Session 2 - Matching needs with solutions

Findings

Jonathan Lonsdale of ICF began the second session by highlighting that understanding capital markets and how they treat risk is key to unlocking investment for climate technology, and to creating the conditions that will allow so-called first-of-a-kind approaches to thrive. Matthew Kennedy of the International Energy Research Centre identified replicability, trust and understanding of local conditions as keys to the successful deployment of technology innovation. According to Mr. Kennedy, as industry will ultimately own the intellectual property being deployed, the potential to build markets for any proprietary technology is what will drive research and investment. Disruptive technologies take business from non-innovators - that is important to acknowledge as industry does not need help with engineering but with business models, analysis of local conditions and understanding of the needs of all partners. Nand Kishor Agrawal (ICIMOD) noted that innovation needs to be low-cost and not too dependent on government intervention.

The subsequent panel discussion emphasized the adaptation of new technologies to local contexts, and encouraged investment in RD&D with an emphasis on deployment. Technology ‘know-how’ and ‘know-why’ were highlighted, as was the need to link technology innovation with capacity building. The CTCN model of tailored technical assistance was identified as an approach that could enable solutions on the ground, while building local capacity as well.

Presentations

Innovative Financial Instruments for First-of-a-Kind, commercial-scale demonstration projects in the field of energy
- Jonathan Lonsdale, ICF

Collaborative business models for energy research
- Matthew Kennedy, International Energy Research Centre
Innovative Financial Instruments for First-of-a-Kind commercial-scale energy demonstration projects

Presented at CTCN Scoping Workshop on Supporting First-of-a-Kind Climate Technology – Session 2: Matching needs with solutions

22/05/17

Jonathan Lonsdale, Consulting Director, Energy & Climate

James Gardiner, Managing Consultant, Energy & Climate
Overview of the study funded by DG Research & Innovation, European Commission

1. Rationale for the study

2. Framework conditions which influence FOAK projects

3. Role of EU and Member State support schemes

4. Benefits of financial instruments

5. Market participant views on funding and risk perceptions

6. Appropriate financial support instruments

7. Study conclusions
Financing is the critical link between innovation and successful commercialisation

- **Large-scale demonstrators face challenges in raising sufficient funds:**
  - they are in a very high risk asset class
  - they attract only limited interest from the market

- **Failure to convince the market to “buy in” to such projects:**
  - hinders EU competitiveness
  - increases the costs of achieving EU climate & energy policy targets

- **DG Research & Innovation therefore commissioned ICF to determine:**
  - the funding landscape in Europe for FOAK projects in 9 technological sectors of the Strategic Energy Technologies (“SET”) Plan
  - identify obstacles to funding of SET FOAK projects
  - which financial instruments (debt, equity, guarantees) might improve the situation.
Framework conditions are critical in helping to promote the deployment of FOAK projects

<table>
<thead>
<tr>
<th>RESOURCE AVAILABILITY</th>
<th>FISCAL SUPPORT</th>
<th>PERMITTING &amp; SUPPLY CHAINS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Larger opportunities exist for deployment of innovative energy technologies in some regions of Europe</td>
<td>Stable support mechanisms create a positive signalling effect to potential investors and financiers</td>
<td>More likely to exist where high penetration rates already exist (e.g. solar, wind, biomass)</td>
</tr>
<tr>
<td>E.g. ocean energy and offshore wind in NW Europe; concentrating solar power around Mediterranean</td>
<td>Retroactive changes to fiscal support regimes (e.g. Spain) massively impact financier &amp; investor sentiment</td>
<td>Where low/no market deployment (e.g. CCS, geothermal power, ocean energy) policy support plays a more crucial role in overcoming barriers</td>
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</table>
ICF reviewed 14 SET support schemes across the EU and Member States, including several covering FOAK projects.
Across Europe, grant funding is relatively common, loans are less common and equity investment is rare for the public sector.

