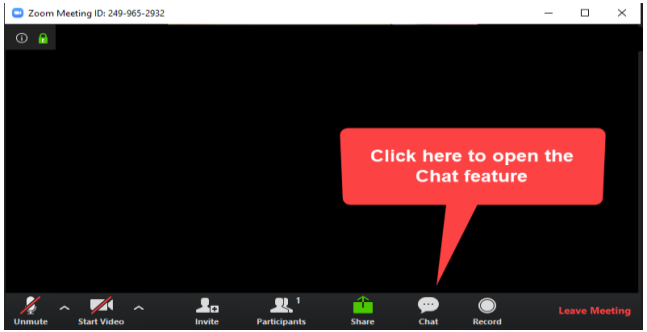
Energy Efficiency Policy and Digital Tools Workshop

23 June 2021 – 14.00-16.00 CET

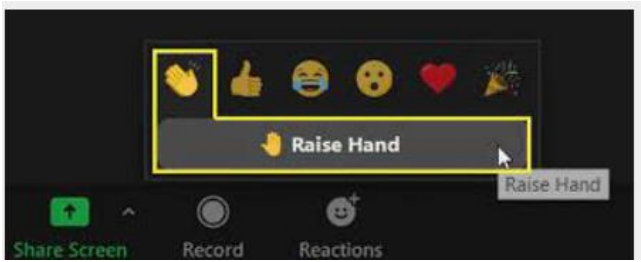
International Energy Agency

Please share your questions and comments with us!

For online audience: please write your questions/comments in English via the chat option:



For Panelists: you can rise your hand using the Reaction option



Workshop Agenda – Wednesday 23 June 2021

14.00-14.10 CET	Introduction	- **Dr Brian Motherway**, Head of Energy Efficiency Division, IEA - **Dr Vik Pant,** Chief Scientist and Chief Science Advisor, Natural Resources Canada
14.10-15.00 CET	Session 1: Digital tools for data driven decision making and policy design	- **Dr Vik Pant**, Chief Scientist and Chief Science Advisor, Natural Resources Canada - **Ms Yujuan Xia**, China National Institute of Standardisation - **Mr Gabriel Prudencio Flaño**, Head of Sustainable Energies Division, Ministry of Energy, Government of Chile - **Ms Rebecca Knights**, Director, Energy Policy and Programs and Department for Energy and Mining, Government of South Australia - **Ms Hanna Grene**, Director of Energy, Americas, Microsoft - **Mr Matt Golden**, Chief Executive Officer, Recurve - Moderator: **Dr Nicholas Howarth**, Energy Policy Analyst, IEA
15.00-15.50 CET	Session 2: Enhancing policy implementation and monitoring with digital tools through improved communication and connectivity	- **Mr Arijit Sengupta**, Director, Bureau of Energy Efficiency, Government of India - **Dr Ashok Sarkar**, Senior Energy Specialist and Task Team Leader – Energy Efficiency Projects, The World Bank Group - **Dr Ronita Bardhan**, Assistant Professor of Sustainability in Built Environment, Leader Sustainable Design Group, University of Cambridge - **Prof Tadj Oreszczyn**, Director, Smart Energy Research Lab, University College London - **Mr Ian Maddock**, Co-Founder and Chief Revenue Officer, MyHeat - **Dr Domenico Palladino,** Energy Efficiency Division, National Agency for New Technologies, Energy and Sustainable Economic Development, Government of Italy - Moderator: **Dr Nicholas Howarth,** Energy Policy Analyst, IEA
15.50-16.00 CET	Summary and next steps: Better Energy Efficiency Policy with Digital Tools	- **Ms Vida Rozite**, Energy Policy Analyst, IEA

Digitalization Across ClimateTech Value Chains

- Built Environment
  - Construction, Fabrication, Assembly
- Heavy Industry
  - Predictive Maintenance, 24/7 Uptime, Green Mining
- Energy
  - Generation, Transmission, Storage, Consumption
- Mobility
  - ZEV, Electric Vehicles, Alternative Fuels
- Buildings
  - Design, Ventilation, Retrofitting
- Land Use & Water
  - Monitoring, Planning, Replenishment
- + many others…

Session 1: Digital tools for data driven decision making and policy design

23 June 2021 – 14.10-15.00 CET

International Energy Agency

Dr Vik Pant, Chief Scientist and Chief Science Advisor, Natural Resources Canada

Case Study: A Grander View

NRCan's ecoENERGY Efficiency for Buildings

Energy Efficient Features Enabled by Digitalization

- Automated natural cooling
- Heating, ventilating, and air conditioning (HVAC) sensors and controls

Energy Efficiency Digital Tools: Energy Modelling

With NRCan's CanQuest energy modelling software, building operation can be simulated for better planning.

Kitchener, Ontario, Canada

Energy Efficiency Policy Key Takeaways

1. Accelerate applications of Digital Technologies
2. Promote a Digital-Driven Culture
3. Develop Strategic Partnerships
4. Establish Governance of Digital solutions

Information Platform for China Energy Labelling Program

Yujuan Xia

China National Institute of Standardization

CEL registration process

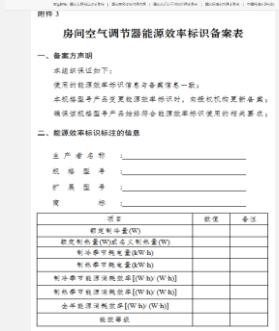
EE testing
obtain a testing report in required format

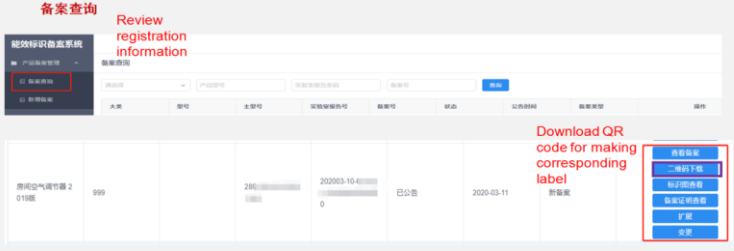
Label registration
upload EE testing report and fill other required information in CEL implementing rules

Generate QR code randomly which can be downloaded by the manufacturer and be used for making and printing a label

After label registration, the registered information are made available to public through CEL website, and the QR code can be scanned using phone, such as using Scanning function of WeChat

产品检测 → 产品能效备案 → 生成二维码供企业下载并制作标识 → 标识信息公告 扫描二维码查询产品备案信息





Information needed for CEL registration

CEL implementing rules for products

产品能源效率标识实施规则的主要内容包括：(Main content)

1、制定依据和适用范围 Products scope

2、标识的样式和规格 Label content, appearance and specification

3、能源效率检测 EE testing

4、标识信息的确定 Determination of label information especially the EE grade

5、标识的印制、加施和展示 How to print, stick and display label

6、标识的备案 Label registration

7、标识的公告 Label announcement

8、附则 Attachment

附件1：标识样式和规格 Label template with detailed sizes

附件2：能源效率检测报告 EE testing report

附件3：能源效率标识备案表 CEL registration form

Label template — Room air conditioner for example

Background: Blue and White

Length: 109 mm， width: 66 mm

Information required for Heat pump ACs：

（1）Name of Manufacturer；
（2）Model；
（3）EE grade；
（4）Annual performance factor [(W·h)/ (W·h)]；
（5）Rated cooling capacity (W)；
（6）Rated heating capacity (W)；
（7） Cooling seasonal power consumption(kW·h)；
（8） Heating seasonal power consumption(kW·h)；
（9）No. of EE standard;
（10）QR code;

Information required for registration — more than those displayed on label and means more possibilities

Air conditioner

Information on Energy Efficiency Label			
1	Manufacturer		
2	Spec. & Model		
3	Ext. Model		
4	Trademark		
5	Rated cooling capacity(W)	Rated value	Measured value
6	Rated heating capacity(W)	Rated value	Measured value
7	Nominal heating capacity (W)	Rated value	Measured value
8	Cooling seasonal total energy (kW·h)	Rated value	Measured value
9	Heating seasonal total energy(kW·h)	Rated value	Measured value
10	Cooling seasonal energy efficiency ratio[(W·h)/ (W·h)]	Rated value	Measured value
11	Heating seasonal performance factor[(W·h)/ (W·h)]	Rated value	Measured value
12	Annual performance factor [(W·h)/ (W·h)]	Rated value	Measured value
13	Energy efficiency grade		

Information required for registration — more than those displayed on label and means more possibilities

Air conditioner

Date of First Use of Label		
14	This energy efficiency label is used from MM/DD/YYYY.	
Sample Description		
15	Product category	□ Revolution-fixed cooling only air conditioner □ Revolution-fixed heat-pump air conditioner □ Revolution-adjustable cooling only air conditioner □ Revolution-adjustable heat-pump air conditioner □ Low ambient temperature air source heat pump air heaters
16	Compressor types	□ AC inverter compressor □ DC speed regulating compressor □ Compressor with controllable capacity □ Others
17	Nature of power supply	□ Three-phase □ Single-phase
18	Structure type	□ Split □ Integral
19	Rated cooling capacity (CC) (W) (Unsuitable for low ambient temperature heat pump air heaters)	□CC≤4500 □4500<CC≤7100 □7100<CC≤14000

Information required for registration — more than those displayed on label and means more possibilities

Air conditioner

20	Nominal heating capacity (HC) (W) (Only required for low ambient temperature heat pump air heaters)	□HC≤4500 □4500<HC≤7100 □7100<HC≤14000
21	Communication protocol functions	□ Sensor □ WIFI □ Bluetooth □ Others
22	Rated voltage (V)	
23	Rated frequency (Hz)	
24	Rated current for cooling (A)	
25	Rated current for heating (A)	
26	Maximum input current (A)	
27	Rated input power for cooling (W)	
28	Rated input power for heating (W)	
29	Maximum input power (W)	
30	Manual control of electrical heater	□Yes □No □ Selected by user with reserved interface for controller
31	Display of electrical heating condition	□Yes □No
32	Input power of electrical heater (W)	
33	Single-pole switch	□Yes □No
34	Switch (all-pole disconnection)	□Yes □No
35	Mechanical thermostats	□Yes □No
36	Control devices in addition to thermostats	□Yes □No
37	Weak parts for protection in abnormal work	□Yes □No

Information required for registration — more than those displayed on label and means more possibilities

Air conditioner

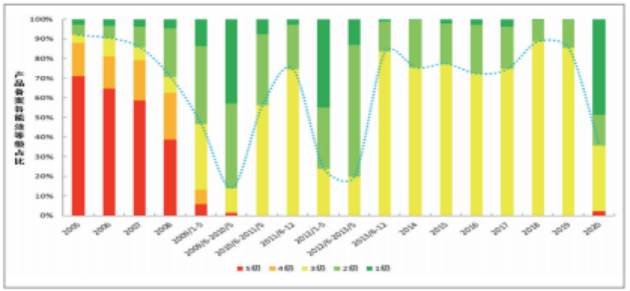
38	Electronic control circuit	□Yes □No	
39	Non-detachable power line	□Yes □No	
40	Separate control panel	□Yes □No	
41	Wander lead controller	□Yes □No	
42	Remote controller	□Yes □No	
43	Refrigerant / Infusion (g)		
44	Dimensions (WxDxH) (mm×mm×mm)	Indoor unit	Outdoor unit
45	Noise dB(A)		
List of Basic Product Configuration			
46	Compressor	Spec. & model / type	
		Cooling capacity (W)	
		Input power (W)	
		COP value	
		Manufacturer (full name)	
Accessories			
47	Extension Application Form		
48	Change Application Form		
49	Front view of product		
50	OEM Statement		
51	Brand Licensing		
52	Manufacturer and Importer Information List		
53	Copies of contracts entered into between manufacturer and importers and foreign manufacturers		
54	Certificate of Relationship		
55	Entrustment documents		
56	Copies of business licenses or registration certificates of manufacturer and importer		
57	Nameplate photo		

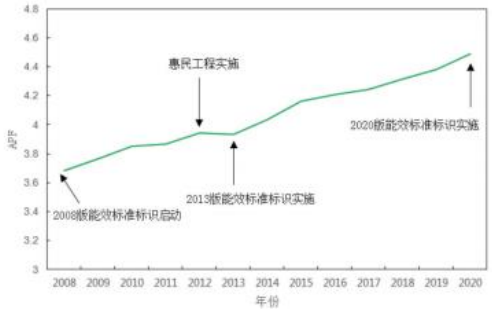
Application of registration database

The information for product models registered can be output in EXCEL format, and statistical analysis can be carried out conveniently to provide information on:

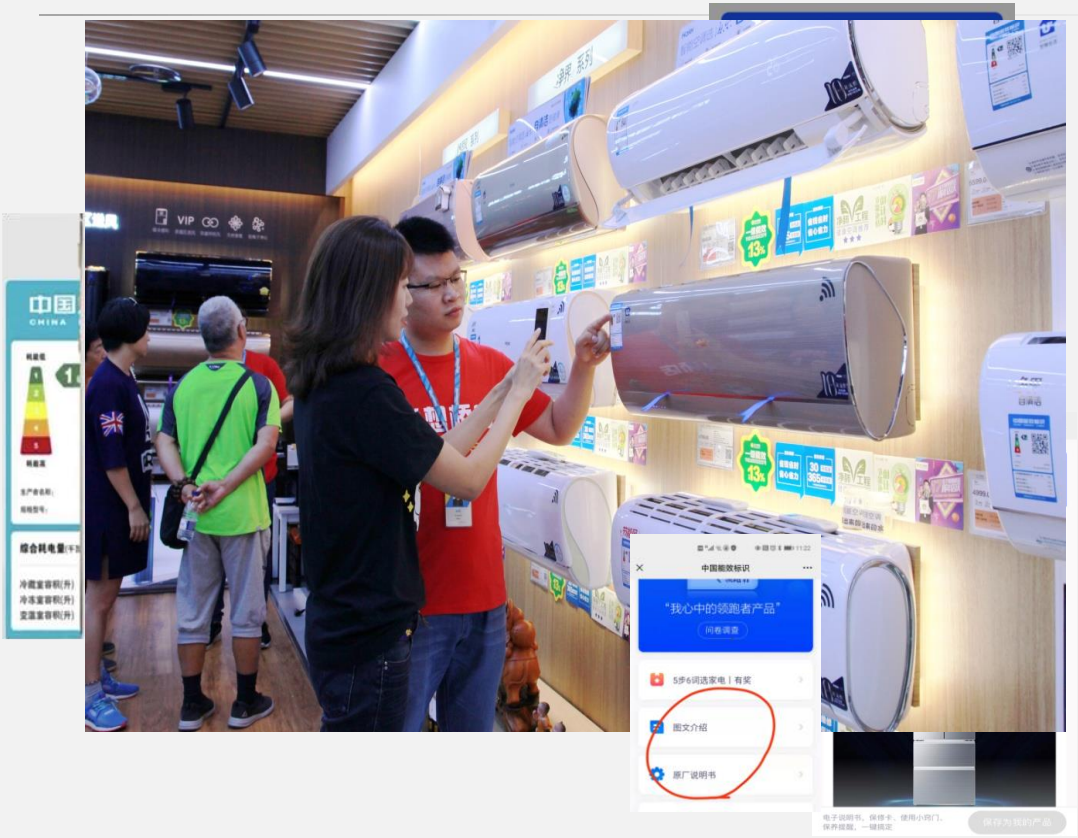
- market share of each EE grade;
- market share of each subcategory for a specific product;
- year-to-year evolution of EE for specific products; etc.

