Jumping the spark: how can innovation in the power system accelerate clean energy transitions in emerging economies?

21 March 2022
## Agenda

### Moderated by: Vida Rozite, 3DEN Project Manager, IEA, and Emi Bertoli, Energy Policy Analyst, IEA

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<th>Session</th>
<th>Speakers/Participants</th>
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<td>Welcome and opening remarks</td>
<td>Brian Motherway, Head of Energy Efficiency Division, International Energy Agency</td>
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<tr>
<td>17h05</td>
<td>Scene setting on enabling framework for innovation in power systems</td>
<td>Amalia Pizarro, Energy Innovation Officer, International Energy Agency</td>
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<td>Richard Dobson, Practice Manager - Data Systems, Energy Systems Catapult</td>
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<td>17h20</td>
<td>Presentations from innovators and moderated panel discussion</td>
<td>William Brent, Chief Marketing Officer, Husk Power Systems</td>
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<td>Carmen Best, VP of Policy &amp; Emerging Markets, Recurve</td>
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<td>Dario Febre, Growth Owner, Slight Artificial Energy</td>
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<td>Irene Calve Saborit, Chief Executive Officer, Sunkofa Energy</td>
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<td>Santiago Ortega Arango, professor at EIA University and senior researcher at</td>
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<td>Transactive Energy Colombia Initiative</td>
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<td>Joel Garcia Galan, Chief Executive Officer, Wirewatt</td>
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<tr>
<td>18h30</td>
<td>Closing</td>
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<td>18h35</td>
<td>End of webinar</td>
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How governments support clean energy start-ups

Simon Bennett (ESIO) and Amalia Pizarro (ETP)

Jumping the spark event, 21 March 2022
Context

• **Who?**  Policy makers navigating a wide range of policy options to accelerate clean energy innovation and deliver local prosperity

• **Why?**  No resources yet exist to help countries learn about their choices and provide inspiration

• **How?**  22 interviews in 2021. IEA analysis according to a framework of 4 policy functions and 2 delivery options (either “directly” by a public institution or via a third party)

• **What?**  14 comparable case studies. 30 other policy highlights from around the world. 8 insights for effective policy.
Clean energy venture capital is attracting record amounts of money. But a larger sustained “wave” of investment in a wider range of areas will be required for a net zero emissions future. Governments aspire to capture a share of this market for climate and economic reasons.
Six reasons governments support clean energy start-ups

1. Without more innovation, energy and climate goals will be out of reach
2. Energy innovation is expanding thanks to start-ups
3. Energy technology companies are underfunded by private capital
4. Nurturing start-ups to maturity creates local economic prosperity
5. Clean energy transitions will be a major market opportunity for all countries, all century long
6. Clean energy entrepreneurship emerged as a recovery opportunity from the pandemic
Support can be categorised according to four functions

<table>
<thead>
<tr>
<th>Financing</th>
<th>Non-dilutive</th>
<th>Dilutive</th>
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<tbody>
<tr>
<td></td>
<td>• Grants via calls to consortiums/solo recipients</td>
<td>• Angel and seed equity investments</td>
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<tr>
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<td>• Grants via prizes</td>
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<td>• Loans and loan guarantees</td>
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<thead>
<tr>
<th>Infrastructure</th>
<th>• Access to public/private laboratories and research expertise</th>
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<tbody>
<tr>
<td></td>
<td>• Access to real-world testing environments</td>
<td></td>
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<td></td>
<td>• Equipment procurement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Access to office space</td>
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<tr>
<th>Services</th>
<th>• Business services (e.g. pitch training, financial/business strategy assistance, staff recruiting, legal advise, intellectual property, etc.)</th>
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<td></td>
<td>• Technical expertise</td>
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<td>• Validation and public recognition</td>
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<tr>
<th>Networking</th>
<th>• Peer-to-peer</th>
<th>• Investors and potential customers</th>
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<td></td>
<td>• Suppliers and other entities in the value chain</td>
<td>• Policy connections</td>
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<td>• International connections</td>
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30 initiatives that provide one or more functions directly or indirectly