<table>
<thead>
<tr>
<th>PUBLIC GRANTS</th>
<th>PUBLIC LOANS</th>
<th>PUBLIC EQUITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most common support</td>
<td>Very modest funds at Member State level</td>
<td>Rarely used mechanism</td>
</tr>
<tr>
<td>Funding limits highly variable across schemes</td>
<td>More tailored provision at EU level for FOAK projects – from €7.5m to €75m</td>
<td>Mainly focused on innovative SMEs, not projects <em>per se</em></td>
</tr>
<tr>
<td>Max grant funding levels 50% of eligible costs</td>
<td>Max loan levels 50%</td>
<td>Good practice not to exceed max % level (33% in France)</td>
</tr>
<tr>
<td>Key schemes: Denmark, France, Sweden, UK</td>
<td>Key schemes: France, Germany, EU - InnovFin Energy Demo Projects facility</td>
<td>Key schemes: France, UK</td>
</tr>
</tbody>
</table>

Innovative Financial Instruments for First-of-a-Kind commercial-scale energy demonstration projects

ICF proprietary and confidential. Do not copy, distribute, or disclose.
Financial instruments bring substantial benefits for the public sector compared to grant funding

Achieve higher quality, bankable projects

Debt must be repaid and projects therefore receive far greater scrutiny

Achieve longer term sustainable finance

Potential for ‘revolving’ public funds to reinvest revenues / returns into a future project pipeline

Provide flexibility in tackling a broader range of low carbon technologies

Help cater to different funding requirements across and within sectors
Market participants are mainly concerned with technology, completion & regulatory / revenue risks

<table>
<thead>
<tr>
<th>TECHNOLOGY RISK</th>
<th>COMPLETION RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Will the project actually work as expected?</td>
<td>Will the project be completed to time, cost and specification?</td>
</tr>
<tr>
<td>Will scale up and integration into existing infrastructure work successfully?</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>REVENUE RISK</th>
<th>LEGAL &amp; REGULATORY RISKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are revenues assured (e.g. offtake agreements, tariffs)?</td>
<td>Is the legal and regulatory framework stable?</td>
</tr>
<tr>
<td>Are revenues enough to service finance, if project is completed and commissioned?</td>
<td></td>
</tr>
<tr>
<td>Is the business model viable?</td>
<td></td>
</tr>
</tbody>
</table>
Market participants have different propensities for risk, which leads to complex and unique financial structures.
Risk and returns of SET projects are different to other sectors, not least due to economic regulatory controls.

<table>
<thead>
<tr>
<th>Risk</th>
<th>Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>

- **Projects will be funded with little problem** – Various market participants
- **Limited opportunities**, although bank debt likely if revenue generating
- **Specialist participants** – although appetite has waned post economic downturn
- **Limited appetite for participants** – public intervention if area is of strategic importance?

**Source**: ICF
Risk and returns of SET projects are different to other sectors, not least due to economic regulatory controls.

- **High Risk**
  - Specialist participants – although competitive bidding?
  - FOAK project opportunities

- **Low Risk**
  - Limited opportunities, although bank debt likely if revenue generating
  - Public intervention if area is of strategic importance?

- **High Returns**
  - Projects will be funded with little problem – Various market participants

- **Low Returns**
  - Limited opportunities, although bank debt likely if revenue generating

Source: ICF
Study options were based on feedback from financial market participants, taking account of existing mechanisms

- Many market participant concerns relate to addressing POLICY risks

- Addressing the financial-support needs of different types of FOAK projects appears to require a number of approaches:
  - Grants – for project preparation / Front-end Engineering & Design (FEED) studies and construction phase only
  - Equity - alongside other investors, especially to help smaller sponsors to fill gaps
  - Loans - for sponsors who can bring equity and forecast cash-flows (potentially including a fiscal subsidy) from a successful operational FOAK project

- Different projects will require different “blends” of support
  - Every project has its own individual set of risks
  - Therefore, the extent of risk support/mitigation will be different for each project
Key conclusions from the study

- A failure hitherto to grasp the scale of funding required
- Current over-reliance on grants within EU and Member State schemes
- Corporate sponsors are a key constituent party in the support mix
  - However, energy utilities have much less finance to support; and
  - Major engineering companies are highly selective about what they will sponsor.
- Complexity of financing needs across and within sectors
  - Massive variations in financing structures of FOAK projects – no “one size fits all”
  - Providing an advisory service would help many project developers to present a more credible case to investors and lenders
- Potential exists for an integrated EU offer, combining grants, equity and loans to SET FOAK projects in order to satisfy market need
Thank you for listening!

Jonathan.Lonsdale@icf.com
James.Gardiner@icf.com
Annex: timescales, sectoral risks, potential risk mitigators, insights into non-EU support schemes
Timeline for FOAK projects may be 9 years or longer, creating tensions with public sector funding programmes

Time schedule, simplified – Bio2G

Projects in some sectors can face insurmountable risks at various stages of the project cycle – or throughout the entire process.