These information can provide reference for policy making and EE standards revision





Application of QR Code



- Allow for providing more information than those included in label, they are not core EE indicator but are important for consumers and market surveillance

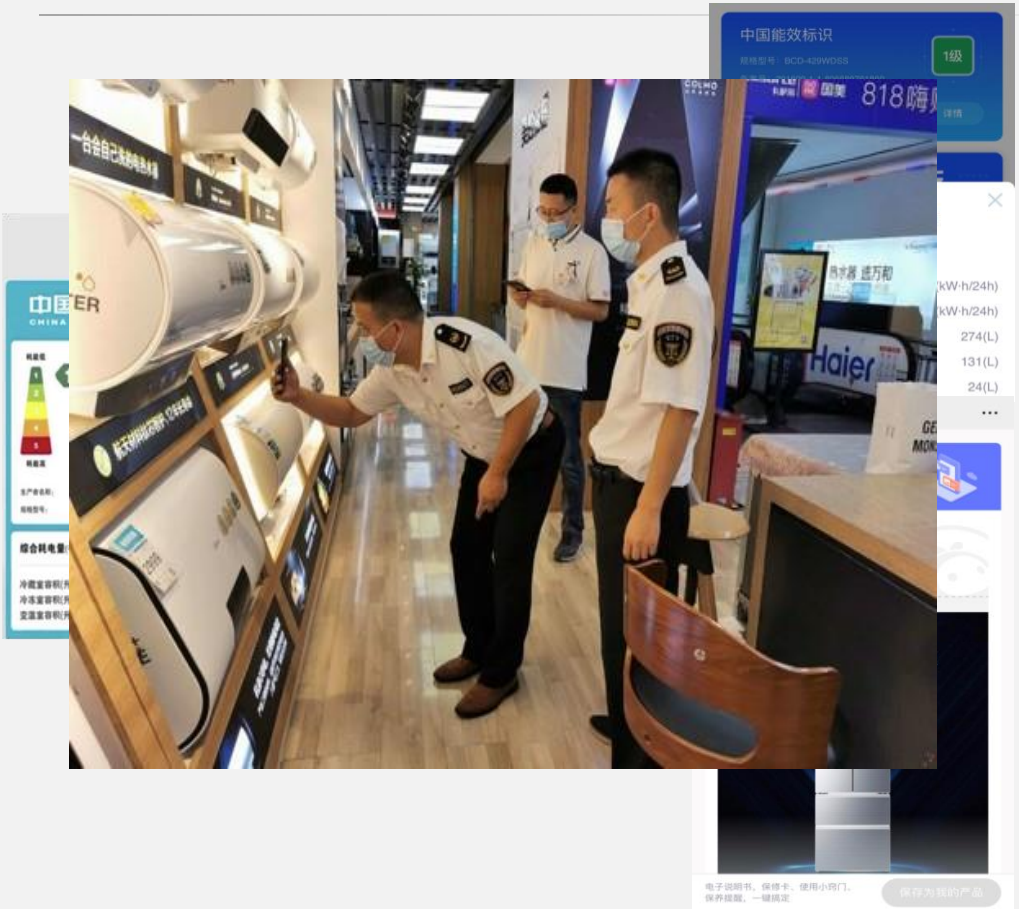
  such as resolution for flat-panel TVs; refrigerant for ACs, refrigerators, etc..

- Allow for further data development to better guide consumers in purchasing

  Such as based on EE parameters and refrigerant information (type and filling quantity), providing information about electricity usage and CO_2 emission based on some assumptions and calculation

- Allow for providing more information about whether the product has got other certification :

Application of QR Code



- **Allow manufacturers to display product manual and guidelines for using appliances:**

Help for users to find the manual conveniently, and may help to save paper resources;

More product information for consumers, help them better understand the target product and save energy during usage.

- **Help for market surveillance**

makes it possible to obtain registered information in real time with smart phone only rather than logging on CEL website with a laptop, help officials to find out whether the product has registered and whether the registered information is consistent with the attached label, etc., which significantly improves the convenience and timeliness of supervision.

中国标准化研究院
CHINA NATIONAL INSTITUTE OF STANDARDIZATION

Thanks for attention!

Website: www.energylabelrecord.com

Digitalization of Energy

June 2021

The 3 pillars of Energy Modernization

Decarbonization

Decentralization

Digitalization

Benefits of Digitization in the energy sector

- **Better and more information** achieves:
  - increase **analytical capacity** and conduct better project and policy evaluations
  - promote the development of **more transparent and competitive** markets
  - **optimize production** processes and reduce costs and make **better projections** of variables

- **Optimization** through performance monitoring that is facilitated in different processes, constituting a key tool for the **energy efficiency** of processes

- **Process automation** is possible (machine learning, AI, robotics) allowing efficiencies

- **Flexibility** by coordinating energy systems that facilitates the development of **renewable energy**

Energy sector faces the big challenge of **moving towards an end-user-centric paradigm**, taking advantage of the opportunities given by digitalization

Study

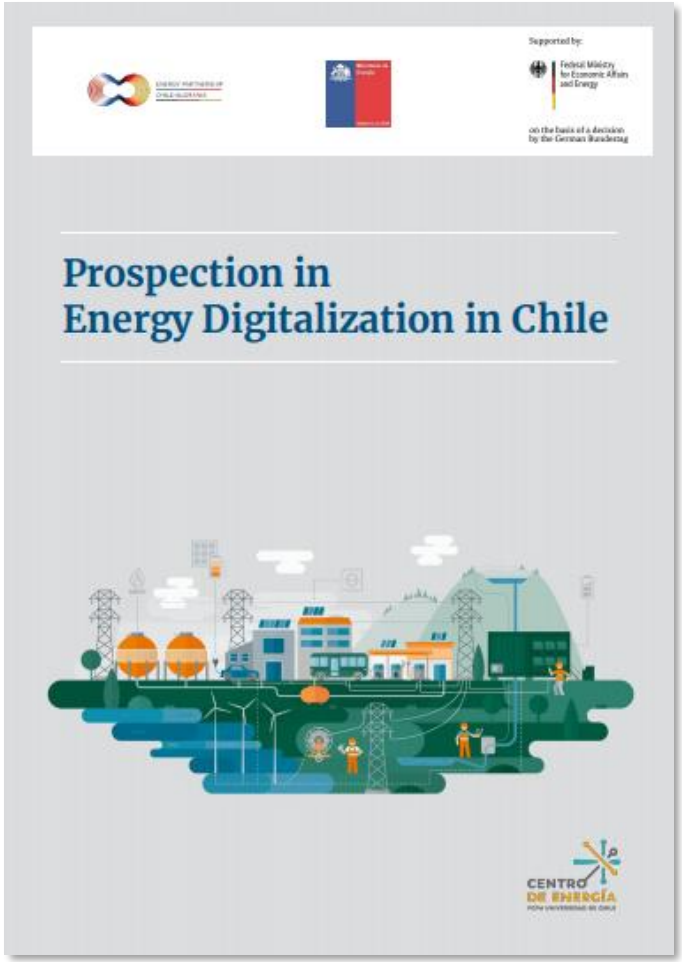
Prospection in Energy Digitalization in Chile

- Study Name:
  Prospection in Energy Digitalization in Chile,
  University of Chile. 2020

- Main Contents:

  I. Review of the national and international state of the art

  II. Analysis of barriers and opportunities



30 digitalization applications in energy

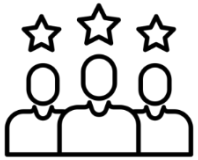
8 categories

Smart Grids

Smart Substation, Feeder automation, Microgrids

Distributed energy resources

Demand Response, Energy Storage, Virtual Power Plant (VPP), Distributed Energy



Clients Domain

Prosumers & P2P, Retailing Billing, Customer orientation

Process Management

Process optimization, Process automation, Emission monitoring

Mobility

Transportation personal use, Public transport, Transport cargo, Shared Mobility

Data Management

Predictive maintenance, Forecasting, Predictive analytics

Smart Cities

Smart traffic, Smart home & building, Smart farm, Smart parking, Smart waste mngmt, Smart fleet mngmt

Others

Market mngmt & operation, Ancillary services, Teleworking

Source: Prospection of Energy Digitalization in Chile, Centro de Energía, U. de Chile, 2020

Enabling technologies for digitization in energy

6 categories

Smart Home/Buildings

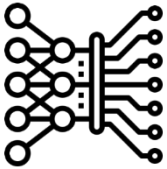
Load Monitor, in home display, smart thermostat, smart light, smart plug/switch, smart appliance, hub

Smart Grids

Smart meters, AMR/AMI, V2G, EV,PHEV, IED, PMU, WAMS

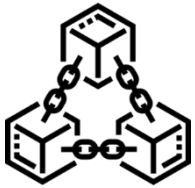
IoT & IoE

Smart sensors, sensor and actuator networks, LAN/HAN/NAN/WAN, Clod, 5G



Big Data, Machine Learning, Artificial Intelligence

Machine learning, data mining, nature inspire intelligence, artificial neural networks, multi-agent systems, clustering, natural language processing, digital twin, autonomous vehicle



Blockchain

Physical Action

Actuators, 3D printers

Barriers and opportunities in digitalization

1 Infrastructure

- Development of enabling technologies are required.
- The use of smart meters is not massified yet.

2 Security

- Protocols for privacy, data sovereignty and information security are needed.

3 Economics

- Implementation and deployment of infrastructure and solutions require public and private investments.
- High investment cost

4 Regulation

- Several applications require a modification or update of the current regulation

5 Capacity Building

- Need of new skills, knowledge and digital education

Source: Prospection of Energy Digitalization in Chile, Centro de Energúa, U. de Chile, 2019

What comes next? Policy recommendations

To take a more active approach:

- Promote **coordination** between the different **institutions**
- **Increase** public investments in digital **infrastructure**, build a robust ICT infrastructure
- Adopt a **common data architecture, tools and standards** and increase the quality, reliability and security of devices and services
- Reduce the **digital gap** between the different **territories** of the country
- Greater investment in **human capital and education**
- **Pilot programs** to promote the use of different digital applications
- Encourage **private investment** in projects associated with digitization

Source: Prospection of Energy Digitalization in Chile, Centro de Energía, U. de Chile, 2020

Learning from a first smart-meters' experience

- The way in which we **communicate** a solution is very important for policy success

- It is necessary for people **to percieve the benefits** of policies

Policy design with participation is key

- We want our **policy to be rooted on people's needs** and address them
- **People** need to be part of the **diagnosis**, as well as on **weighting prospective solutions**
- **People** need to be **part of the implementation** of energy policies:

For policies to be appropriated it is key to integrate actors in the policy design process

End goal of policies and actions:
Enhance people's quality of live and boost sustainable development

Thank you

Gabriel Prudencio
Head of Sustainable Energy Division
gprudencio@minenergia.cl

Ministerio de Energía

Gobierno de Chile

DIGITAL TOOLS FOR ENERGY EFFICIENCY POLCY

A SOUTH AUSTRALIAN VIEW

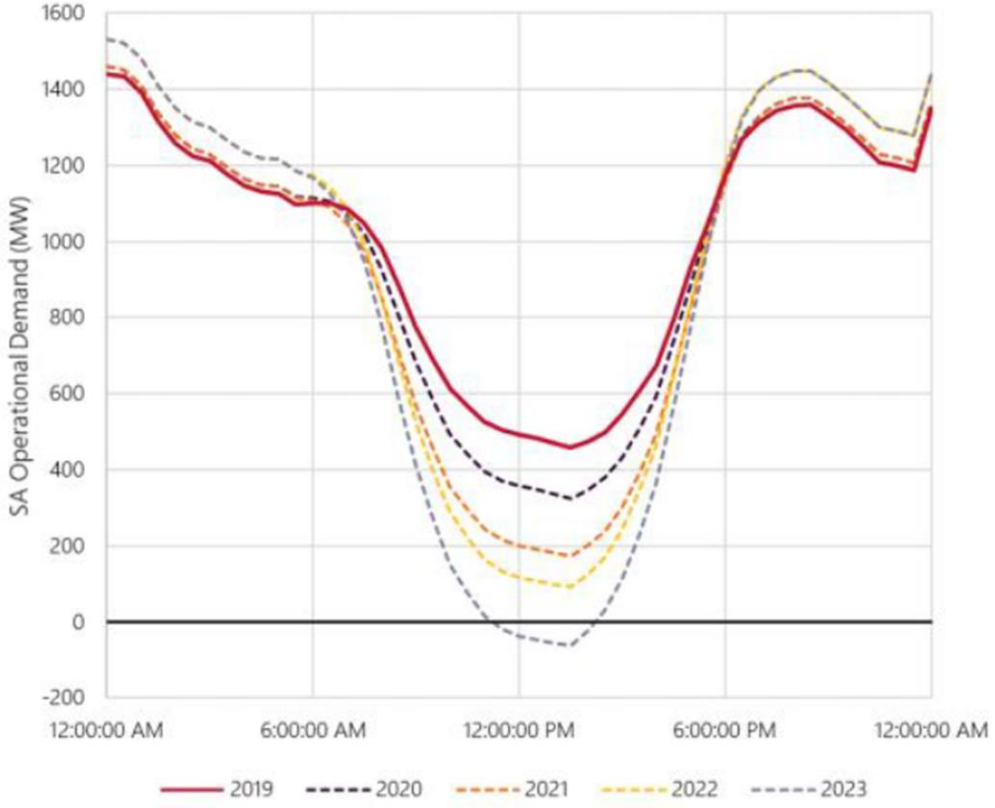
Rebecca Knights
Department for Energy and Mining

SOUTH AUSTRALIA

Government of South Australia
Department for Energy and Mining

CONTEXT: SOUTH AUSTRALIAN SYSTEM DEMAND

Government of South Australia
Department for Energy and Mining



Source: AEMO, Minimum Operational Demands Thresholds in South Australia, May 2020

POLICY DESIGN

Government of South Australia
Department for Energy and Mining

- Digital tools are enabling different policy solutions to energy system challenges

- They offer new opportunities to manage a system with high penetration of renewable energy

  - Agents to remotely disconnect and reconnect rooftop solar in an emergency

  - Household smart meters capable of separating essential supply from non-essential

POLICY DESIGN

Government of South Australia
Department for Energy and Mining

- Digital tools were employed to design the Retailer Energy Efficiency Program
  - AccuRate (CSIRO software tool) simulation to generate hourly profile for heading and cooling for an entire year

- Digital tools were enablers for the program design
  - New activities that relate to when consumers use energy (Virtual power plants, Demand response aggregation)

POLICY IMPLEMENTATION & MONITORING

Government of South Australia
Department for Energy and Mining

- Digital tools are enabling more efficient monitoring and compliance

- Electronic certificates of compliance – electricians certify works is safe and compliant with AS & Regulations
  - Accessible via desktop and mobile devices
  - Facilitates collection of information on DER
  - Provides for desktop audits
  - Timely targeting of compliance activities

Contact

Rebecca Knights
Director, Energy Policy and Programs
Energy and Technical Regulation

