Investment Opportunities in Energy Transition

OC&C
Strategy consultants

OC&C Energy Transition Expertise

We have deep, global experience in strategy and diligence work across the value chain energy transition and renewable energy sources

OC&C Project Experience

Select Experience – Not Exhaustive

Renewable Energy Generation and Energy Transition

TRC

SKANSKA

TROJAN BATTERY COMPANY

Balfour Beatty

Confidential Heat Pump Manufacturer

CEA Clean Energy Associates

enel x

[cellcius]

AREVA

ROC PARTNERS

TOYOTA

MITSUI&CO.

Confidential solar panel installation

RRC Energy Services, LLC.

Confidential Solar panel Wholesaler

stanwell

Hydrocarbon Energy Production, Energy Networks and Services

MGroupServices

bp

spice

TEAM

e·on

centrica

Beauparc

ONSTREAM

ONET

EDF

SHAWCOR

EDDYFI NDT

Confidential US Transformer as a Service Business

Confidential US Transformer Repair Services

Sustainability in Infrastructure and Construction

ERM

amey

BARRATT DEVELOPMENTS PLC

SLR

PARSONS BRINCKERHOFF

wood.

enva

ATLAS

orion RESOURCE PARTNERS

Trinity Consultants

Anthesis

WSP

WOOLPERT

Augean

MODNPODS

UTEX

POLLUTEC

Lloyd's Register

element

gna

ESG Environmental Scientifics Group

APEX

Contents

The energy transition has wide-spread implications from generation to consumption, with many potential pockets of investment opportunity

Framework for Energy Transition Markets

Generation

- Wind
- Solar
- Nuclear
- Hydro
- Geothermal
- Bioenergy
- Waste-to-energy
- Traditional Hydrocarbon Generation

Transmission & Storage

- Transmission & Distribution
- Grid-scale Storage (mainly Pumped-storage Hydropower)
- Battery Storage
- Hydrogen Storage
- Other Storage (e.g. mechanical, thermal)

Consumption

Industry

- Metals
- Chemicals
- Other (e.g. food, paper etc)

Transport

- Road (EVs)
- Shipping
- Aviation
- Other

Buildings (Resi./Commercial)

- Insulation
- Efficient Systems
- Heat Pumps
- District Heating

Source: OC&C analysis

Investment in energy transition has been increasing over the last 5 years; PE investors are a significant and growing share of deal activity in the space

Investment Activity & Trends Summary

Overall investment trends	• **Investment is increasing:** Global investment in the energy transition has increased rapidly, nearly doubling from 2019 to 2022, largely due to technological advances and increased policy support • **Investment targets are changing:** – Total investment in generation has exceeded investment in consumption historically. However, investment in consumption surpassed generation for the first time in 2022 due to outpacing generation investment growth historically (31% vs 10% CAGR ’16-’22) – Investment in transmission & storage has remained relatively unchanged in net but storage grew 43% YoY ’15-’22 • **New tailwinds are emerging:** Growth in transmission & distribution historically lagged other areas (c1% CAGR ’15-22), however changes in generation and consumption patterns, as well as generally ageing infrastructure, have created an urgent need for grid modernisation
Overall deal trends	• **The number of deals** in energy-transition relevant sectors **increased by 116% from 2019 to 2022** in Europe and USA combined – Largely driven by the increasing # of deals within companies in the generation stage (e.g. renewable energy technology developers and producers) • **Deal value has increased prior to 2022** (up +151% since 2019), but has since decreased significantly due to deterioration in macro-economic conditions (this was also reflected to a lesser extent in # deals)
PE & VC trends	• **PE and VC firms make up an increasing share of the overall energy-related deals in Europe and the USA**, gaining ~0.8 %pts pa from 2019-2022 • Europe and US-based PE houses have **focused investments on energy generation,** resulting in an increasing # of deals in this area by 39% (EU) and 66% (US) YoY from 2019-2022