<table>
<thead>
<tr>
<th></th>
<th>PLANNING</th>
<th>EXECUTION</th>
<th>OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Technical design</td>
<td>Regulatory design</td>
<td>Legal design</td>
</tr>
<tr>
<td><strong>PV</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>DRM</strong></td>
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<td><strong>WIN</strong></td>
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<tr>
<td><strong>CSP</strong></td>
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<td><strong>GEO</strong></td>
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<td><strong>BIO</strong></td>
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<tr>
<td><strong>OCN</strong></td>
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<tr>
<td><strong>CCS</strong></td>
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</tbody>
</table>

Key:
- Green: Limited risk(s)
- Yellow: Risk(s) which will require assessment and potential resolution
- Red: Potentially insurmountable risks that may become project deal breakers
Potential risk mitigation actions which could be considered to overcome actual / perceived risks

- **Technology Risk:**
  - sponsor support (e.g. utility/engineering company)
  - ensure original equipment manufacturer (OEM) locked into project [performance warranties and guarantees not available for FOAK]

- **Completion Risk:**
  - sponsor support (e.g. utility/engineering company)

- **Revenue Risk:**
  - support with FiT or CfD regime
  - support / guarantees for performance

- **Regulatory & Legal Risks:**
  - support for stable national policies for FOAK projects
  - support for contractual counterparties, e.g. for CfD
  - establish consistent legal status and rights for FOAK projects
  - impose international arbitration into contractual arrangements
ICF reviewed seven international schemes supporting FOAK clean energy projects.
Performance to date of non-EU schemes is mixed

- **Loans Projects Office (USA)** - deployed US$ 22 bn of loans/guarantees in Bioenergy, CSP, Geothermal; Wind, SPV; seeded utility-scale PV market leading to extra 17 projects >100MW financed without loan guarantees

- **CCS Demonstration Programme (USA)** – several projects terminated due to co-financing and planning considerations

- **NextGen Biofuels Fund (Canada)** – only 2 projects funded over 8 years

- **NEDO (Japan)** – demonstrations worldwide include Europe (Spain, UK)

**Milestone payments** for some schemes in the USA are an effective approach to managing project risks – for the sponsor & public sector alike
Matching needs with solutions

A collaborative business model for energy research

Dr. Matt Kennedy

CTCN ‘First of a kind technology’ workshop
IERC as a research enabler

Government supported, Hosted in Tyndall Institute

Industry led and relevant

Innovations from TRL 3 to TRL7

€20M investment in jobs and tangible returns

AT Kearney

United Technologies Research Center

Bord Gáis Energy

Tyndall National Institute

Gas Networks Ireland

ESB

amarengo

redT

Siemens

Bombardier

BiLFINGER
Decentralised Grid
- Microgrid
- Storage
- Ancillary services
- Aggregation
- Demand response
- Secure trading

Energy efficient systems
- Certification and standards
- Verification & Validation
- Flexibility and performance

Core skills
- Interdisciplinary
- Data analytics
- Systems development
- Algorithm development
- Energy modelling
- Energy trading
- Project development

IERC Solution
- Collaborative projects
- Translation and consultation
Context for Energy R&D

Decarbonisation Must happen
- Destination clear
- Path uncertain
- Pace is uncertain

Renewables Unstoppable
- Costs reducing
- Efficiency Gains
- Flexibility solutions

Demand stalled
- Passive housing
- DM technology
- Data Centre offset

Prosumer Take-off
- Connected Homes
- DER availability
- Heat & Transport

New business models
- Multiple Players
- Service/Data orgs
- Towards ‘Free’ electricity
Is R&D Innovation ‘standardized’?
R&D isn’t rocket science,

Why isn’t everything this easy?

R&D needs discipline!
Listen to the stakeholder

We Love Our Drivers!