Department for Energy and Mining

11 Waymouth Street
Adelaide, South Australia 5000

GPO Box 320
Adelaide, South Australia 5001

E: rebecca.knights@sa.gov.au

SOUTH AUSTRALIA

Government of South Australia
Department for Energy and Mining

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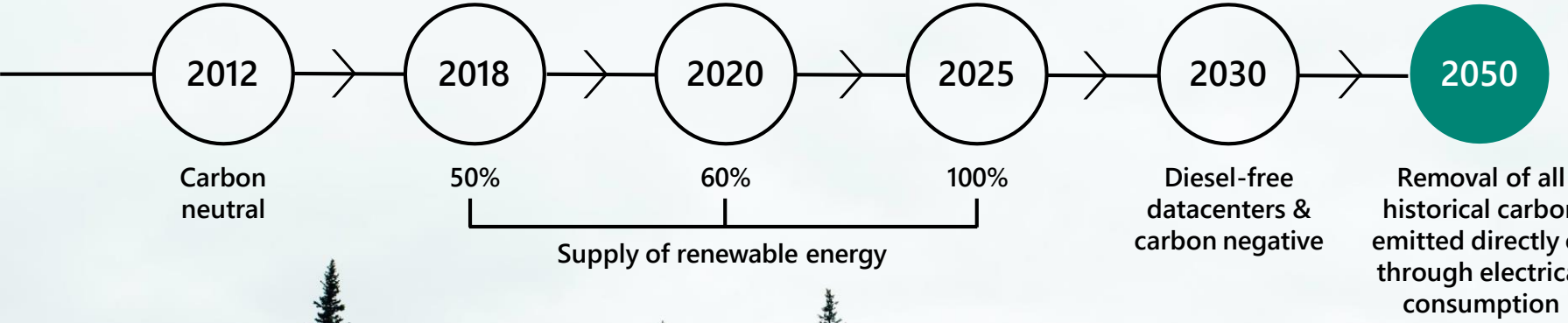
SOUTH AUSTRALIA

Government of South Australia
Department for Energy and Mining

Decarbonizing the grid

Hanna Grene
Director, Energy Industry for the Americas

Microsoft is committed to sustainability



Discussion topics today

- ➔ Microsoft as an energy consumer, partner, and innovator
- ➔ Digitial enablement in policy and market transformation

VATTENFALL

Jointly developed a first-of-its-kind hourly matching (24/7) of renewable energy solution

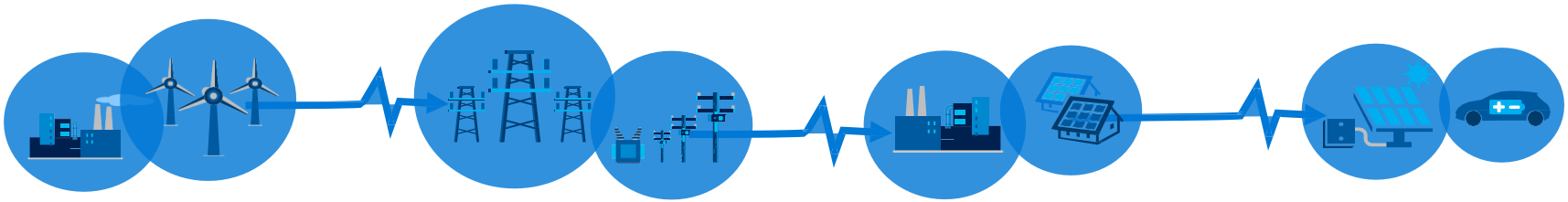
"We are very happy to further develop our relationship with this advanced offering. Microsoft has high renewable ambitions, and this solution shows how new digital solutions and technology can be used to enable fossil free living. The solution gives us possibilities to offer customers specific data and unique precision, that can support them in decisions, environmental efforts and communication."

Andreas Regnell
Senior Vice President, Vattenfall

Australian Energy Simulation Center (AESC)

- Simulation of the entire energy supply
- Integrates data from multiple suppliers and systems of record
- Enhanced forecasting and grid reliability
- Detailed models of wind, solar and battery storage systems
- Simulated grid behaviors to better enhance decision support
- Objective is a one-minute simulation with 3 minutes of processing time
- Enhanced support for environmental mitigation

Power & Utilities Value Chain



Generation

- Sensors & IIoT monitoring
- Renewable integration and markets
- Fuel switching
- Equipment optimization
- Generation optimization
- Carbon capture & storage

Transmission & Distribution

- Drones for monitoring & inspection
- Substation modernization & security
- ADMS, VPP and DERMS
- Distribution automation
- Grid sensors and advanced analytics

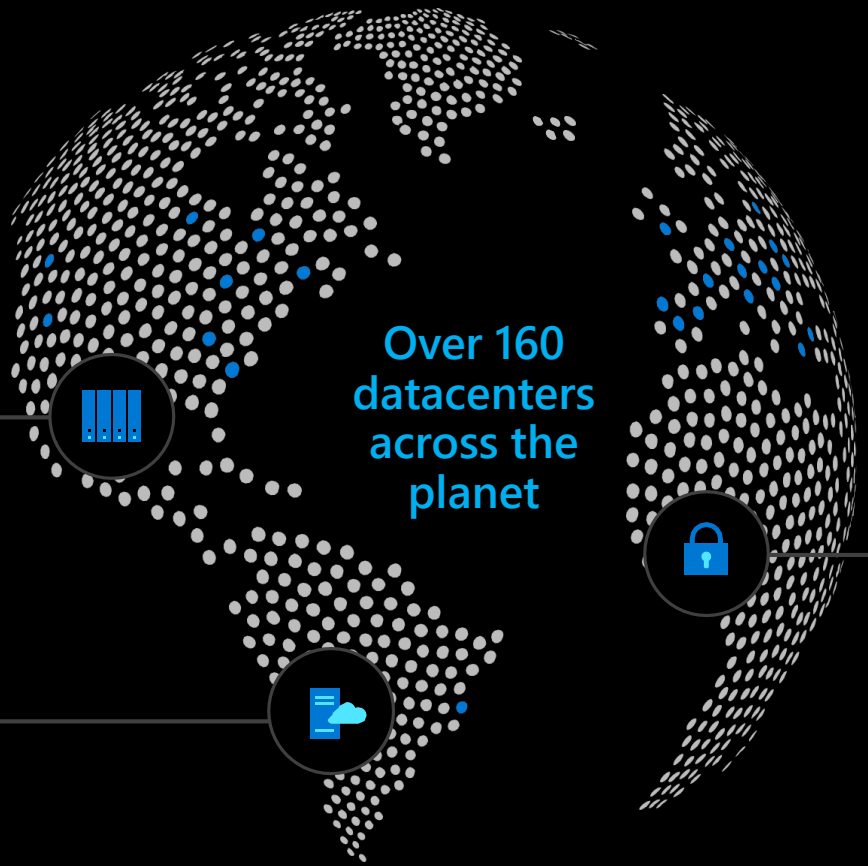
Commercial & Residential

- AMI (smart meter) analytics
- Commercial generation & storage
- Commercial fleet management
- Demand management and load flexibility
- Building to grid integration and management and aggregation

Prosumer

- Energy usage analytics
- Onsite renewables, storage & aggregation
- Smart appliances & energy management
- EV managed charging
- Usage regulation to shift load

Azure represents a secure, global computing foundation



Each **physical datacenter** protected with world-class, multi-layered protection

Global cloud infrastructure with custom hardware and network protection

Over 160 datacenters across the planet

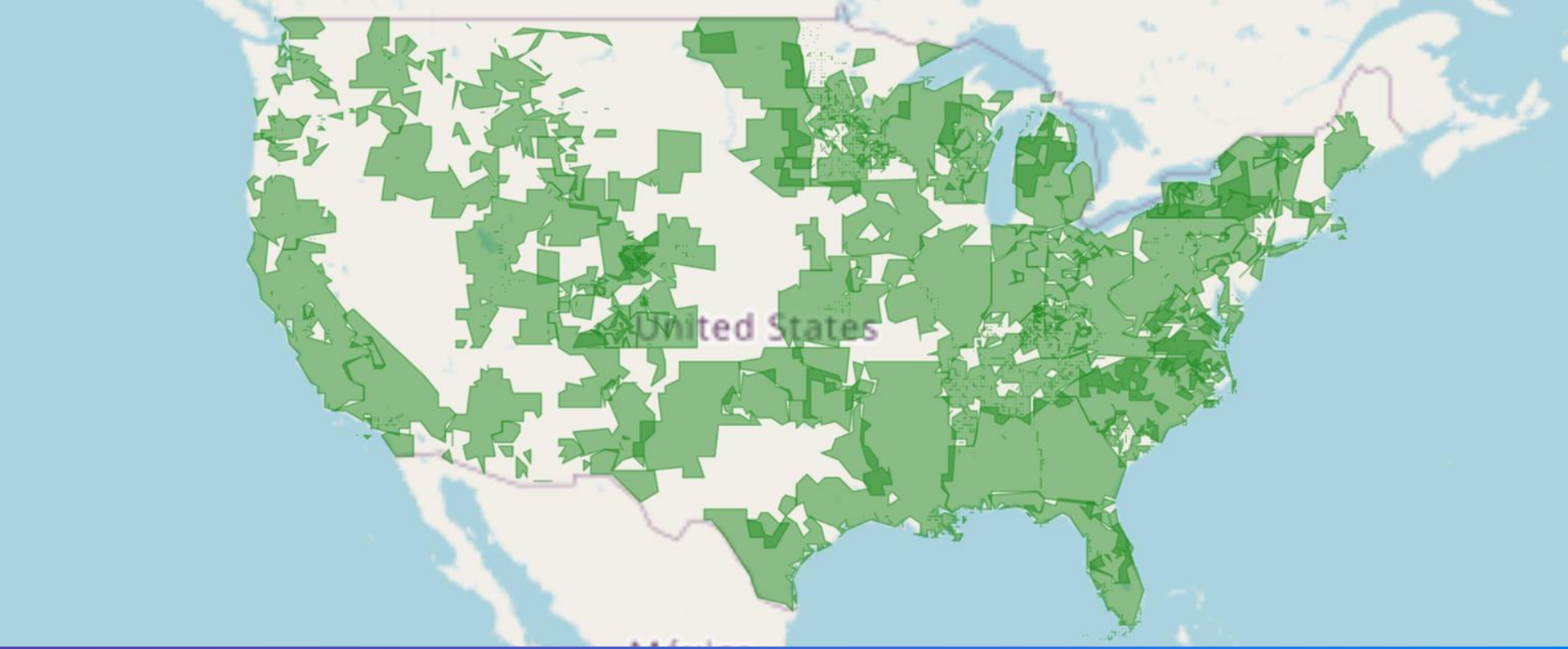
Secured with cutting-edge **operational security**

- Restricted access
- 24x7 monitoring
- Global security experts

61

Azure regions

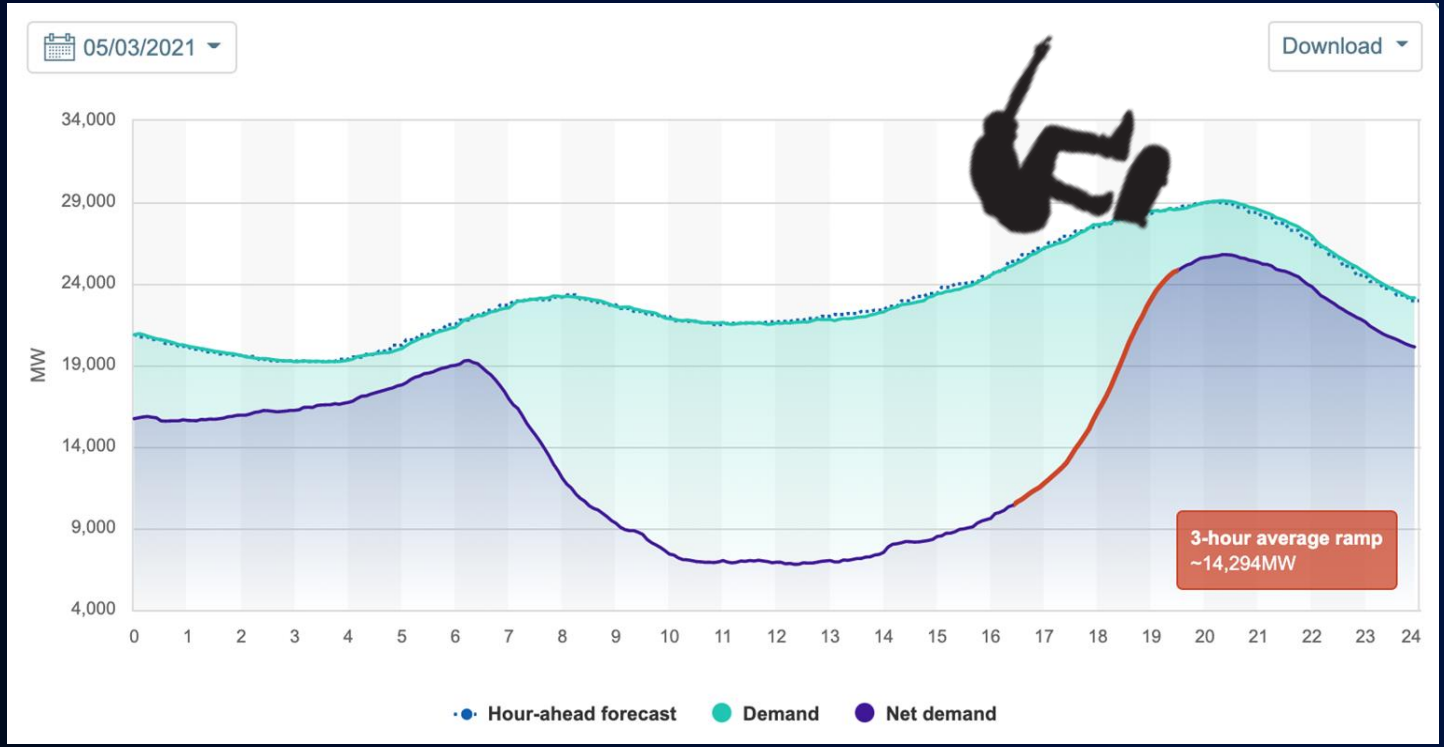

RECURVE
SHAPE THE FUTURE OF ENERGY



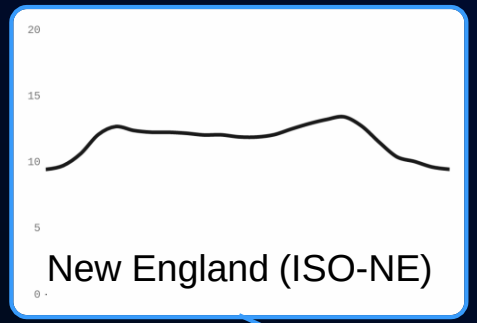
71% of US customers are served by a utility with a **carbon or emission reduction goal**.