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<th>Direct</th>
<th>Indirect</th>
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<tr>
<td><strong>Financing</strong></td>
<td><strong>Financing</strong></td>
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<tr>
<td>Women in Cleantech Challenge</td>
<td>InnoEnergy</td>
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<tr>
<td>Start Up Energy Transition</td>
<td>EIT ClimateLaunchpad</td>
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<tr>
<td>Innovasjon Norway</td>
<td>CaliSeed</td>
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<tr>
<td><strong>Infrastructure</strong></td>
<td><strong>Infrastructure</strong></td>
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<tr>
<td>ST&gt;RT-UP CHILE</td>
<td>EIT ClimateLaunchpad</td>
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<tr>
<td>Green INNO BOOST</td>
<td>PortXL</td>
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<tr>
<td>Innovation Norway</td>
<td>CLEAN Energy International Incubation Centre</td>
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<tr>
<td><strong>Services</strong></td>
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### 14 case studies

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<thead>
<tr>
<th>Country</th>
<th>Programme</th>
<th>Features</th>
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<tbody>
<tr>
<td>Canada</td>
<td>Women in Cleantech Challenge</td>
<td>Female-only prize with unconditional grants &amp; lab access for finalists</td>
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<tr>
<td>Chile</td>
<td>Start-Up Chile</td>
<td>Non-technology specific incubation, open to overseas applicants</td>
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<tr>
<td>EU</td>
<td>EIT InnoEnergy Highway®</td>
<td>Private entity funded to provide incubation in return for equity</td>
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<tr>
<td>Germany</td>
<td>Start Up Energy Transition</td>
<td>Modest prize with a focus on publicity and policy dialogues</td>
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<tr>
<td>India</td>
<td>Technology Business Incubators</td>
<td>Funding for private incubators who also channel public funds</td>
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<td>CEIIC</td>
<td>Incubator that invests in equity in line with Indian clean energy goals</td>
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<td>Morocco</td>
<td>Green Innoboost</td>
<td>Incubation via grants or equity in partnership with Moroccan labs</td>
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<td>Norway</td>
<td>Innovation Norway</td>
<td>Uses advisors to guide start-ups to market research, loans and grants</td>
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<tr>
<td>Singapore</td>
<td>EcoLabs-COI</td>
<td>Incubation support and facilitation of access to international test sites</td>
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<tr>
<td>Sweden</td>
<td>Swedish Energy Agency grants</td>
<td>Grants for technology projects designed for different maturity levels</td>
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<tr>
<td>UK</td>
<td>Energy Systems Catapult Living Lab</td>
<td>Access to connected households for field trials of smart products</td>
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<tr>
<td>USA</td>
<td>American-Made Challenges</td>
<td>Technology-specific prizes with access to labs and networks</td>
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<td>Incubatenergy Network</td>
<td>Private network of incubators to join up support as start-ups mature</td>
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<tr>
<td></td>
<td>Innovation Incubator (IN²)</td>
<td>Provision of lab access &amp; expertise in partnership with private funders</td>
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Notable policy design choices

- Start-ups can choose between grants or equity investment. If they choose grants, IRESEN is entitled to 1.5% of resulting annual revenue.
- Each finalist received a stipend for three years to help them devote time to launching the business.
- Creation of a cohort of founders facing similar issues (peer-to-peer support).
- The prize targets early-stage innovators that can benefit as much from the publicity generated by the Germany Energy Agency as from the cash reward.
- The annual prize cycle is structured as a means of connecting start-ups with investors, policymakers and the public imagination.
- Winners get vouchers for national laboratory support.
- DOE departments sponsor technology-specific editions.
- Has developed an international network of accessible test beds in different industries.
- Hosts start-ups from government programmes in other countries.
- Aims to provide a one-stop-shop for start-ups navigating the different types of support available, including grants and debt.
- Start-ups can apply at any time and get an account manager to support them.
- The public funding is provided to a third party that has the flexibility to regularly adjust its offering, operate internationally and co-fund elements using other funds or in-kind support.
- As in other initiatives, the programme length is designed to accommodate longer hardware development cycles.