Source: OC&C analysis

Key Considerations for Investment

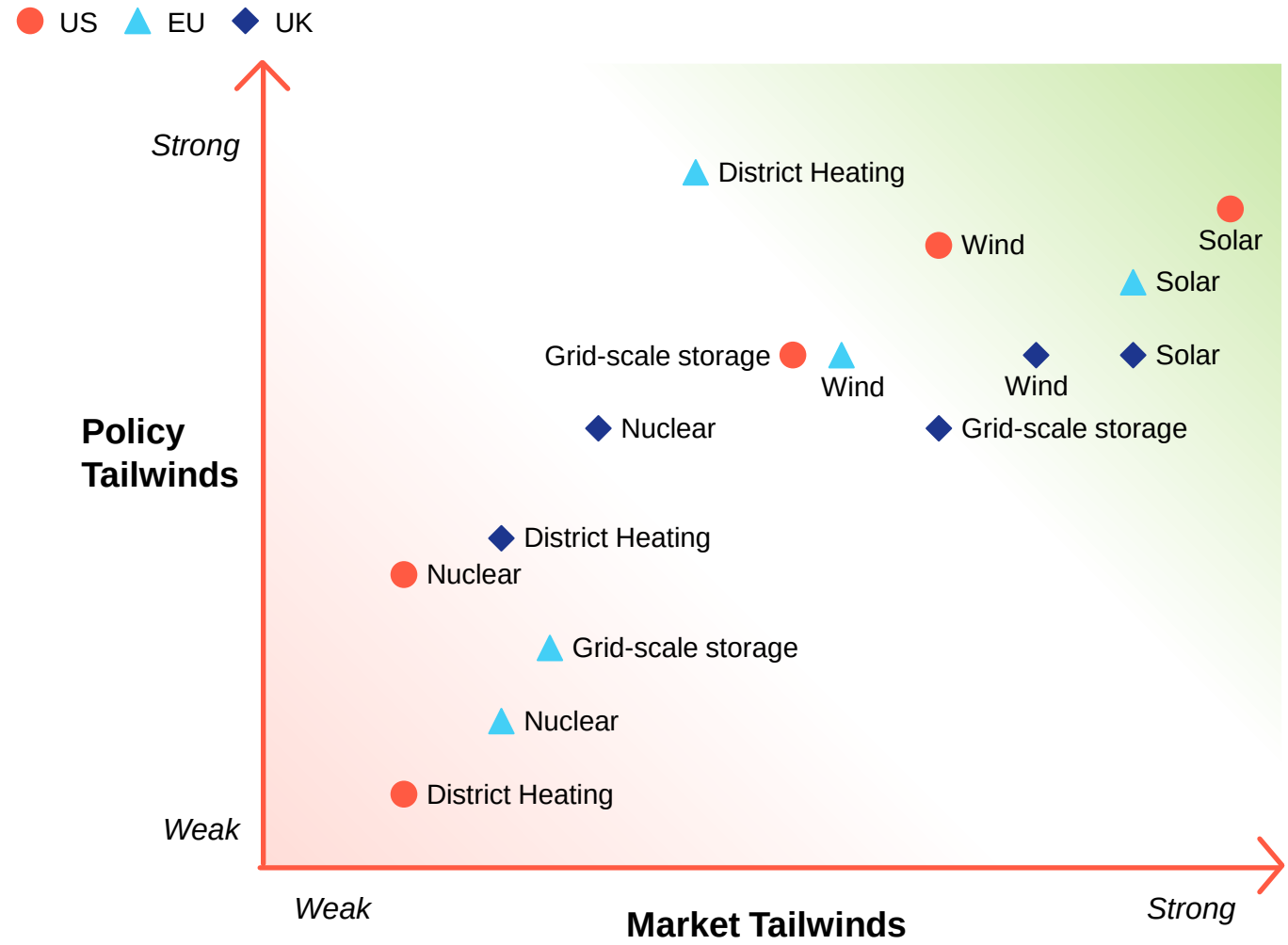
There will be winners and losers among those who invest; it's critical to consider opportunities carefully and pay close attention in 5 areas