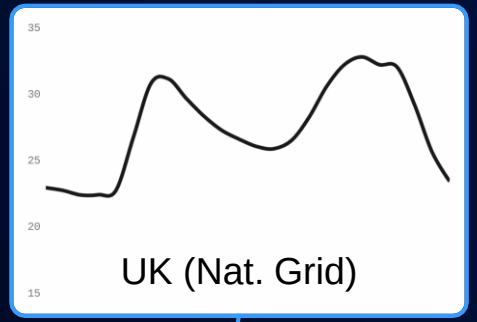
May 3rd 2021 California Duck Curve

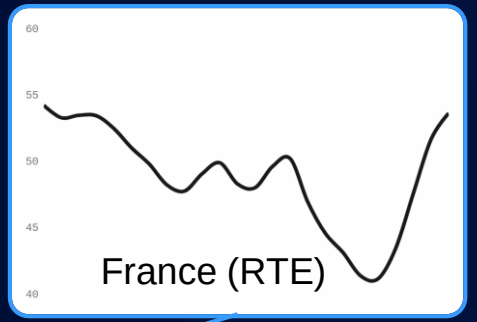
- > 14 GW evening ramp
- 2.5 GWh renewables curtailed

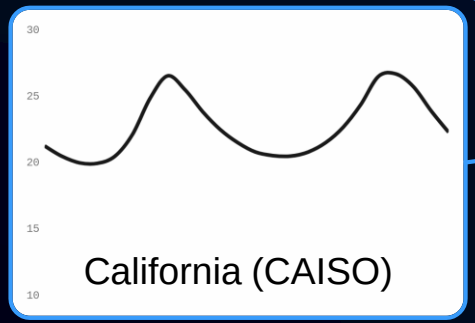


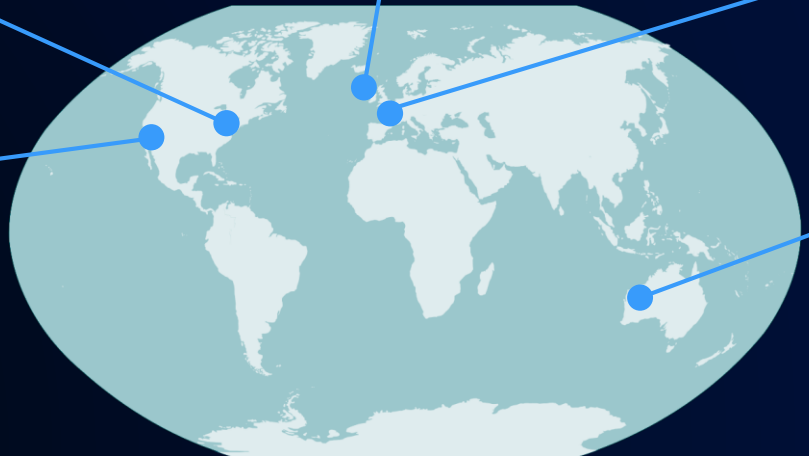
Decarbonization Creates Costly New Load Shapes

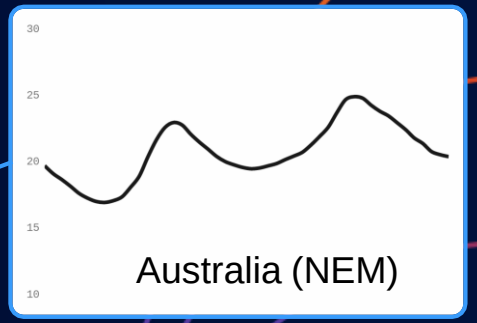








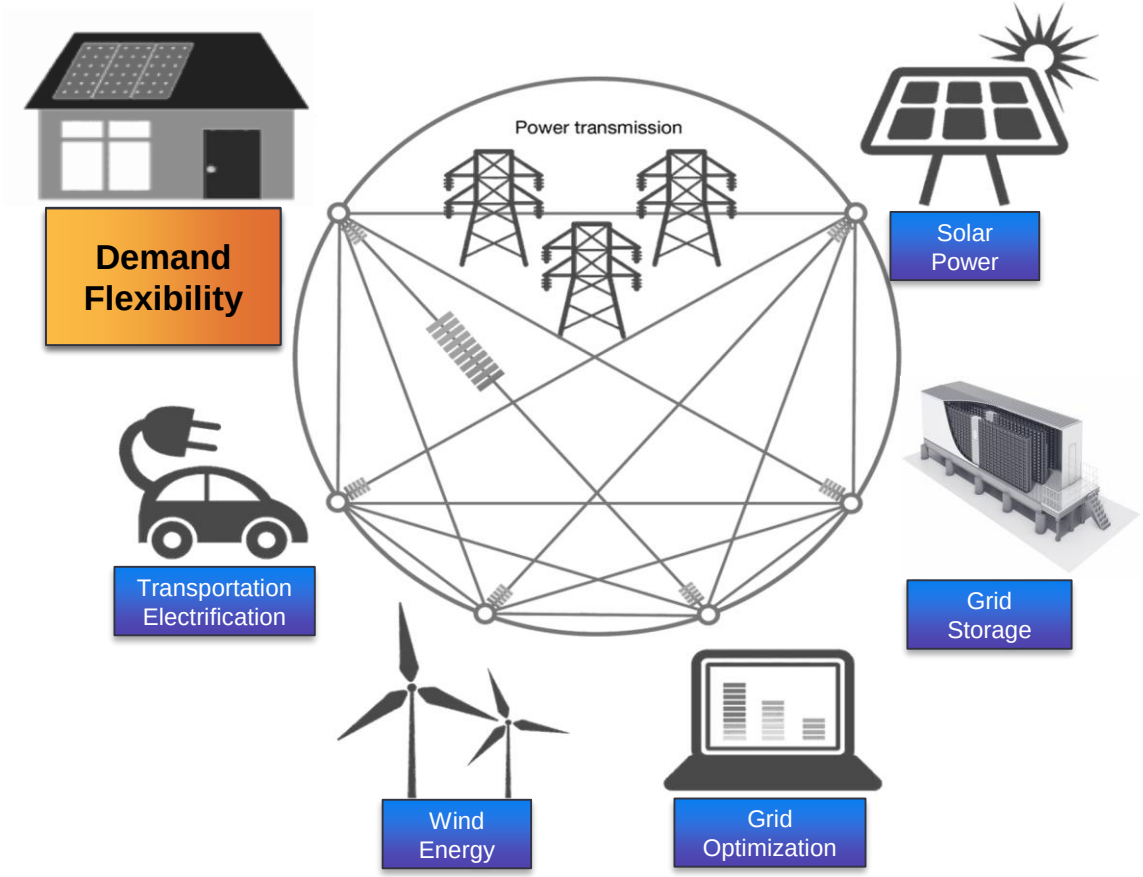




Integrating the Virtual Power Plant

Demand Flexibility

- ➔ Dispatchable
  Storage, Demand Response, EV Charging
- ➔ Predictable
  Energy Efficiency, Solar, Electrification



Open-Source Revenue-Grade Software

- ➔ **Revenue-Grade:** open-source, auditable, reproducible
- ➔ **Verifiable** Standard for demand flexibility calculations
- ➔ **Scalable** to every meter on the grid
- ➔ **Automated** from smart meter data to settlement-quality transaction

CALTRACK

LFENERGY OPENEEMETER

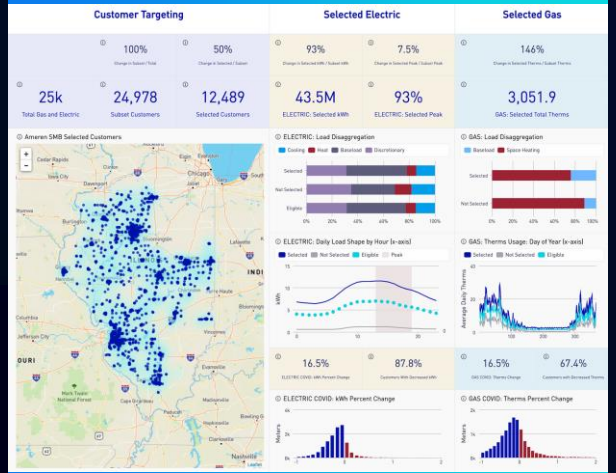
OPEN GRIDMETER

ENERGY DIFFERENTIAL PRIVACY

FLEXVALUE

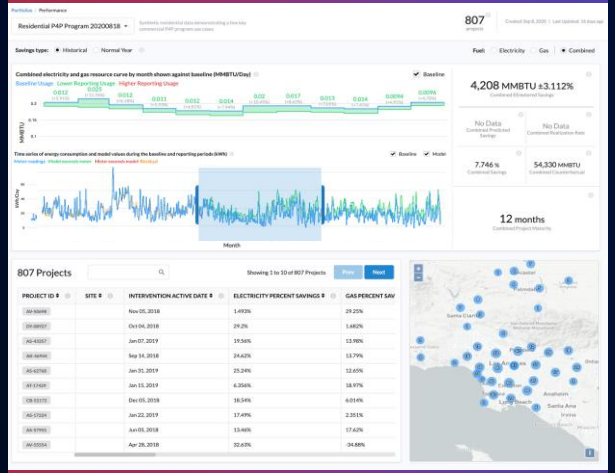
Digitization Is The Platform for Grid Innovation

Resource Planning



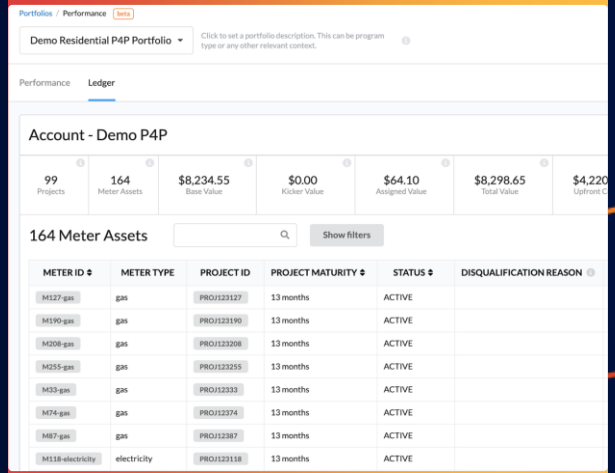
Meter level analytics to identify potential and target customers

Fleet Management



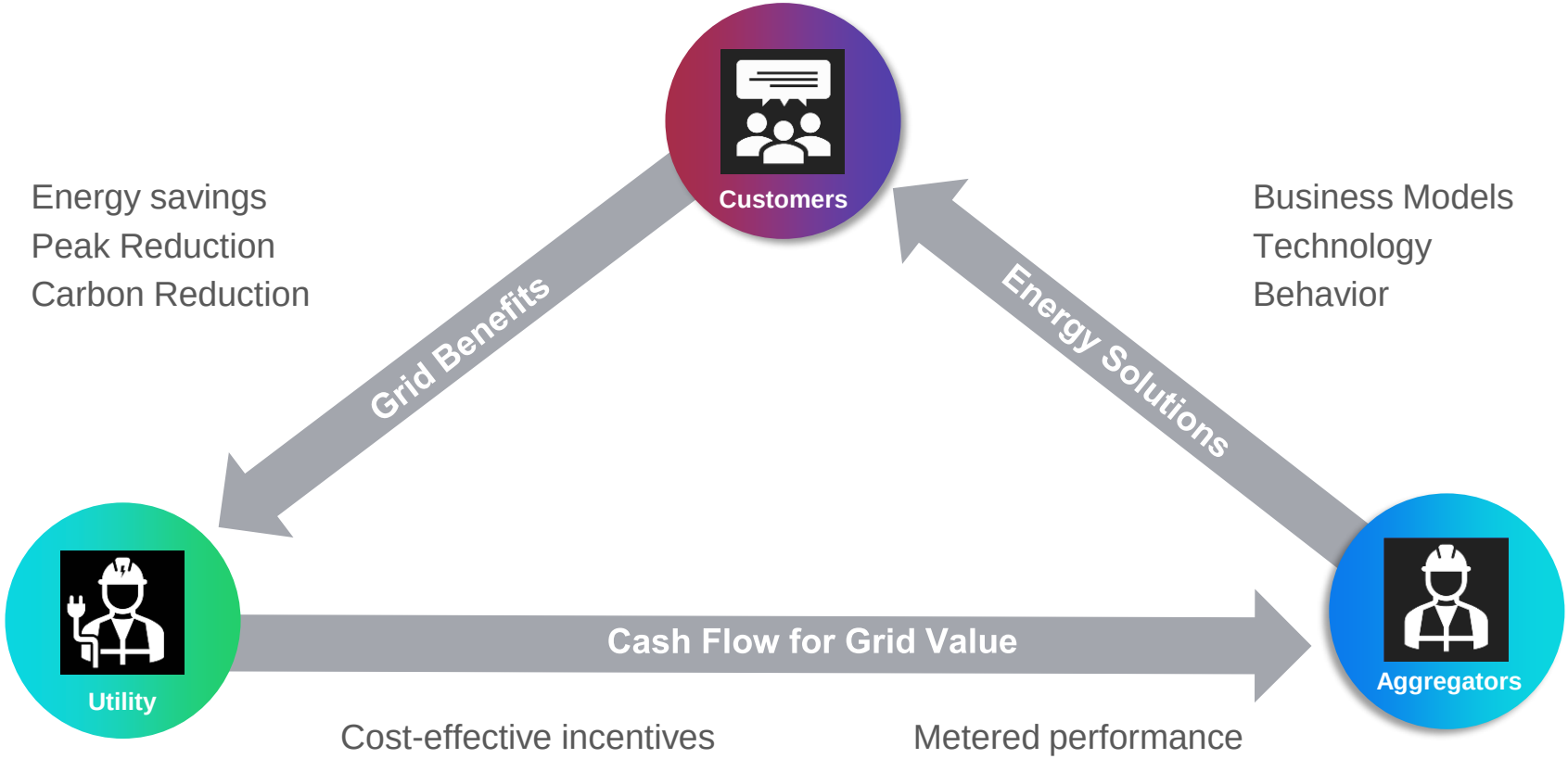
Real-time Asset Level Telemetry to Manage VPP Deployment

Ledger



Revenue-Grade Transactions, Integration, and Reg. Compliance

A Market Platform for Flexibility as a Resource

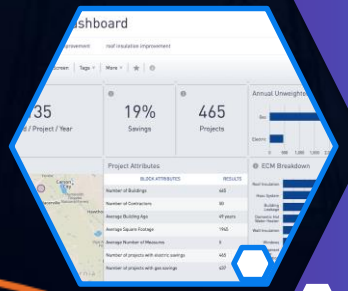


Policy Strategies to Enable Demand Flexibility

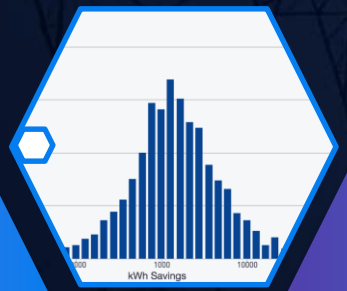
Data Access	Meter-Based Quantification	Performance Payment	Competitive Procurement
✓ Access frameworks are risk-based and include market use cases	✓ Deploy AMI, and require using it for EE/DR/Storage programs	✓ Call for expansion of performance oriented program designs	✓ Adopt technology neutral solicitations
✓ Utilize best practice in security (i.e. differential privacy)	✓ Track changes in consumption for targeting & participants	✓ Define expectations with potential aggregators	✓ Leverage common meter-based outcomes for payment / criteria
✓ Operationalized for scaled application	✓ Adopt definition of “savings” that considers change in consumption	✓ Support market with training, data and instruments to manage risk (like insurance)	✓ Fund all DERs via procurement funding & tied to grid planning (IRP, RA, NWA, or General Rate Cases)

RECURVE

SHAPE THE FUTURE OF ENERGY



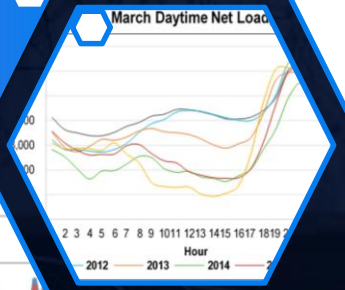
Pay for Performance



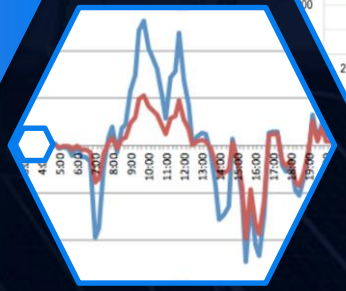
Resource Curve

Demand Flexibility

Procurement



Metered Flexwatt



Matt Golden, CEO

matt@recurve.com

Session 2: Enhancing policy implementation and monitoring through improved connectivity

23 June 2021 – 15.00-15.50 CET

International Energy Agency

IEA Energy Efficiency Policy and Digital Tools Workshop

Session 2: Enhancing policy implementation and monitoring with digital tools through improved communication and connectivity

Wednesday 23 June, 15.00-15.50 CET

Mr Arijit Sengupta
Director,
Bureau of Energy Efficiency

Digitalisation and its importance

- **Digitalization** is the adoption or integration of digital technologies into everyday life by the digitization of everything that can be digitized
- ***Vision of Digital India :*** *a programme to transform India into a digitally empowered society and knowledge economy.*
- Digital technologies are therefore emerging to become integral to 21st century low-emission energy systems as these can play a major role in delivering effective solutions
- Enable policymakers to meet the energy efficiency targets
- They have a huge potential to reshape the consumer perceptions on the services and interactions.