Partnership between government, a major energy company and a not-for-profit.
International outlook with engagement in Mission Innovation.
Eight insights for effective policy

1. Maximise what you already have, including public infrastructure, expertise and networks
2. Take a global outlook
3. Channel the right money at the right time
4. Support peer-to-peer networking
5. Publicise innovators and raise awareness
6. Focus resources on priority technologies
7. Establish milestones and provide regular feedback
8. Offer one-stop-shops for multiple support measures
How Governments Support Clean Energy Start-ups

Insights from selected approaches around the world

Analysis in this presentation was made possible through the Clean Energy Transitions in Emerging Economies programme, which has received funding from the European Union’s Horizon 2020 research and innovation programme (grant agreement No 952363.)
Energy Systems Catapult

Dr Richard Dobson, Practice Manager

21 March 2022
Delivering a Digitalised Energy System

Energy Digitalisation Taskforce report
Dr Richard Dobson

An independent report sponsored by

[Logos of Department for Business, Energy & Industrial Strategy, Ofgem, UKRI, Innovate UK]
Data & Digitalisation are not just enablers, they are drivers of transformative change.
Aims and Approach of the Taskforce

- Digitalisation is a core component of transformation, not just an enabler
- Accelerate decarbonisation of the energy system, enabling Net Zero compatible business models, markets, and industry structures
- Draw on experience from other sectors and provide a focal point to ensure digitalisation efforts are coordinated and effective
- Identify digitalisation gaps that require innovation support
- Identify the governance risks that digitalisation raises and present frameworks to mitigate issues.

Guiding Principles

- Customer Trust and Satisfaction
- Decarbonisation and Flexibility
- Policy and Regulation fit for future system design
- Thinnest layer of central intervention possible
- Act now
Whole system ambitions and requirements

**Prices to Devices**
Automated communication & contracting to optimise system needs, carbon & cost. Enabling value to flow through the system.

**Automated & Optimised System Stability & Resilience**
Digitalised system management operated at central, regional, local or building level.
Getting the plumbing right

Tower Of Babel

- Disjointed
- Uncoordinated
- Inefficient & expensive
- Monopolies

Driving Net Zero

Consumer Protection

Data driven
- Secure and Stable

Consumer Centred
- Interoperable
- Optimised

Innovation Led
Unlock the value of consumers actions and assets
- **Customer consent dashboard** Customer control and acceptance is crucial to build trust and deliver appropriate consumer protection
- **Mandate smart energy assets** Unlocking flexibility by ensuring customer energy assets are connected and smart

Deliver Interoperability
- **The Digital Spine** Distributed systems monitoring to enable whole system interoperability and operation

Implement new digital governance and entities
- **Digital delivery body** Delivering public interest assets at speed and independent from vested interests

Enable carbon monitoring and accounting
- **Dynamic carbon monitoring and reporting** Carbon visibility is critical to future policies and informing consumer actions
Unlock value of customer actions & assets

Government and the Regulator need to create policy, regulation, and digital infrastructure which enables industry to deliver the trust and assurance to unlock the value of customer actions and assets.

**Actions**

- Develop a simple customer consent dashboard
- Mandate smart enabled energy assets
- Streamline asset registration
- Review customer protection regime
- Utilise smart meter data for public good
- Recognise data based, virtual solutions

Customer acquires energy asset → Energy asset is auto-registered → Customer gives data access consent → Energy asset provides system services → Data can be used to verify response → Customers are rewarded

Customer’s are protected from negative outcomes, particularly as new products and services are developed
The sector needs to deliver interoperability through the development and deployment of key Public Interest Digital Assets including a Digital Spine solution.

**Actions**

- Deliver data sharing fabric
- Adopt network data standard
- Deliver energy asset register
- Deliver energy data catalogue
- Evolve flexible asset standards
- Deliver a digital spine for the system

Limited interventions to aid interoperability and create commercial opportunities

Customer Centred

Open Source and Open Data
Develop a common digital spine for the energy system that enables mission critical information to flow seamlessly to support the operation of a distributed and decarbonised energy system.