Key Themes in Energy Transition

1	**Each geography behaves very differently**	• Individual geographies vary significantly in their net zero maturity, and in the relative attractiveness of a specific asset type (based on a number of factors) • It will be valuable to identify and invest behind leading geographic markets, there is often significant first mover advantage, it is critical to understand where the global winners will originate
2	**Policy is critical and can make or break returns on investment**	• Governments use a combination of financial incentives, target setting, and regulation to drive change • Policy is a major determinant of market outlook in most Energy Transition markets; very few markets take off in the absence of robust policy support even where other geographic or economic factors are in their favour
3	**Target capacity and potential investment do not always translate to real market opportunity**	• Target capacity and spend certainty are different; understanding the factors that can create a gap between theoretical and real market opportunity are critical • Investors must understand (among other things), policy robustness, supply chain maturity, visible project pipeline, technological certainty and consumer engagement
4	**The effects will be wide reaching and change who wins and how**	• Changes in energy transition will transform whole ecosystems, they fundamentally alter the way consumers and businesses operate creating new challenges and opportunities for established business models
5	**Current supply constraints can provide challenges but also opportunity**	• Supply Constraints are a major factor influencing the pace of market expansion in some asset types, but can present an opportunity for business models that provide temporary or long term relief to challenges supply chains

Variations in policy & market tailwinds between geographies can have a significant impact on market outlook by asset type

Policy & Market Tailwinds by Geography & Asset Type



Market and policy tailwinds are generally correlated, with robust regulation and funding and/or incentive schemes supporting investment

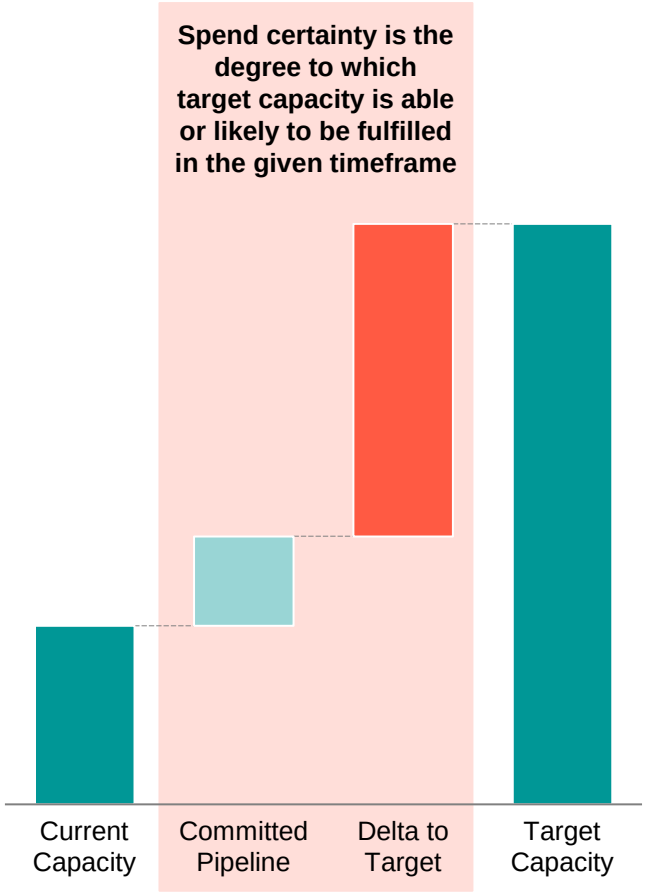
US Solar: In the US policy is a much more significant determining factor in domestic PVP penetration than peak sun hours (which impact generation)

Domestic PVP Penetration and Average Peak Sun Hours by State

Source: EnergySage, SEIA, Lawrence Berkeley National Laboratory, Desk Research, OC&C analysis

There are multiple factors that influence the certainty of spend by asset type and therefore the delta between target capacity and tangible pipeline