Relevance to appliance energy efficiency

Data collection and management	Sales, stocks, usage patterns, energy use
Tools for data analysis	Trends, policy impact, market changes, energy savings
Product Registration	Transparency, streamlining processes, information for consumers
Monitoring and Compliance	Effectiveness of policy measures, transparency and accountability,
Awareness and Outreach to consumers	Information and education, Access to relevant information for informed decisions, engaging consumers to provide feedback , complaints redressal

India as case study

- Product registration system

  https://beestarlabel.com/Home/Searchcompare

- Information on energy savings and number of appliances in each star rating band for all appliances under labeling program on the website

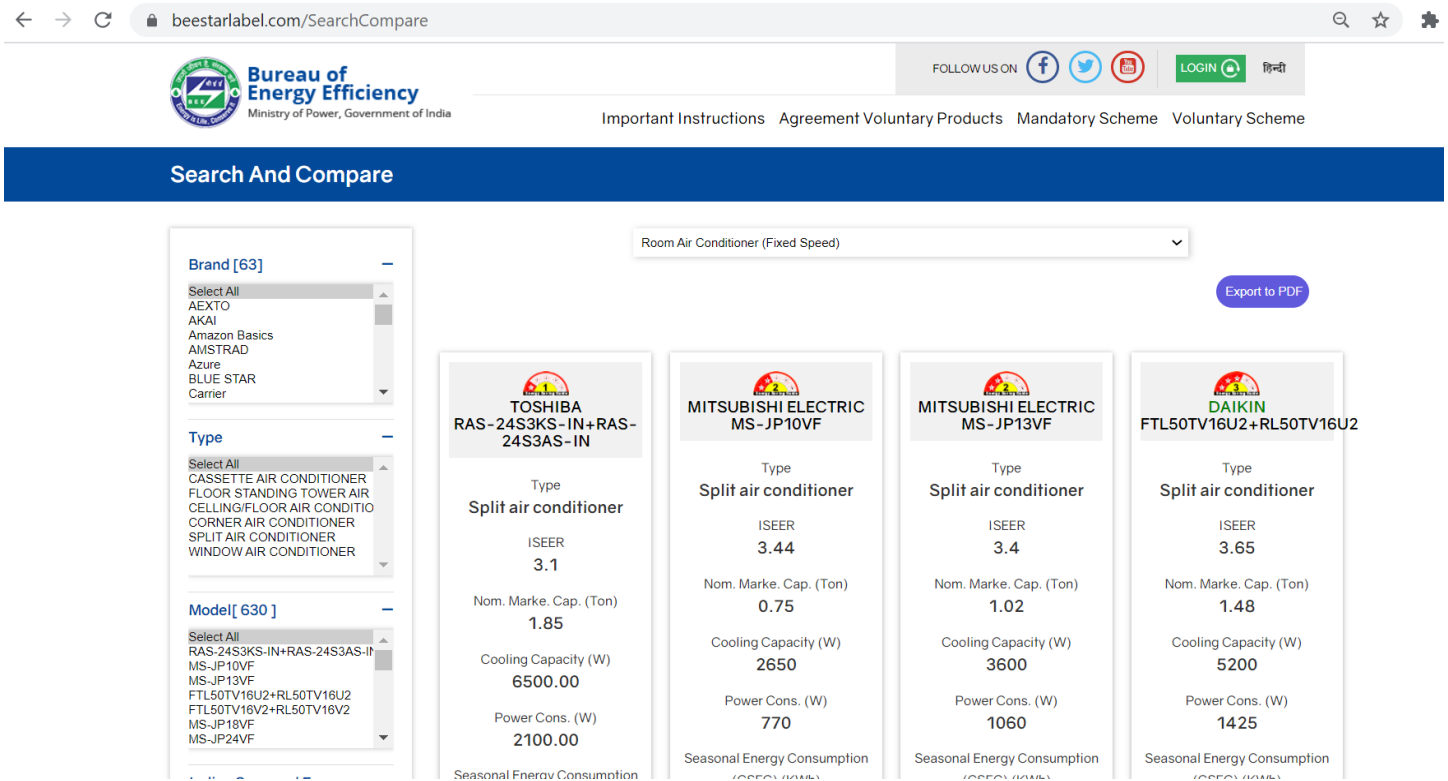
  https://beestarlabel.com/Home/EnergySavings

- PPAT tool for prioritization of products for labeling program and policy analysis
- Mobile application for informed purchased decision making and features such as information on monetary savings and product related feedback

  https://beestarlabel.com/Home/MobileApp

- Consumer behaviour study to get real time data on appliance usage pattern and behaviour to support policy decision, revision and evaluation

Product Registration Database



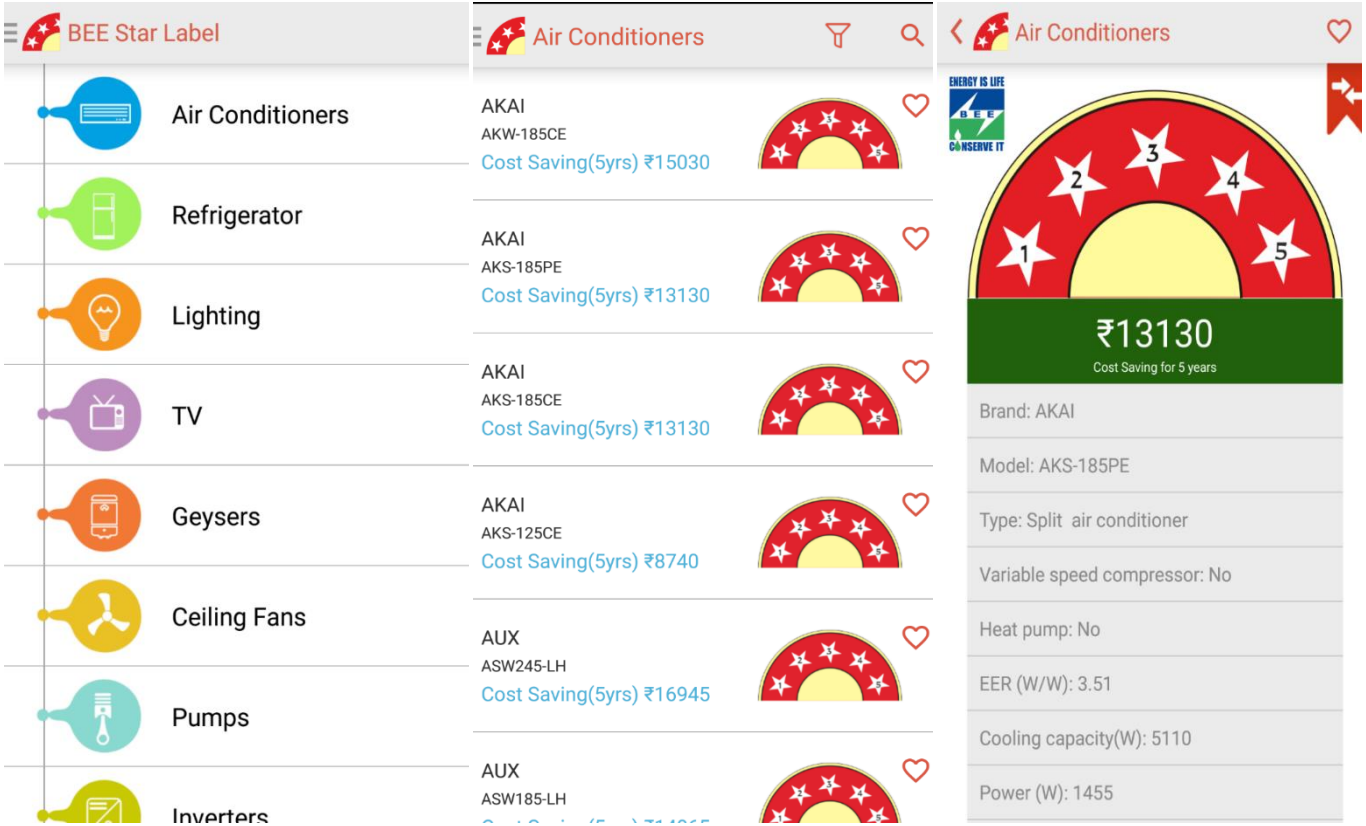
Tools and Technique

- Calculation of appliance energy consumption and savings
  - Tools for product prioritization, policy analysis and energy savings
  - Mobile App.
  - QR code

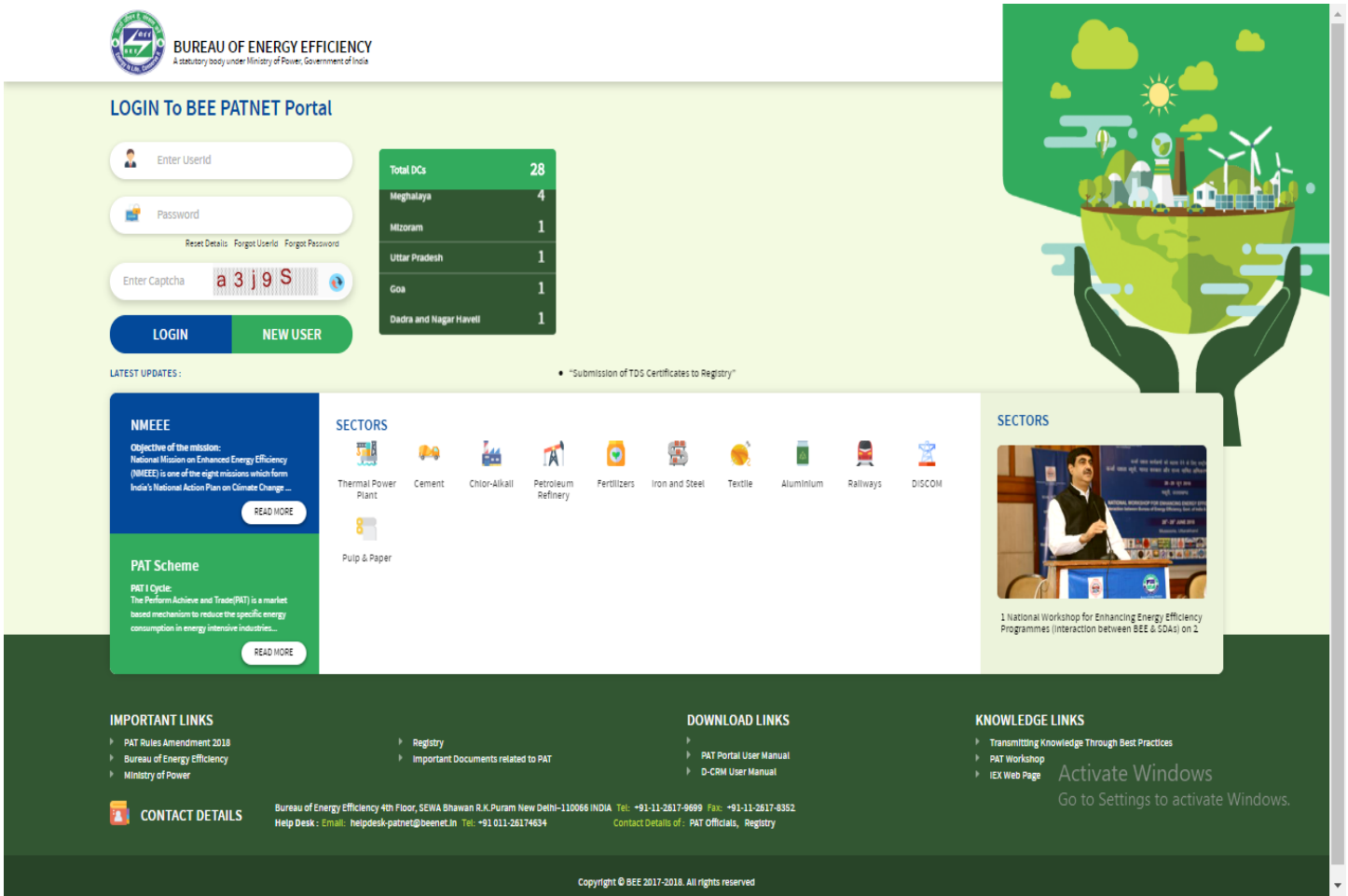
Advantages

- Selection and prioritization of products, projections for market growth
- Estimation of energy saving potential for policy decisions and impact analysis
- Support data acquisition, handling and visualisation
- A historical view of electricity consumption over time (also indicating the resulting costs)
- Provide labelled appliance data in accessible manner influencing purchase decisions
- A household-specific recommendation service on how to save energy

BEE Star Label Mobile application



PATNet - Home Page



Benefits of PATNet portal to Industries

- Industries(DCs) can fill their Energy Return Forms online instead of sending it on email or hard copy.
- Online forms filled in by the DCs are automatically shared with the SDA with a copy to BEE.
- Total 803 DCs have successfully registered on PATNet from PAT Cycle I to PAT Cycle VI covering 13 energy intensive sectors across PAN India.
- SDAs and EmAEA firms have also given login on the PATNet portal.
- Before and after trading of Energy Saving Certificates (ESCerts) are automatically updated on the dashboard of every DC.