**Features**

- **Deliver Interoperability**
- **The Digital Spine**
- **Create options for the future system**
- **Create commercial opportunities**
- **Enable core digital functions**

Inspired by cloud scale technology providers, distributed energy systems leaders and government technology innovators such as GDS and HMRC.
Digital Governance needs to be embedded as business as usual with a new Energy Digitalisation Delivery Body to develop the Public Interest Digital Assets and support sector-wide Digitalisation.

**Actions**

- Establish governance principles for Public Interest Digital Assets
- Establish Algorithm Governance
- Promote Digital Energy Competition
- Establish a Delivery Body for Public Interest Digital
- Regulate Interdependencies
- Develop a Dynamic Risk Dashboard
- Initiation, Incubation and Transition
- Working with industry stakeholders
- Utilising open approaches
- Time Limited and Mission Driven
- Enabling commercial innovation
Carbon emissions from energy production, storage and delivery need to be measured at source with data reported and shared in a standard format.

**Actions**

- Mandate dynamic carbon reporting
- Mandate dynamic carbon monitoring
- Require separate emissions and offsetting reporting
- Adopt carbon data open standard

**Existing carbon and GHG monitoring**

- Data published aligned with settlement periods
- Additional monitoring of ‘non monitored’ energy assets
- Separate emissions and offsetting reporting
- Adopt open data standard when leader emerges
Improving Digital Security and Digital Leadership

**Adopt digital security measures**

Digital security principles and interventions need to be embedded throughout the sector to collectively enable safe digitalisation at scale.

**Embed a digitalisation culture**

A digitalisation culture needs to be embedded throughout the energy sector by promoting digital leadership, valuing digital assets, and focusing on whole system user experience.

**Actions**

- Implement modern password policies and merit order patching
- Map cascade effects of system security zones
- Increase frequency of penetration testing
- Adopt zero trust and least privilege
- Work towards a “Just Culture”
- Run drills and threat assessment exercises
- Leverage cross-sector collaboration

**Actions**

- Promote Digital Leadership
- Value and Investment in Digitalisation
- Focus on whole system user experience
Thank you

For more information contact us at:
digitalisation@es.catapult.org.uk
Recurve
Carmen Best, VP of Policy & Emerging Markets
21 March 2022
We provide a revenue-grade open-source platform that empowers planning, procurement, and the deployment of Demand Flexibility as Virtual Power Plants.

We promote the following no-regrets policies to enable a distributed clean energy future:

- Data & Digitization
- Open-Source Quantification
- Performance Payment
- Competitive Procurement
The Demand FLEXmarket is an **Open Pay-For-Performance Marketplace** in which Aggregators (Trade Allies / Contractors) receive **incentive payments** for saving end customers energy *at the meter.*
Demand FLEXmarket
Flexibility Platform as a Service

Utility

Energy Efficiency Market

➔ Utilities Pay for Delivered Flexibility at the Rate that is Cost-Effective Based on Time and Locational Price

Carmen Best <carmen@recurve.com>
Demand FLEXmarket webpage.
Splight Artificial Energy

Dario Febre, Growth Owner

21 March 2022
Artificial Intelligence & Power Sector:
Unlocking the Physical World with the Power of AI

March 21st 2022
We are Slight, an AI-COMPANY.

Our neural network framework deploys AI-Solutions at the speed of light.

AI-Solutions accelerate energy transitions at a fraction of the cost.
Traditional System

**CENTRALIZED**
- **PRODUCTION**: Few large power plants
- **TRANSMISSION**: Based on large power lines and pipelines
- **DISTRIBUTION**: Top to bottom
- **CONSUMER**: Passive, only paying
- **NETWORK**: Centralized, mostly national

**DECENTRALIZED**
- **PRODUCTION**: Many small power producers
- **TRANSMISSION**: Including small-scale transmission and regional supply compensation
- **DISTRIBUTION**: Both directions
- **CONSUMER**: Active, participating in the system
- **NETWORK**: Decentralized, ignoring boundaries

Phygital Ecosystem

**AI-DRIVEN**

**EXPANDED PRODUCTION** = Production + Consumers

**INTERCONNECTION** = Transmission + Distribution

A complex system that integrates digitalization with the physical world. Enabled by state-of-the-art technologies.