Spend Uncertainty



Spend certainty by asset type is influenced by several factors

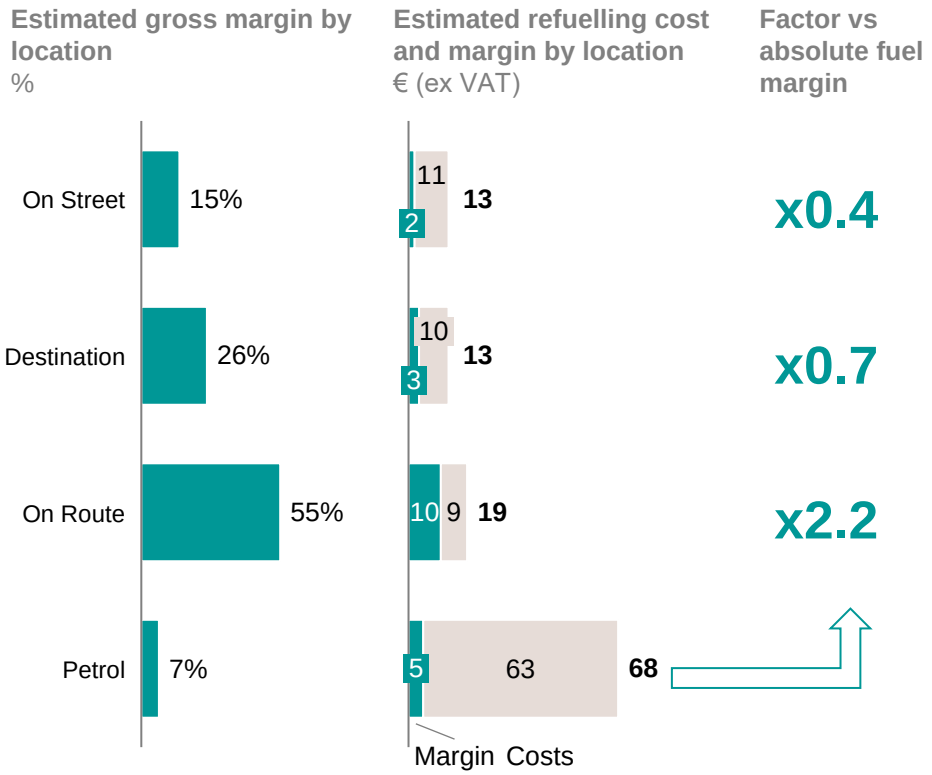
Policy Robustness	• Is there **sufficient regulation, funding & incentive in place to support investment**?
Supply Chain Maturity	• Does the existing supply infrastructure have **sufficient bandwidth to deliver at the required pace**? (eg material & labour availability)
Visible Project Pipeline	• To what extent is the **target capacity covered by the pipeline of committed projects** with known financial backers and a clear plan for deployment of capital
Technological Certainty	• Is there **technological consensus in the market**? Or could risks around the lack of known 'winning' technology hinder investment?
Consumer Engagement	• To what extent does reaching target capacity **rely on consumer behavioural change**? (eg adoption of EV, uptake of heat pumps) **Are there clear economic (or other) reasons for consumers to change behaviour / adopt solutions?**

Source: FES July 2023, REPD, British Hydro Association, OC&C analysis

Energy transition will cause a total transformation of some ecosystems, such as the impact of EV rollout on the traditional forecourt model

Impact of EV on the Forecourt Model

Forecourts that invest in EV and support a dual-fuel model will be better placed; EV provides ~2x more margin per visit



There is also a material retail opportunity; EV drivers spend 2-3x more on retail than ICE drivers

- EV recharging at fast-chargers **takes longer than refuelling an ICE car**
- As a result EV customers are **more likely to convert into retail**
- Longer dwelling time also **drives them to spend more** (e.g. lunch meal instead of only a coffee)

	EV	ICE
% Customers who transact into non-Fuel	~60%	~40%
Average food retail transaction value[1 2]	€12-14	€7-8
Average Per Visit Food Retail Spend	€7-8	€2-3
Implied Gross Profit Uplift per Visit[3]	€2-3	~€1