- cost
- adherence to standards
- ease of use
- Products, tech, services
- Production ready
- ease of deployment
Engagement reduces risk

1. Identify Seed
   - Ambition
   - Capability
   - Credibility

2. Build Consortium
   - Define value stream logic
   - Approach potential partners
   - Identify and agree members

3. Scope Workshop
   - Pre-fill questionnaires
   - Attend formal session
   - Sign-off final project plan

4. Project Definition
   - Due diligence on needs
   - Launch EOI for external PI or complete internal EOI
   - Select Principle Investigator

5. Project Planning
   - Work-streams, timelines, milestones and budgets

6. External Review
   - External peer review of proposal and PCA
   - Legal Negotiations
   - CSC Approval

7. Sign Contracts
   - Contracts Issued
   - Reviewed and signed

8. Kick-off Project
   - Contribute funds
   - Contribute active leadership
   - Provide feedback
Define the problem
• Arising from business need, e.g.:
  • Integrated systems
  • Energy storage
  • Performance contracting

Identify gaps
List, rank and prioritise
• Technical
• Information and intelligence
• Behavioural
• Business model
• Policy and regulatory

Identify stakeholders, actors, participants
• Who is existing and who is new?
• Actors may be passive
• Participants essential to process

Determine value and impact of solutions
• Potential market value to each participant
• Value to all market actors
• Impact on security, affordability and emissions

Develop project plan (including full research business plan)

Develop execution plan

Lenses

DRIVERS
CAN YOU SEE THE FUTURE?
IERC Strategic Research Themes

Research Lenses

- Technology
- Information & Intelligence
- Behaviour
- Business Models
- Policy and Regulation

IERC Strategic Research Themes:

1. Smart and Sustainable Communities
2. Low Carbon Heating and Cooling
3. Energy Efficiency & Analytics
4. Distributed Generation Systems
Link to market need

- Distributed Storage
- Micro-grid Franchises
- Pro-sumer Markets
- Renewables Integration
- Grid Stabilization Policies
- Resident & Community Engagement
- Distributed Generation Systems & Microgrids
- Demand Response
- Embedded PV
- Smart Metering

International Energy Research Centre
Consider IP v Financing

**Extent of Research Engagement with IERC**

- **Type 1 Projects**
  - Funding: IERC
  - FIP: RPO Owned

- **Type 2 Projects**
  - Funding: Joint
  - FIP: Inventor Owned

**Benefit to stakeholder**

- **Collaborative**
  - Type 2 Projects
  - Funding: 35% members
  - FIP: Inventor Owned

- **Advisory/steering**
  - Type 1 Projects
  - Funding: IERC
  - FIP: RPO Owned

Informative → Transformative
Picking R&D winners isn’t easy
Maintain Portfolio Diversity

Microgrids

- **MiFIC**: Maximize the clean energy penetration from grid-connected micro-generation systems. **Partner**: IERC
- **Community Grid**: Flexible energy trading and business model for community grid operator. **Partners**: M Power/Siemens/SystemLink

Energy Storage

- **StoreNet**: Demonstrate the potential of distributed demand-side storage to facilitate the transition to a 100% renewable future, whilst delivering value to consumer, renewable generator and grid operator. **Partner**: Solo/ESBN/DP Energy
- **ImPRESS**: Flow Battery optimization for renewable storage and DS3 services. **Partners**: QUB/Williams Industrial/Erova/Energia/Green Lizard Technologies.
- **PhoBEAns**: Maximise the techno-economic values of Photovoltaic (PV) and/or battery storage operating in Ireland in order to assist in enabling a secure and sustainable electricity system. **Partner**: Amarenco/RED-T.
Maintain Portfolio Diversity

Building Energy Performance

- **NOVICE**: Developing business models to grow the ESCo market via the dual revenue stream of energy savings and demand side services. **Partners**: Technalia/Kiwi/Hypertech/Solintel/E7 Energie/Joule Asset/Noel Lawler/Bilfinger.

Residential Retrofit

- **Superhomes**: Optimization of Air Source Heat Pump Applications in NZEB Residential Retrofits to achieve 10-15% improvement in COP and SPF for ASHP operation. **Partners**: TEA/ESB.

Green Gas Certification Scheme Blueprint

- **GreenGasCert**: A renewable Green Gas Certification scheme tailored to Irish conditions. **Partners**: DBFZ/Dena/GNI/RGFI.
New Innovations

We believe that energy efficiency should pay for itself.

THE SUSTAINABLE ENERGY REVOLUTION REQUIRES A SUSTAINABLE FINANCIAL MODEL!

URBAN VOLT

BLOCKCHAIN ENERGY: DISRUPTING THE POWER MONOPOLY

redT

MICRO GRID SOURCES
"If I had an hour to solve a problem I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solutions." — Albert Einstein

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