**NETWORK**
Decentralized and powered with blockchain technology, which provides transparency and accountability.
Accelerating Energy Transitions

Impact on pathways to Net-Zero

- **Lowering Costs**
  - AI-Solutions cost a fraction vs. traditional solutions
  - Costs are often overestimated
  - Efficiency refers to the demand side

- **Accelerating Timelines**
  - AI-Solutions can be deployed swiftly
  - Overcomes non-realistic timelines in terms of transmission and overestimation of transmission capacity expansion

- **Maximizing Capacity**
  - Better use of existing capacity by improving operational efficiency. Reduce need for new investments.
  - Operate systems integrating new information to unlock static conditions

- **Managing Complexity**
  - AI can easily manage complex systems
  - Renewables, prosumers and distributed energy
**Creating value for energy stakeholders**

<table>
<thead>
<tr>
<th>Generators and Utilities</th>
<th>Regulators</th>
<th>Consumers</th>
<th>Environment and Society</th>
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</table>
| **Operational benefits** | ● Fostering market transparency and fair market transactions  
● Managing grid complexity  
● Maximizing the efficiency of existing power infrastructure  
● Enhancing cybersecurity  
● Increasing number of market players | ● Facilitating lower energy prices  
● Enhancing energy reliability  
● Increasing access to renewable energy  
● Facilitating prosumers' integration | ● Accelerating energy transitions at a fraction of the cost  
● Leveraging renewable energy sources  
● Lowering the need for new infrastructure  
● Optimizing existing power infrastructure  
● Lengthening energy assets’ lifecycle  
● Promoting sustainable economic growth |
| **Financial benefits** | ● Maximizing efficiency  
● Increasing energy injection  
● Enhancing transmission capacity  
● Boosting grid reliability and safety  
● Lengthening assets' lifecycle  
● Reducing technical losses  
● Facilitating operations  
● Enhancing distributed resources  
● Increasing revenues  
● Lowering O&M costs  
● Decreasing CAPEX  
● Reducing the cost of capital | | |
AI-Solutions
Case Studies
# Case Study - Renewable Generation Curtailment

## The problem
- The symptom

## Underlying Issue
- The disease

## Traditional Solution

## AI-Solutions
- The treatment

<table>
<thead>
<tr>
<th>Curtailment</th>
<th>Impact</th>
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<tbody>
<tr>
<td>Grid security: static assumption of thermal threshold</td>
<td>Revenue</td>
</tr>
<tr>
<td>Grid security: operational restriction (n-1)</td>
<td>Fossil fuel generation</td>
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<tr>
<td>Grid stability: Short Circuit Ratio</td>
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<tr>
<th>Traditional Solution</th>
<th>Impact</th>
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<tr>
<td>Build additional transmission infrastructure</td>
<td>CAPEX</td>
</tr>
<tr>
<td>Build additional transmission infrastructure</td>
<td>OPEX</td>
</tr>
<tr>
<td>Keep fossil fuel power plants running</td>
<td>ROI</td>
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<tr>
<td></td>
<td>Fossil fuel generation</td>
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<tr>
<th>AI-Solutions</th>
<th>Impact</th>
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<tr>
<td>DDO</td>
<td>Revenue</td>
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<tr>
<td>Algorithms using real time data</td>
<td>OPEX</td>
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<tr>
<td>DAS</td>
<td>ROI</td>
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<tr>
<td>Smart decentralized architecture and data-driven tools</td>
<td>Fossil fuel generation</td>
</tr>
<tr>
<td>GDT</td>
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<tr>
<td>Advanced modeling and optimization technology</td>
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</table>
Existing wind farm = 232 MW
New wind farm = 158 MW
Existing transmission line = 220 KV (33 km long)