1. Calculated using ACS 3rd party estimate on average transaction value (excl fuel) in 2019, rolled forward with inflation. EV estimated based on the survey results for % more spend on EV non-fuel purchases than fuel purchases
2. Survey question used: Roughly how much did you spend on each of these things?, Only including Snacks, Food to eat that day at home, Groceries, Hot food or drinks on premise or to take away ICE N=433, EV N=143; Excludes anyone who stated they spend >£50 on any one or more of these categories
3. Assumes average non-fuel transaction margin of 30%

Source: OC&C EV Survey Jan 22, OC&C Fuel Survey Jan 22, Expert Interviews, Desk Research, OC&C analysis

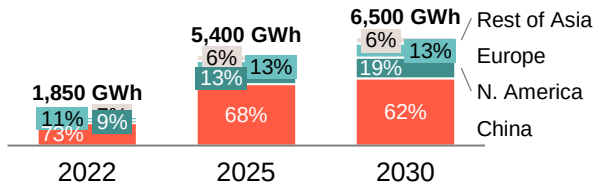
Battery Storage: Future battery storage deployment is highly dependent on the raw material supply chain

Battery Supply Chain Challenges

Future battery storage deployment is dependent on raw material supply chain

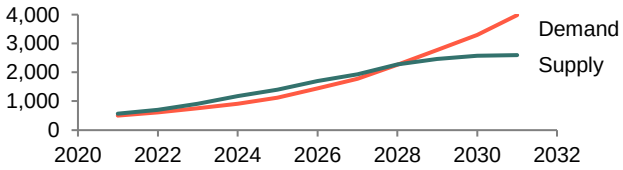
- The supply chain is fragmented and carries geopolitical risk

Lithium-Ion Battery Cell Capacity (GWh), 2022-2030



- Growing demand for Li-ion batteries (across multiple use cases) main result in constraints in raw material supplies

Lithium Carbonate Equivalent (Kilotonnes) 2021-31

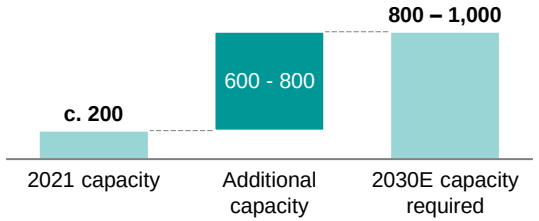


- Li-ion battery technology must continue to evolve to meet this challenge

Limitations in the number of installers and parts shortages could limit the penetration of heat pumps in the UK

- 800k additional heat pump installers:

Number of Required Heat Pump Installers (#k)

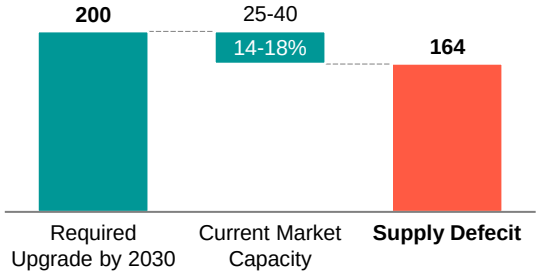


- The ramp-up of installation capacity is supported by three drivers:
  - Training of heat pump installers is quick, simple and abundant
  - c. 250k installers of fossil fuel heating systems can easily be retrained to install heat pumps
  - Heat pumps installation yields attractive rates compared to other jobs in the industry
- Manufacturing capacity has been constrained due to semiconductor shortage, but this is expected to resolve

Only 14-18% of buildings can be covered for commercial retrofit by 2030 with current supply

- 1 billion sq ft of commercial space in the UK will need upgrading to a B+ EPC rating by 2030 under new government regulation, with an estimated **£190-410bn[1] decarbonisation investment required**
- However, based on London benchmarks, at the current rate the **market will only deliver an estimated 14-18%[2] of required building upgrades by 2030**