Thank
you

Making Energy Efficiency Implementation Smarter: The Role of Digital Tools:

Ashok Sarkar

WORLD BANK GROUP
Energy & Extractives

IEA Energy Efficiency Policy and Digital Tools Workshop
23 June 2021

Demand-side EE Ecosystems are Complex…

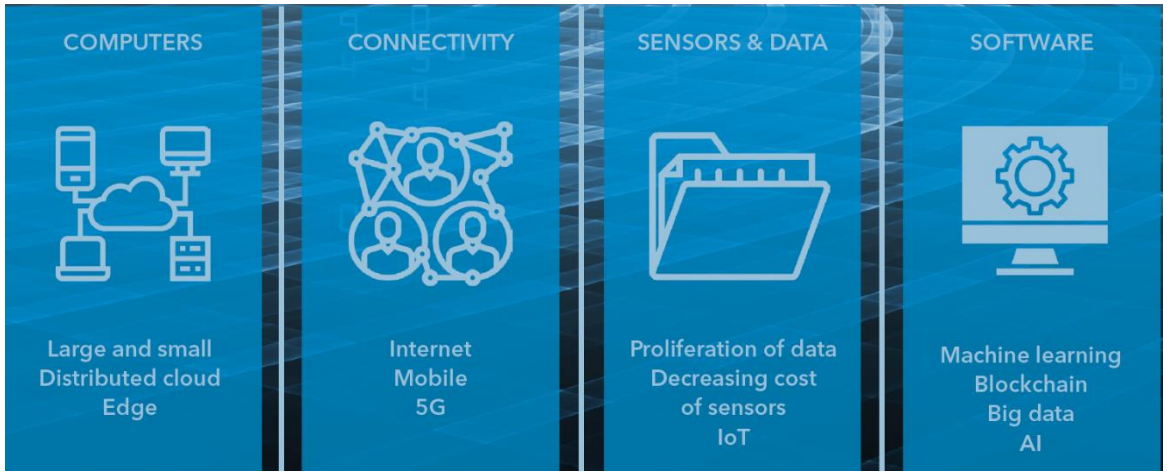
Digital Transformation Can Address Multiple EE Barriers

Implementation Barriers

- **Small and Dispersed**
- Multiple Stakeholders
- **No "One Size Fits All" Solutions**
- High Transaction Costs
- **Heterogenous Market**
- Financing based on "Savings" (Not Asset- Based)

- Data/Information
- Transaction Costs

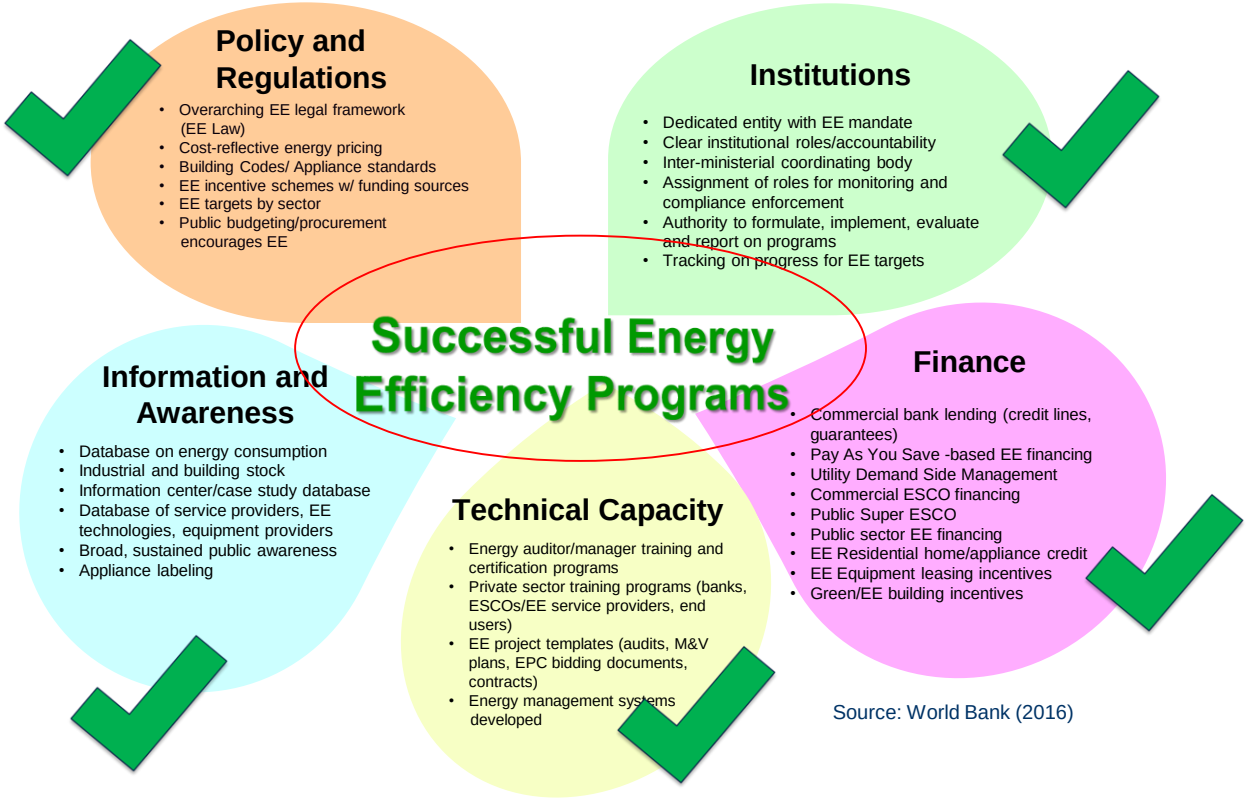
- Measure
- Analyze
- Communicate



Source: DNV-GL (2019)

Digital Tools have a Role in Every Pillar of EE Market Transformation:

Addressing Market Failures & Barriers through Multi-Pronged Efforts



Source: World Bank (2016)

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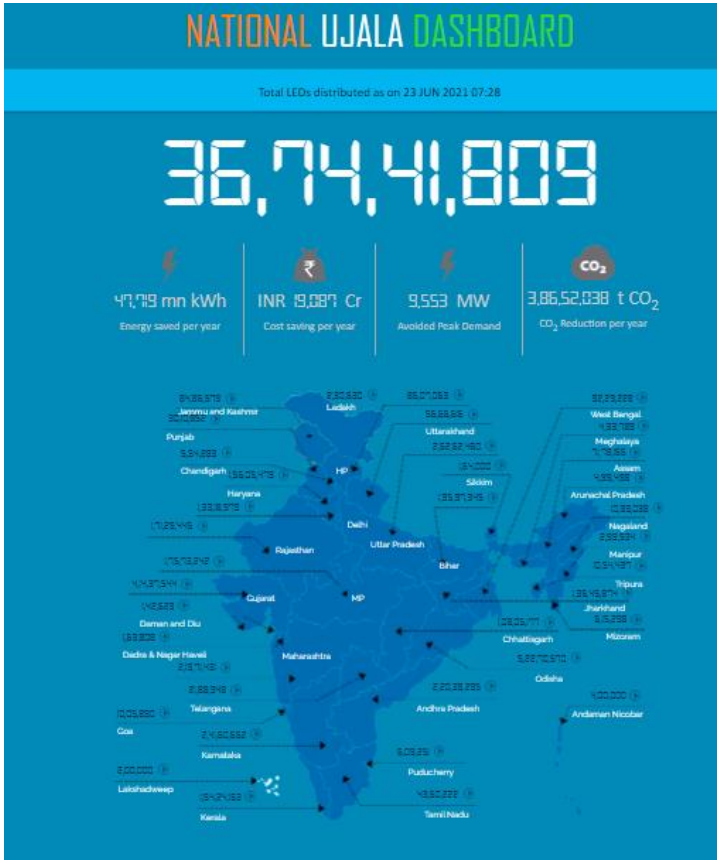
Illustrative Example: India – EESL…(1)

How Digital Tools Helped Transform EE Markets at Scale

- National-level Deployment
- Analytics
- M&V
- Real-time Monitoring & Impact Evaluation
- O&M
- Lower Transaction Costs
- Higher Accuracy
- Better Comparison and Targeting



LED Lamps Deployment Program

Source: UJALA Dashboard http://ujala.gov.in

Illustrative Example: India – EESL…(2)

How Digital Tools Helped Transform EE Markets at Scale

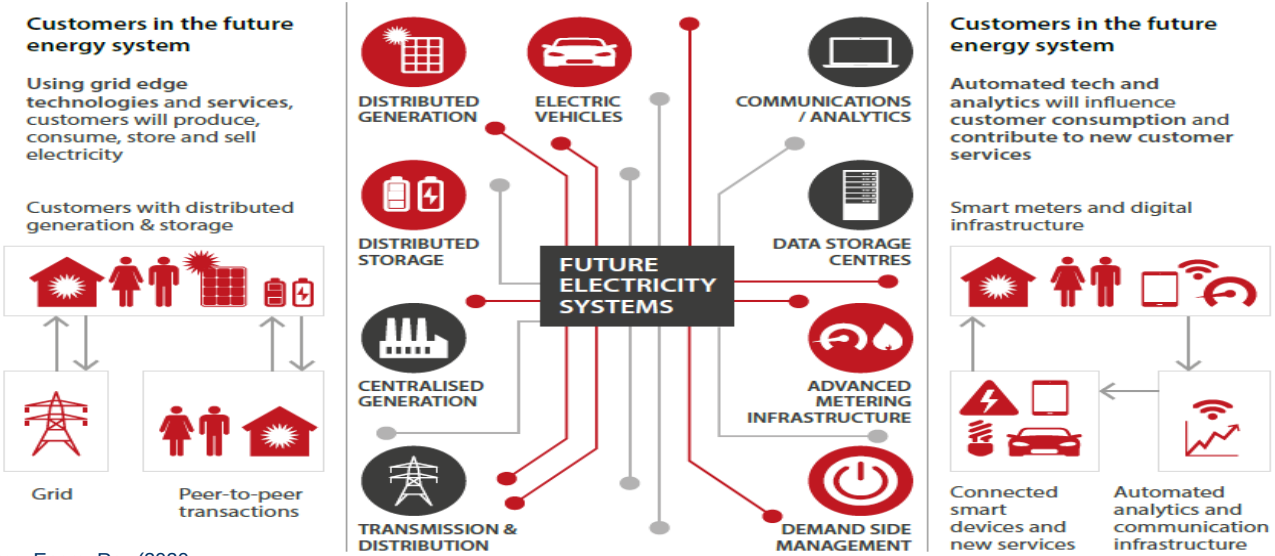
Building Energy Efficiency Program (BEEP)

Source: BEEP Dashboard: https://beep.eeslindia.org/

Future Energy Systems → Unlocking More EE through Digitalization

- Decentralized energy assets and resources, incl. generation, storage, and electric vehicles – connected to the network.
- **Digitalization of this network will allow data, communications and analytics to be used to improve the energy efficiency and resilience of the system**.
- Customers are likely to have a more active role than they do today; individually-owned assets can provide flexibility to the system, and new markets could allow trading between households or communities.

Mega-TrenDs
Disruption
Decarbonization
Decentralization
Democratization
Digitalization



Source: EnergyRev (2020

ASHOK SARKAR (World Bank), IEA Workshop Presentation, 23 June 2021

Thank You

For More Information:

Dr. Ashok Sarkar, Ph.D.
Senior Energy Specialist – Team Leader
Energy & Extractives Global Practice
The World Bank, **Washington, D.C.**
E-Mail: asarkar@worldbank.org

https://www.linkedin.com/in/dr-ashok-sarkar-ph-d-35b58187/

UNIVERSITY OF CAMBRIDGE

Digital Tools for *good energy & health policy* in the Global South

A case of low-income housing in India

Dr. Ronita Bardhan
Assistant Professor of Sustainability in the Built Environment
Director, MPhil in Architecture and Urban Studies
Department of Architecture;
University of Cambridge

ENERGY EFFICIENCY POLICY AND DIGITAL TOOLS

International Energy Agency (IEA)

June 23, 2021

behaviour and building performance group | BBP | Sustainable Design group

Research domain

Research Group

Sustainable Design group

SCAN ME

Good health and well-being through design

This vertical informs the SDG3. We investigate how building design effects health and well-being in resource constrained settings.

Sustainability in low-income habitat through design

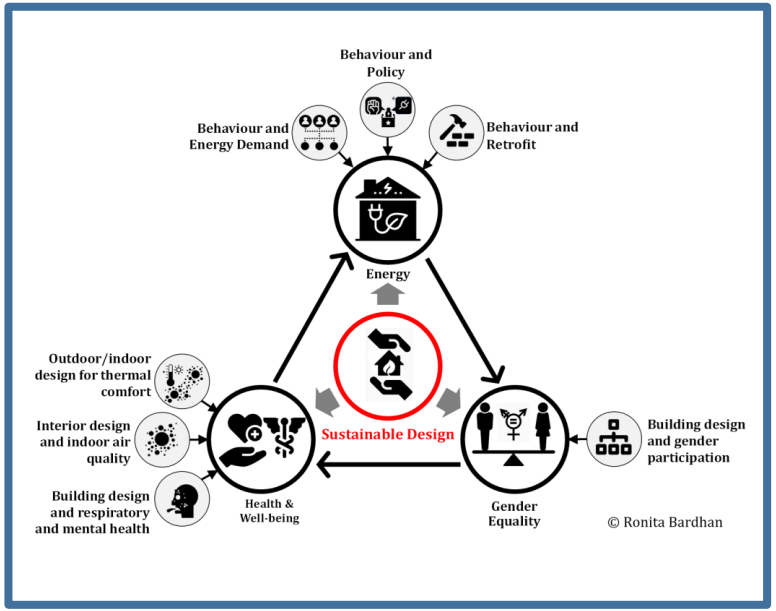
This vertical informs the SDG11. We derive data-driven solutions for vulnerable communities to tackle problems of climate change : heat island effects, flooding, for climate sensitive urban planning.

Energy efficiency through design

This vertical informs the SDG7. We use state-of-the-art building simulations and experimental methods to derive demand side energy efficient solutions.

Gender equality through design

This vertical informs the SDG5. We aim gender mainstreaming through participatory housing design for sustainability.



Philosophy – Data-Driven Design

- I see '**design as a Solution**'.
- 'effective design **Can foster Well-being** and that the measure of effectiveness is inherent in outliers'.
- **Solution lies in Outliers**

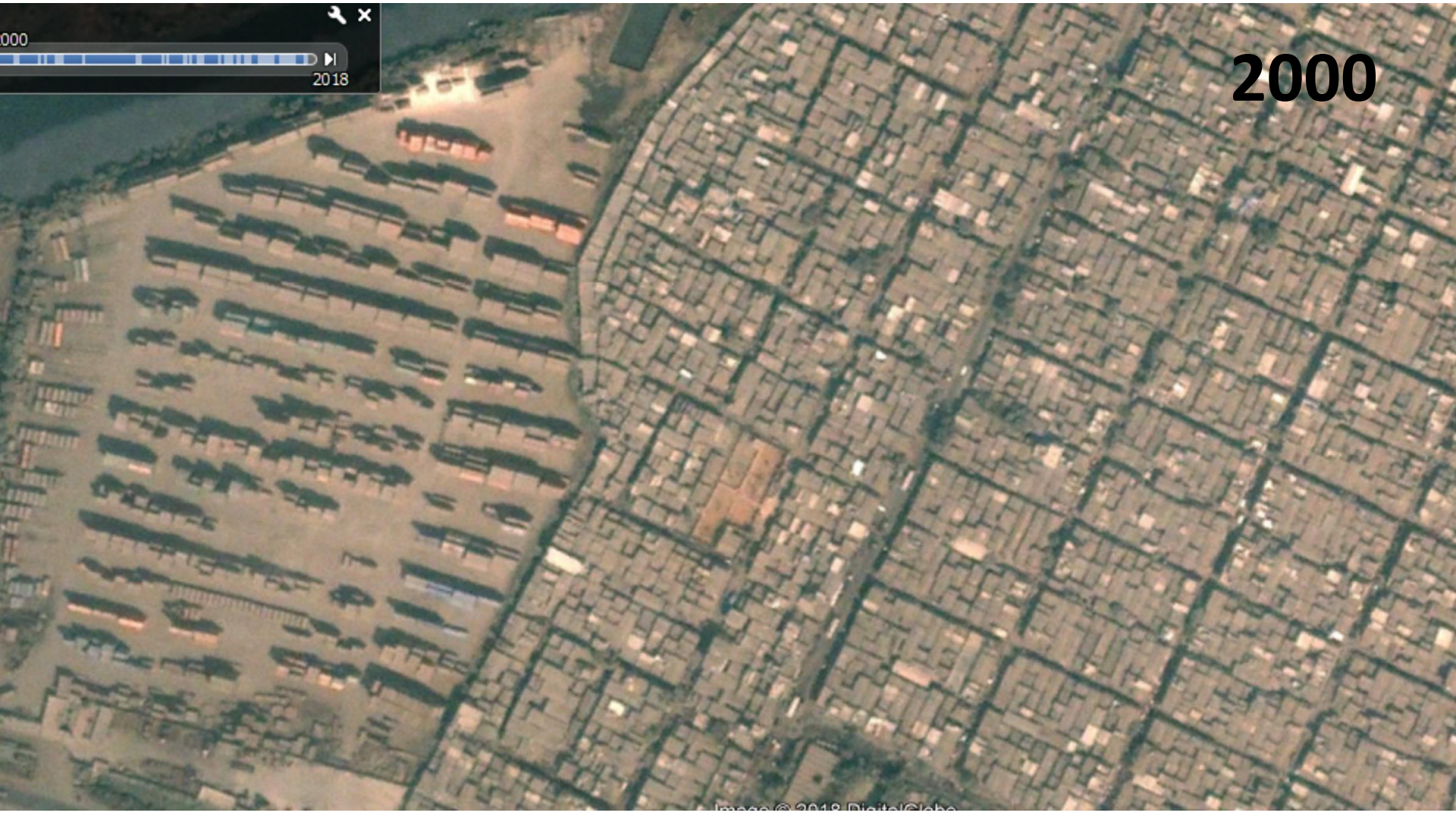
Keywords extracted from publications

Mumbai ~Around 65% live in the cramped, airless slums/slum like, making for easy dis-stress, and transmission of the disease.