DDO = no additional transmission infrastructure

**Digital Dispatch Optimizer (DDO) Case Study**

**Infrastructure**
- Existing wind farm = 232 MW
- New wind farm = 158 MW
- Existing transmission line = 220 KV (33 km long)

**Generation (MWh)**

- **+40%** Line capacity

**Operational Outcomes**
- **Transmission capacity** increased by up to 40%, which eliminates the need to build an additional transmission line (i.e. traditional solution).
- Enhanced **reliability and safety** of existing infrastructure.
- Data and forecasting of the system delivered in **real time**.

**Artificial Energy**

- **553 GWh/year**

**Artificial Energy Impact**

- **- USD 13m** (estimate based on market values of USD/Km t-line)
- **+ 16.6 M USD** (estimate based on PPA price of USD 30)
- **+ 90 Ha forest** (estimate based on technical studies)

**Operational Outcomes**

- **Revenue**
- **Deforestation**
Dario Febré - Growth Owner
dario.febre@splight-ae.com

Dario Febré is an international senior executive specialized on Business Development and Strategy with broad experience in the development and implementation of energy solutions. Dario is currently Growth Owner at Splight Artificial Energy, an AI-company devoted to implementing artificial intelligence solutions for the energy sector. Dario worked for more than 16 years at ENGIE holding various managerial positions throughout Latin America, US and France.

Dario holds a Master in Business Administration from Universidad Torcuato Di Tella, a Master in Energy Regulation from Universidad de Buenos Aires and obtained a Chartered Public Accountant degree also from Universidad de Buenos Aires. Dario is an active member of the Institute of the Americas, the French-Argentine Chamber of Commerce, the Argentine Association of Christian Businessmen and the Argentine Council for International Relations.
Sunkofa

Irene Calve Saborit, Chief Executive Officer

21 March 2022
THE FOUNDING TEAM: EXPERTISE IN ENERGY ACCESS

IRENE CALVÉ SABORIT – CEO

ESTEBAN PEREZ GONZALEZ – CTO

ANTOINE VEYRE – CFO

GUILLAUME VAN DER SCHUEREN – Strategic advisor

JUAN GARCIA MONTES – Strategic advisor

- Total cumulated expertise in energy access: **35 years**
- Covered in the African continent: **25 countries**
- Working together as a team: **3 years**
- Installed/deployed/operated for the past 15 years in Africa: **+100 mini-grids**
- Deployed for the past 15 years in Africa: **55 000 SHS**
- Developed for off-grid PAYGO client management: **3 platforms**
- Raised in grants and 8 MUSD in equity: **3.5 MUSD**
PROVIDING ENERGY SERVICES THANKS TO MINI-GRIDS

GENERATION SOLUTION
PV modules
Batteries
Power Electronics
100% Clean Energy

DISTRIBUTION GRID
Low Voltage
Alternating current (AC)
Aligned with national standards

4 ALL CLIENTS
Residential services
Tertiary services
Industrial services

OFFER FOR 100% OF THE VILLAGE
For each customer, a 100% renewable solution is proposed

PAYGO TECHNOLOGY
Smart metering
Payments via mobile money
Digital platform for client management and data analytics
COMMERCIAL OFFER BRIDGING MINIGRIDS AND SOLAR HOME SYSTEM, WITH A SOLUTION FOR EACH TYPE OF CLIENT

Residential clients, communities & small businesses

Daily allowance
Electricity sold as a service in bundle offers, adapted to the different customer segments

Appliances on DC
On a lease basis included in the bundle allowing energy efficiency & a smooth transition from SHS to a mini-grid connection

Energy service offer
Bundling appliances and electricity together

Industrial clients

Capacity pricing
Monthly fee based on contracted power

Energy pricing
Based on consumption

Productive appliances
On lease to own or lease basis via Sunkofa or partners

Using Mobile money and PAYGO technology
Removing cash related and un-payments risks

Technical AC/DC design
Allowing use of same appliances for SHS and MGs, increasing energy efficiency and safety
FOCUS ON WEST AFRICA AND HIGH MARKET POTENTIAL COUNTRIES WITH LOW COMPETITION

Special focus on French speaking African countries and Portuguese speaking countries due to, the willingness to develop MGs, the appropriate specific existing regulation for MGs and the Sunkofa’s team French/Portuguese speaking competitive advantage.