Required London Commercial Upgrade vs Supply (m Sq ft)



1. Based on average upgrade cost per square foot from example projects (£190-410 / sq ft) to upgrade the c1bn sq ft of buildings with EPC rating below B
2. Estimated based on 4-5m sq ft delivered in London per year versus total 200m sq ft of space requiring upgrade by 2030 (as of 2023)

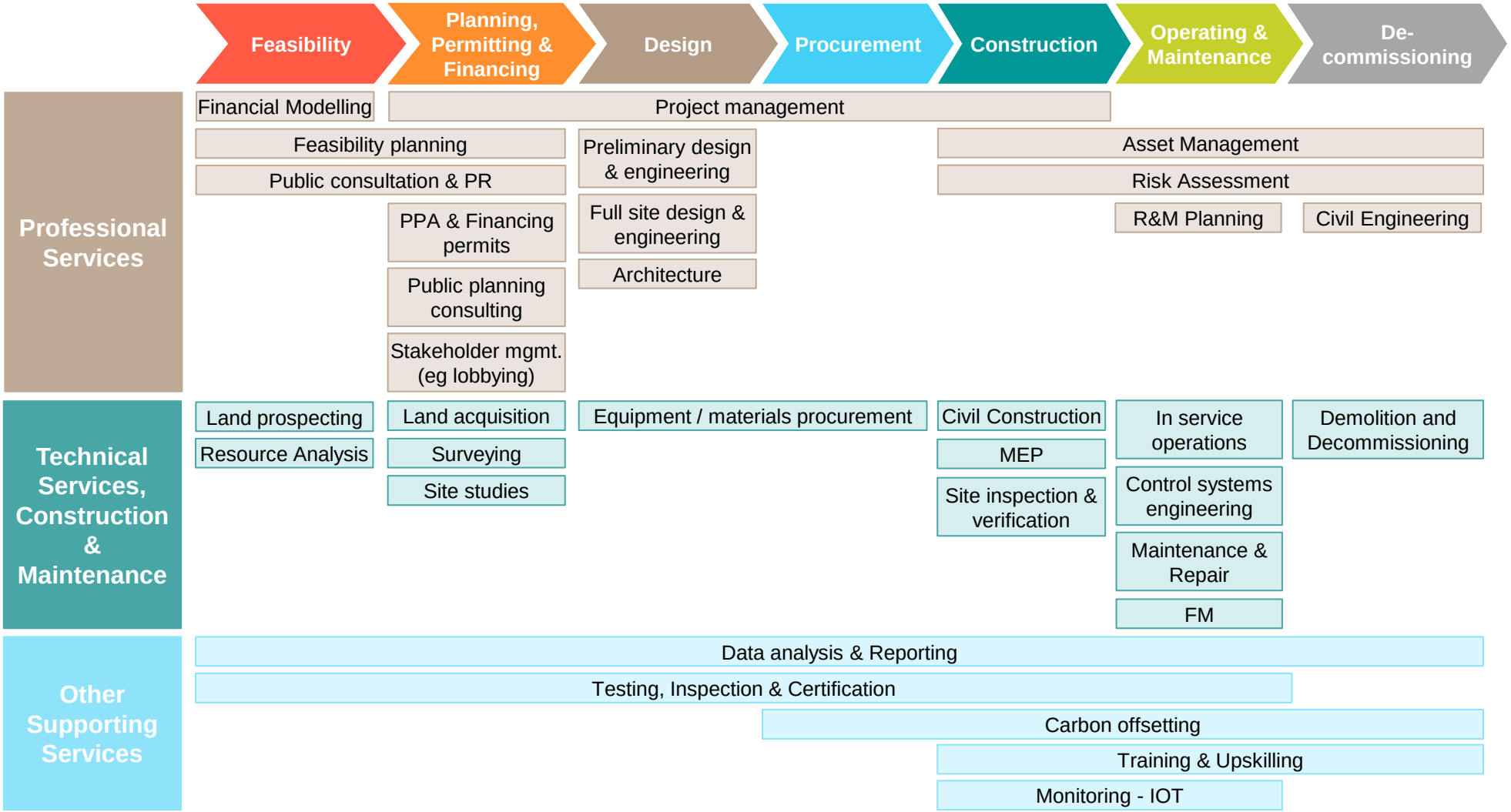
Source: McKinsey, World Materials Forum, BloombergNEF, Oxford Institute For Energy Studies, The Faraday Institution, Physics World, ARUP 'Future Proof Now' Report 2023, Climate Watch – the World Research Institute 2020, UK Heat Pump Association, OC&C analysis