- REUTERS, 2020

Source: Anonymous

(Source: Gully Boy, The movie)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2018
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Image © 2018 DigitalGlobe


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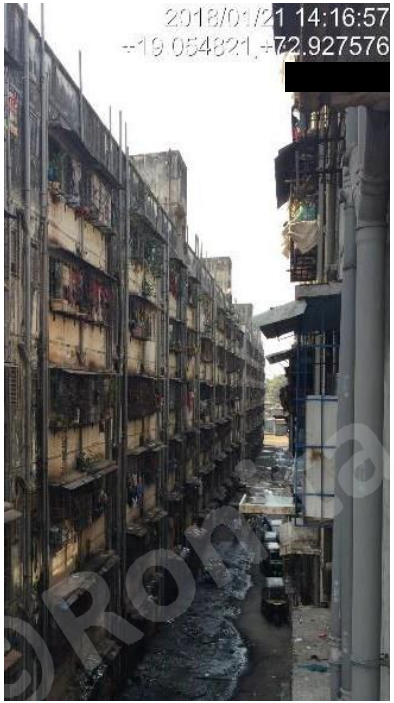
Image © 2018 DigitalGlobe


2017


2017
Neo-Informality
Informality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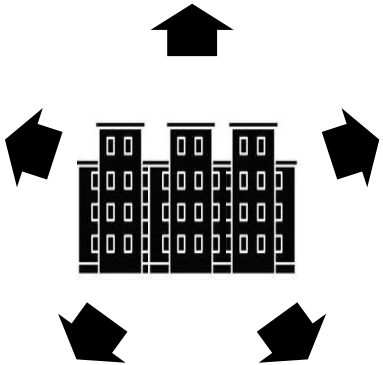
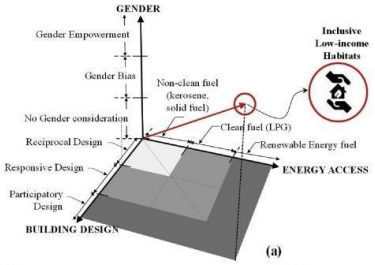
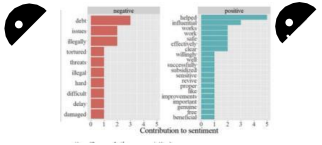
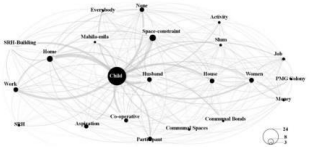
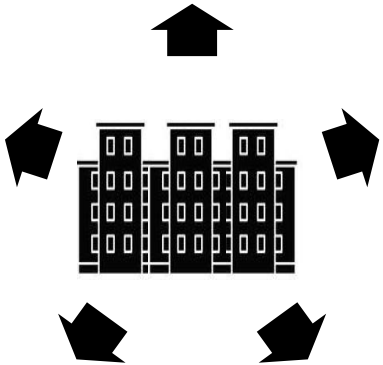


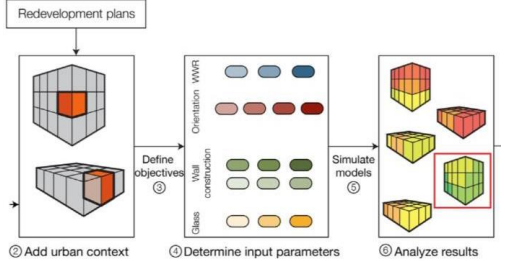




Gender mainstreaming

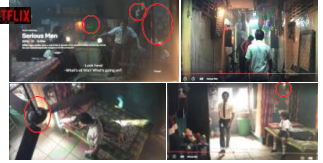


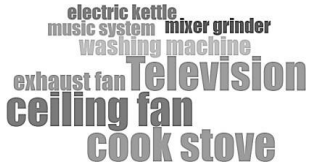


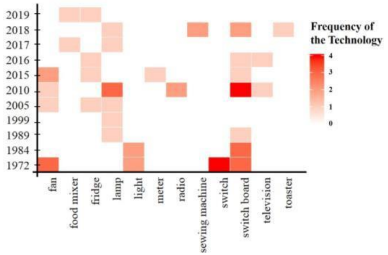


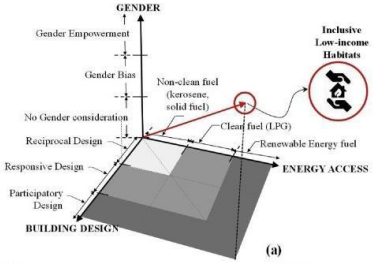
Sensors

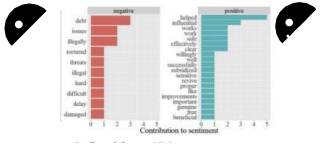
Films



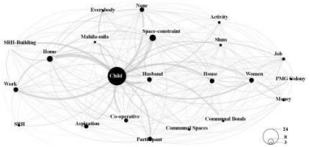




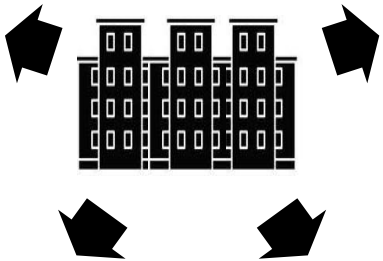


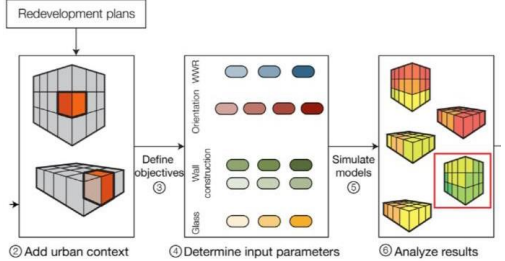


Gender mainstreaming



Energy





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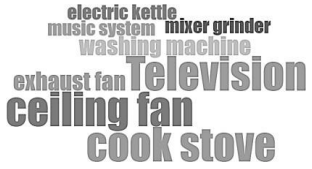
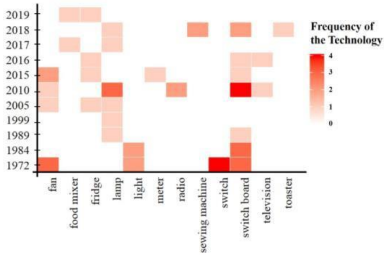
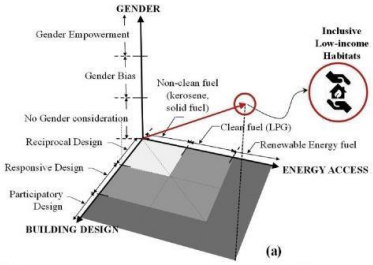
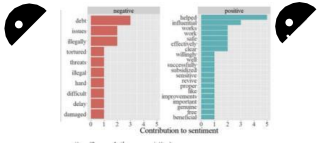


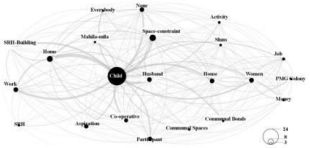


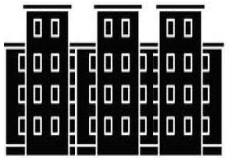
Energy



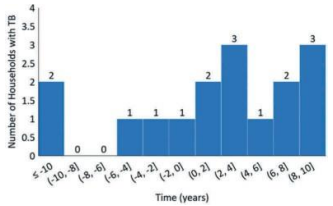


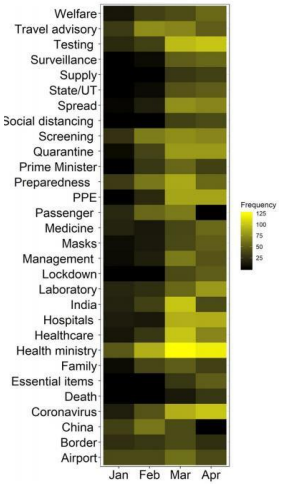
Gender mainstreaming

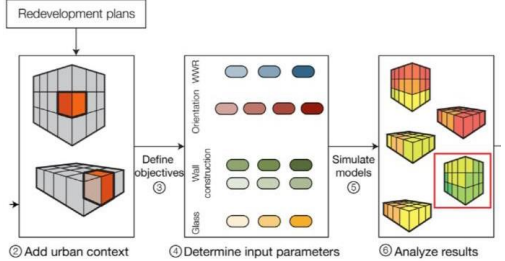




Health

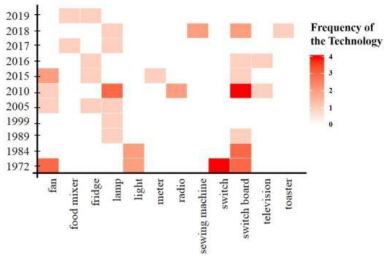


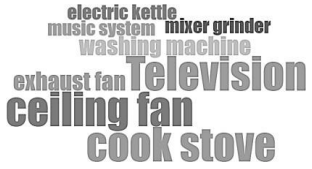




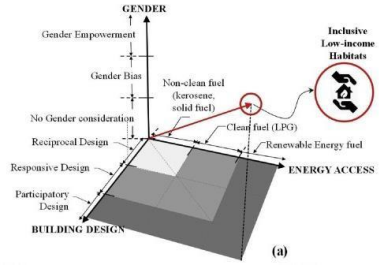
Sensors

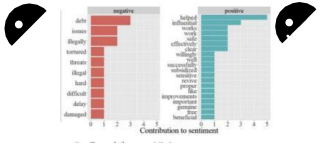
Films





Energy





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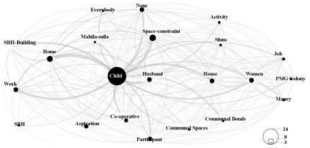
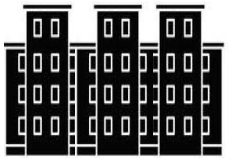
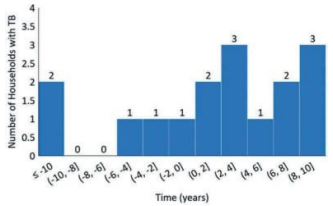
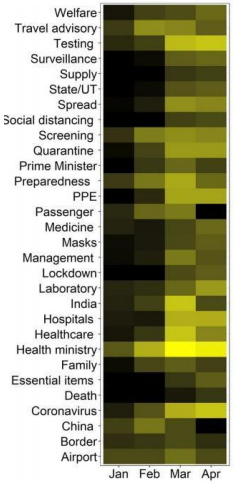


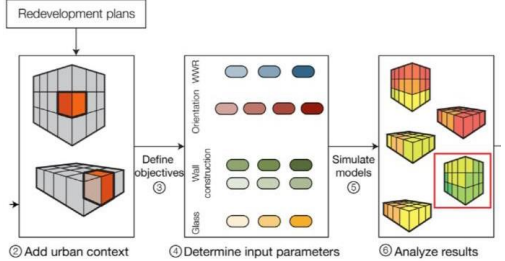


Health



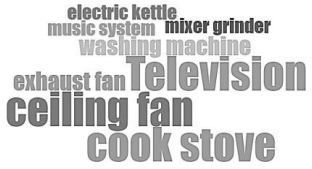


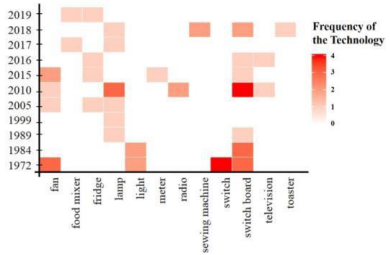
Comfort / Distress



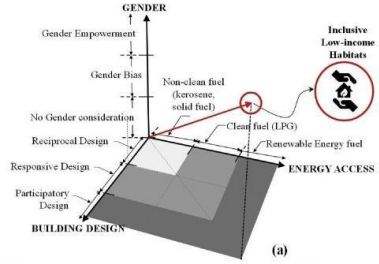
Sensors

Films





Energy



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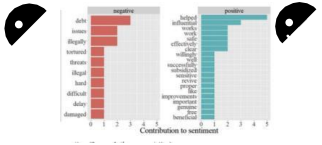
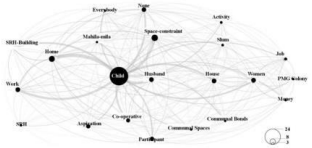
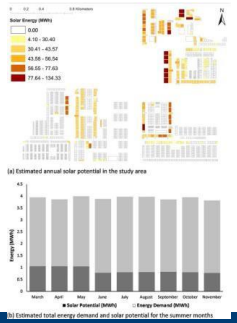
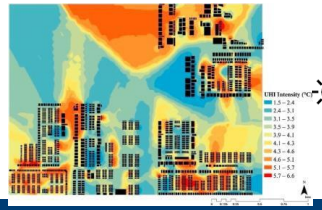
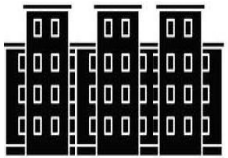




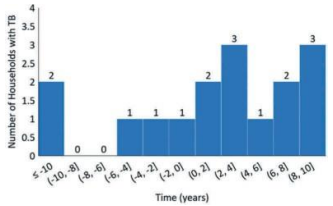


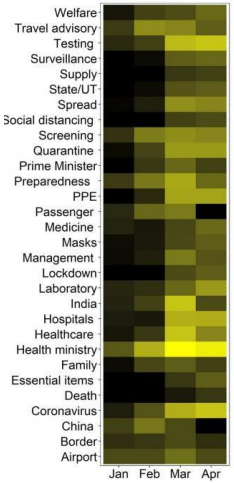


Heating Climate



Health





Comfort / Distress

Thank you !!

rb867@cam.ac.uk

Decarbonising the built stock: A digital twin of London and smart meters

Tadj Oreszczyn, UCL Energy Institute

Smart Energy Research Lab (SERL)

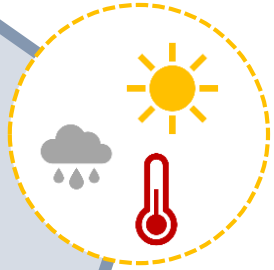
Gas data

Daily
Half-hourly
All participants with a SMETS2 mains gas meter (~70%)
Up to 12 months before consent, ongoing collection