**Legend**

- **Tier 1 countries**
- **Tier 2 countries**

**Benin:**
40 mini-grids awarded under the OCEF program.

**Zambia:**
21 mini-grids awarded under IAEREP program.

**Mozambique:**
Pre-qualified for Brilho program
Pre-qualified for BGFA program.
SUNKOFA’S POSITIONING: DEVELOPMENT, IN HOUSE OPERATIONS, CUSTOMER MANAGEMENT AND DEMAND STIMULATION

**FOCUS**

- Village selection
- Technical design
- EPC
- Operations

Can be done by Sunkofa or externalized under control of Sunkofa

A mini-grid is a long-term investment

Value creation is driven by increase of ARPU* during the lifetime of the project

Budget dedicated to energy expenses is limited and an increase of electricity services usage will only be possible if the ability to pay of the clients increase.

Productive usages and trading bring new revenue streams in the village

New productive services

The village becomes a development pole

Ability to pay for electricity increased

*ARPU: Average revenue per user
Sunkofa Energy is providing clean renewable energy (SDG13) in non-electrified rural areas (SDG 7-10), powering water sanitation facilities, schools & health centers (SDG3-4-6), empowering women as employees of the company and in the villages as entrepreneurs (SDG5) and focusing on productive usages enabling the socio-economic development of the village (SDG8).
THANK YOU
EIA University, Transactive Energy Colombia Initiative

Santiago Ortega Arango, professor at EIA University and senior researcher at Transactive Energy Colombia Initiative
21 March 2022
Transactive Energy Colombia Initiative

Digital Energy Models in Latin America.
Case Studies in Medellín, Colombia.

Santiago Ortega Arango
Transactive Energy Colombia Initiative

Objective

Develop an evidence base for new user-centred energy models in the Colombian context

- Technical and Industrial Development
- Academic Research
- Partnership and Cooperation
- Outreach

Universidad EIA

- One of Colombia’s Top Engineering Schools
- 2000 students
- Located in Medellín, Colombia. Medellin in a major Latin America Energy Hub
  - EnergEIA: A research group focusing on the opportunities for energy prosumers to become active agents of the system
Medellín P2P energy trading pilot

1 Community centre: Casa Kolacho
- Virtual microgrid
- 12 residential participants
- 1 community centre
- Digital energy exchange platform

6 mid to high-strata consumers
3 higher-strata prosumers
3 lower-strata prosumers

CONSUMERS ENERGY BILLS REDUCTION
- Consumer 1: 4.34%
- Consumer 2: 5.11%
- Consumer 3: 4.09%
- Consumer 4: 5.52%
- Consumer 5: 5.02%
- Consumer 6: 5.15%

PROSUMERS ENERGY BILLS REDUCTION
- LI Prosumer 1: 13.62%
- LI Prosumer 2: 7.59%
- LI Prosumer 3: 301.43%
- HI Prosumer 1: 5.86%
- HI Prosumer 2: 3.02%
- HI Prosumer 3: 1.04%
- Community Centre: 341.84%

TOTAL ENERGY BILLS REDUCTION: 5.11%

TOTAL SELF-SUFFICIENCY AND SELF-CONSUMPTION INCREASE:
- Self-sufficiency: +18.2%
- Self-consumption: +51.6%
Wirewatt

Joel Garcia Galan, Chief Executive Officer

21 March 2022
Frictionless Financing for Clean Energy Upgrades in Mexico
ENERGY in Mexico is super expensive

<table>
<thead>
<tr>
<th></th>
<th>Mexico</th>
<th>Texas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Price</td>
<td>$0.25 / kWh</td>
<td>$0.10 / kWh</td>
</tr>
<tr>
<td>Installed Solar</td>
<td>$1.00 / watt</td>
<td>$2.90 / watt</td>
</tr>
<tr>
<td>Loan Interest Rate</td>
<td>24%</td>
<td>0.99%</td>
</tr>
</tbody>
</table>

