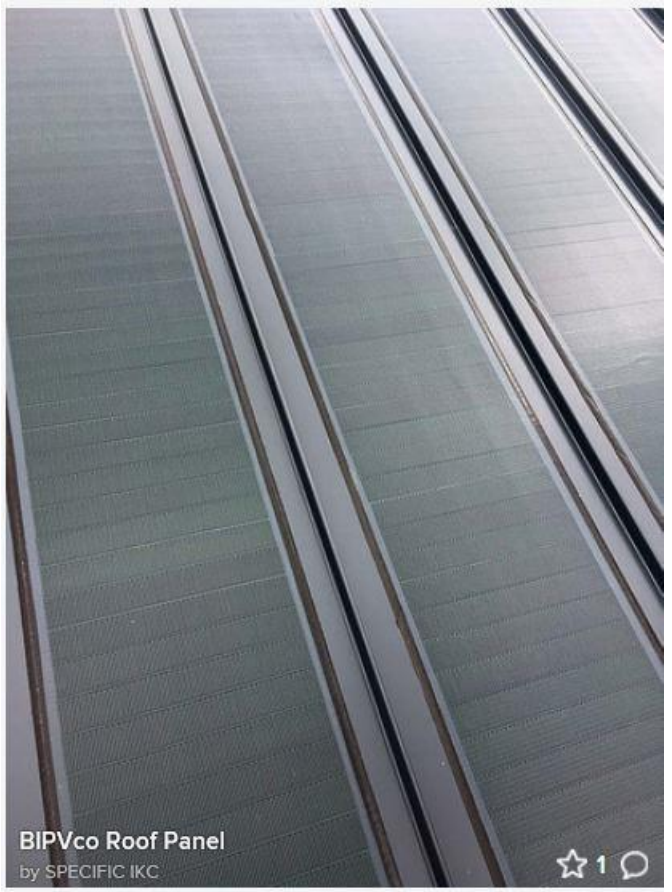
Hub

£

£

Swansea University – Specific Active Classroom

Swansea University – Specific Active Classroom Photovoltaic



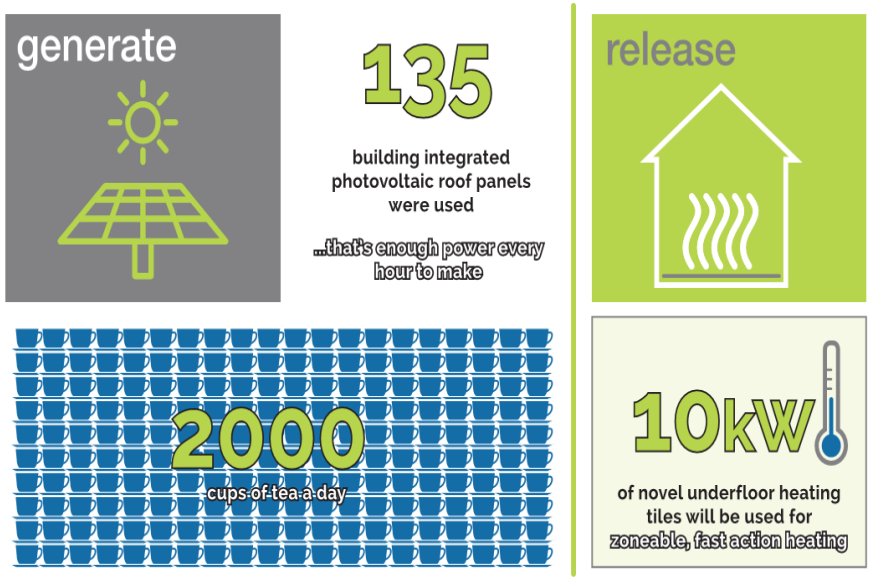
Swansea University – Specific Active Classroom DC Storage

CERTIFIED cradle to cradle BRONZE

CRADLE TO CRADLE CERTIFIED™ BRONZE PRODUCT

Cradle to Cradle Certified™ is a multi-attribute certification program that assesses products and materials for safety to human & environmental health, design for future use cycles, and sustainable manufacturing. Cradle to Cradle Certified™ products are evaluated for material health, material reutilization, renewable energy use and carbon management, water stewardship, and social fairness. The Aquion S20-P080, S20-P08F, and S30-0080 are the only energy storage products or batteries that have met these requirements. Please see www.c2ccertified.org for more details on specific program requirements.

Swansea University – Specific Active Classroom Underfloor Heating



Arup – DC Desk Solution