Range of Investment Opportunities

There are many opportunities beyond just investment in infrastructure assets themselves, with opportunities up and down the value chain

Potential Business Models Across the Asset Life Cycle

Not Exhaustive



Range of Investment Opportunities

Within the Solar value chain, there are multiple investable areas, although the greatest opportunity likely sits in manufacture and maintenance

Sample Investment Opportunities Across Solar Value Chain

● Interesting area for investment ○ Less interesting area for investment

Services | Products | Technology

Solar Lifecycle

Manufacture → **Distribution** → **Purchase & Installation** → **Operators** → **Maintenance** → **End-of-life**

Panel OEMs
- Solar Panels
- Accessories

Battery OEMs

Emerging Solutions OEMs
- Solar windows
- Solar roads
- Solar paint

Component Manufacturers
- ***Panel parts***
- Metering

Testing
- Software testing
- Materials / component testing

Wholesaler
- Residential
- Commercial

Demand Management Software
- Assist distribution network management by allocating and predicting where solar demand will be high

Residential Installers
Sell and install new solar panels and products; retrofit existing solar systems
- PV-only
- PV with storage
- Solar Thermal (heating water)

Commercial Installers
- Land-based
- Floating / ocean-based

Installer Software
- Lead conversion and proposal customization
- Data insights

Generation Farms
Owners of solar farms, investing in the infrastructure and selling the energy
- Traditional land-based solar farms
- Ocean solar farms (floatovoltaics)

Given the residential installers space is very fragmented, the investment opportunity is less attractive in Europe and more attractive in US, where there has been greater sign of successful consolidation and scale effects

Panel Health Optimisation Software
- Within panels' internal systems
- External tool used by maintenance /servicers

Maintenance Programmes
- Warranties & insurance
- Maintenance and repairs

Second Hand Panel Market
- Very nascent: limited by lack of supply (lack of incentive to remove solar installations from buildings)

End-of Life
- Panel / Battery Recycling
- Disposal

Source: Desk Research, OC&C analysis

Range of Investment Opportunities

Within the commercial retrofit value chain there are a range of potential investment opportunities in related services, software & installation

Sample Investment Opportunities Across Commercial Retrofit Value Chain

● Interesting area for investment ○ Less interesting area for investment

Services Products Technology

Advisory / Business Development	Financing & Design	Installation & Maintenance	Monitoring & Performance Verification
Commercial Mgmt & Advisory Services • Establishing project viability • Feasibility assessment	***Sustainable Design Consultancy*** • Project financing	***Maintenance Programmes*** • Warranties & insurance • Maintenance and repairs	***Energy Management & Surveying*** • Building information systems • Facilities management software • Identification of ongoing energy reduction opportunities
Carbon Analytics • Modelling building carbon footprints • Carbon accounting tools • Compliance with industry standards	***Solution Design Software*** • Optimise power usage effectiveness • Identification of energy & utilities inefficiencies • Cost auditing and assurance • Cost estimation	***Energy Efficiency Solutions*** • Eg HVAC systems, LED lighting, insulation manufacturers	***Consumption Tracking Software*** • Measure & report sustainability metrics
	Architecture & engineering services • Re-engineering of buildings	***Commercial Renewable Generation*** • Eg onsite solar or power storage facilities	
		Commercial Installers • Programme management • Onsite renewable installation	

Source: Desk Research, OC&C analysis