Source: SunPower, 2021
Accessed: Mar, 2021
*Example of a 4kW system for a home consuming 900 kWh per month
Wirewatt provides frictionless financing for clean energy upgrades to homeowners and SMEs

We raise and manage funds from capital providers and deploy them through our platform used by solar and home improvement contractors

Capital Providers
- Too much friction with banks
- Heavy underwriting
- Large scale needed

Contractors
- Low volume of projects
- Small balance sheets
- Unable to access debt
- Growing market of green contractors

Homeowners and SMEs
- No cash for projects
- Want to transition into clean energy
- Projects save them money on day 1
Our platform helps contractors remove customer friction and sell more

- **Point-of-sale app**
- **15-min credit decision**
- **Multiple payment options**
- **48-hour funding**
Wirewatt Snapshot

Nationwide Presence

+1,400
Largest solar contractor network in Mexico

+$5M
Project finance raised in SPVs

+30
Cities with Wirewatt presence
Leading net-zero energy company in rural Asia and Africa

March 2022
Who we are

Positioned to impact 10 million people by powering households and businesses 24×7×365 with clean electricity

- Raised Series C equity of $25 Million and closing low cost debt of $22 Million

- Design, build, and operate mini-grids using renewable power. Monetized 15,000+ tons of CO₂ credits

- Most experienced minigrid operator with 12 years of experience with over 130 minigrids portfolio under mgmt. in India and Nigeria

- Highest ARPU and lowest LCOE in the sector ensure an IRR of 20%+ across 130 minigrids portfolio
What we do – sell lifestyle and productive use appliances to shape the demand curve

Husk has monetized the entire rural energy value chain

Husk 4th Gen Hybrid Minigrid

Husk EPC Business builds minigrids, solar C&I rooftop and solar water irrigation pumps

Husk 4th Gen Hybrid Minigrid
• Cloud-based IoT management of solar, biomass and battery

Right customer mix for high Electricity Sales
• Majority from businesses, factories & institutions

Husk-owned enterprises for 70%+ CUF
• Excess dispatchable energy during daytime powers motors for cleaning water

Energy efficient appliances Sales
• Sale of home appliances and productive uses appliances helps increase CUF further
Husk demand creation process achieves 50% capacity utilization and ARPU (average revenue per user) at $12 are both 2X Market Benchmark.

### Site Selection Process
- **MSMEs**: 100-200 shops
- **Factories & Institutions**: 10 - 15
- **Households**: 300-800
- **Husk-owned Enterprises**: Water services needed, Irrigation as service, Cold storage needed, Other Energy service

### Customer Demand
- **Characteristic**: The heart & bulk of the demand, key to daytime
- **Daily Profile**: High ARPU anchor demand = high starting CUF
- **Relatively low and lumpy demand**: Dispatchable: daytime excess power providing irrigation, clean water etc.

### Integrated Demand
- Creates high utilization (CUF) and high profitability

- **CUF**: 20% 30% 50% 70%
- **Typical demand**: 24% CUF
- **HUSK Driven Demand**:

### Husk Capacity Utilization Factor (50%) and ARPU (average revenue per user)
Husk Integrated technology stack can manage large portfolio (1000+ site) profitably with 20% ROI

Husk Pipeline Development Process
proprietary, AI-enabled site sourcing and evaluation process

Husk GIS
HUSK* Site scorecard

HUSK site selection algorithm

Husk EPC
ensures lowest Capex and LCOE

HUSK* IoT and Husk* AI Algorithms

Automation ensures lowest Opex thus LCOE

Husk* Demand system ensures high CUF and customer stickiness

HUSK* 4 Demand pillars

HUSK* App

HUSK* Credit facility

Broad IP portfolio of automated processes enables rapid scaling to 1000+ sites