Electricity data

Daily
Half-hourly
All participants (in theory)
Includes exports if available
Up to 12 months before consent, ongoing collection

SERL (13,000) Observatory Dataset

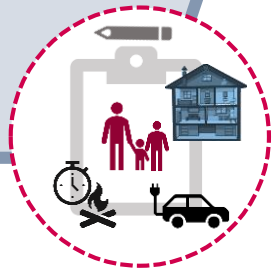


Weather data

ECMWF ERA5 reanalysis data
Publicly available
Hourly, 30km resolution
Initially surface temperature, adding ~20 more variables
Updated quarterly

Energy Performance Certificate

~50% of participants
Sourced externally, publicly available
Updated quarterly/as appropriate



SERL Survey

~40 questions on the dwelling, occupants and attitudes/behaviours
~97% of participants partial/complete
One-off collection

3DStock – A Digital Twin

Valuation Office Agency

Non-domestic rating: Business Floorspace England and Wales

Building heights and domestic building floor areas

Environment Agency

Light Detection and Ranging (LIDAR)

Mastermap

Ordnance Survey

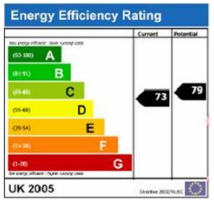
AddressBase

3DStock

Measured energy data

Department for Business, Energy & Industrial Strategy

EPCs & DECs



Land parcels & sites

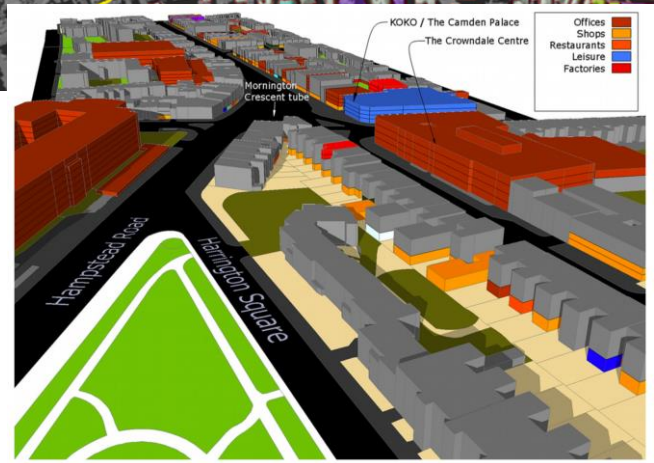
Land Registry

Others:

- Experian
- UK Buildings
- Census
- .....

CREDS

Research Councils UK Energy For a Low Carbon Future

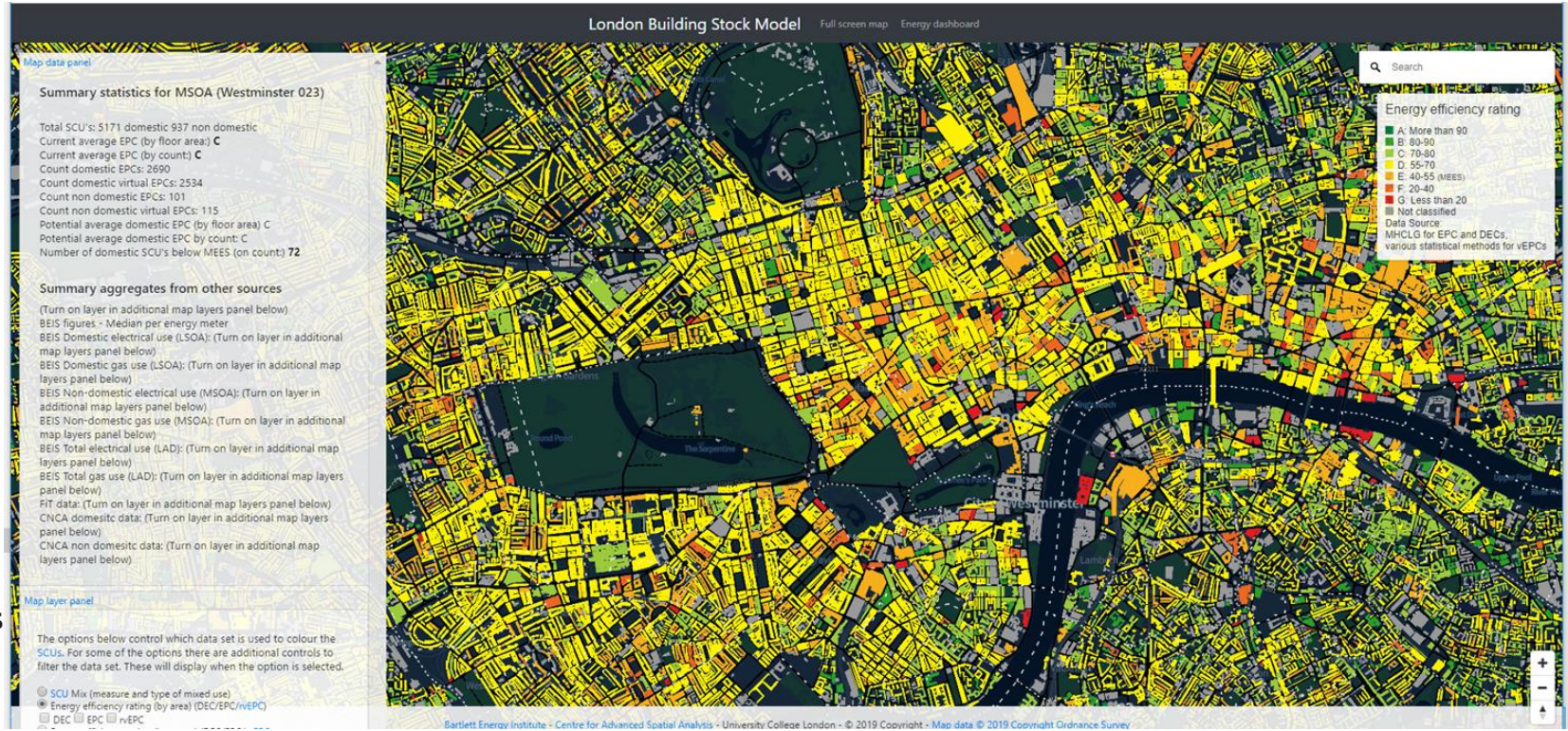


3DStock model of Camden High Street, London. The dominant activity on each floor of each building is colour coded. Houses and flats are shown in grey.

LBSM (London Building Stock Model)

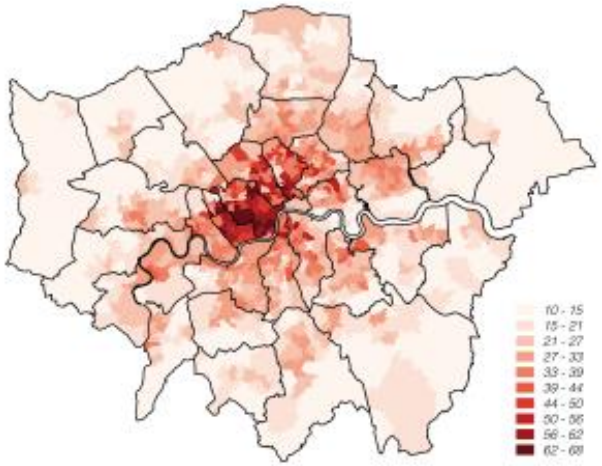
All buildings—domestic, non-domestic and mixed use—33 boroughs of Greater London.
3.78m premises = 1.5 million houses, 1.9 million flats + 250,000 non-domestic premises.

- fuel poverty
- minimum energy efficiency standard (MEES).
- poorly performing non-domestic buildings
- Plan energy improvements
.

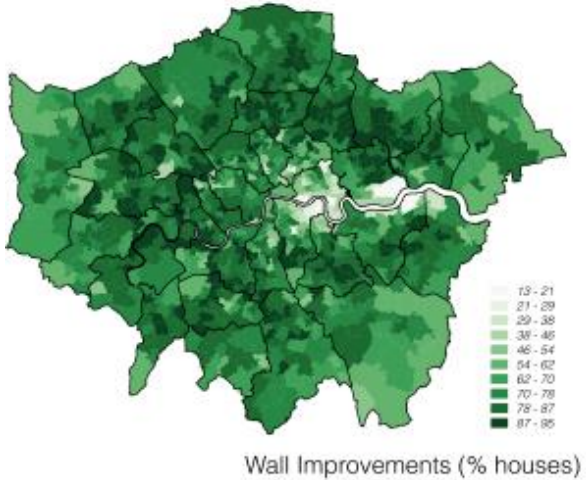


Public version see: https://www.london.gov.uk/what-we-do/environment/energy/energy-buildings/london-building-stock-model

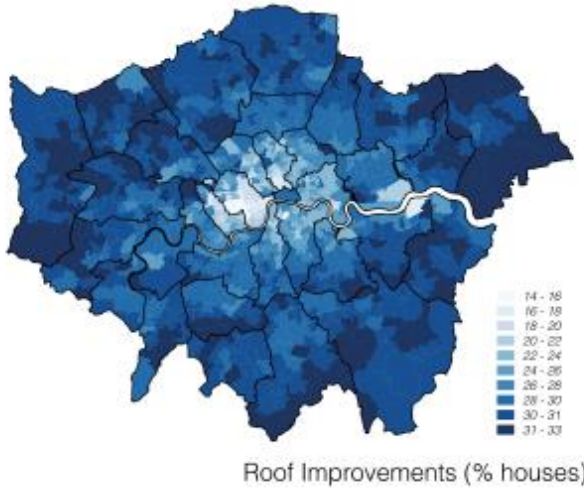
Recommended fabric improvements for London (% of houses in each borough)



Glazing Improvements (% houses)



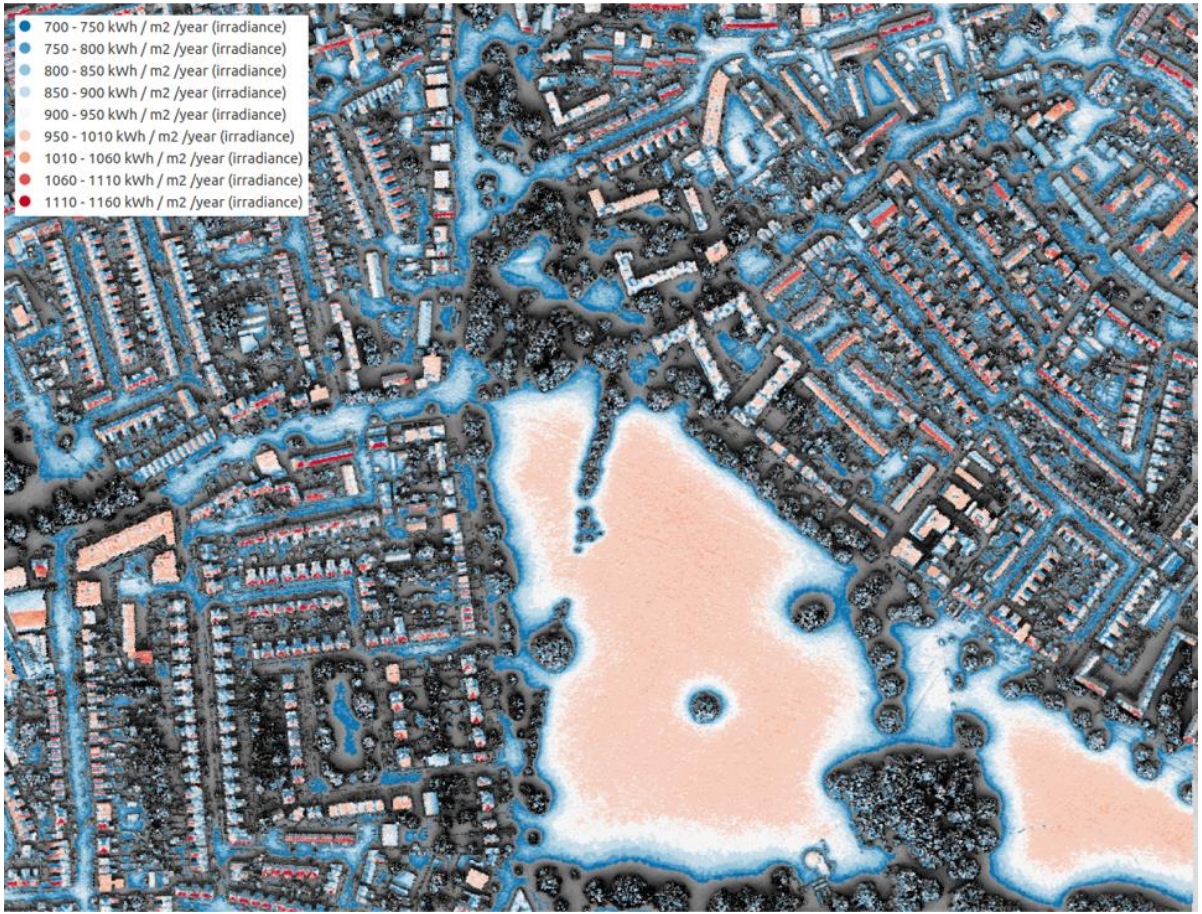
Wall Improvements (% houses)



Roof Improvements (% houses)

Solar Opportunity Map

Public version:
https://maps.london.gov.uk/lsom/



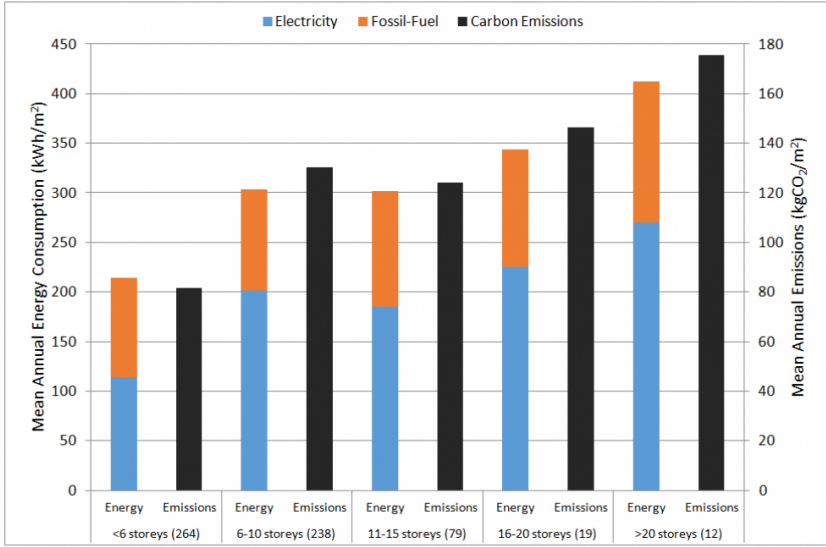
Other uses and results from 3DStock

Research (much government related)

- EPCs overpredict energy use in poorly insulated properties but underpredict energy use in new homes. New empirical EPC?
- High rise buildings use more energy
- What is the normal post covid energy use

Local and national government planning

- Post construction reporting platform – Building Passports
- Local planning for net zero (skills, materials, heat distribution)
- National policy planning and evaluation (very cost effective)
- Performance contracting, metered energy savings etc
- Measuring building heat loss from smart meters rather than surveys



Digital Technologies can help with the following key challenges:

1. Where and how to start?
   - which homes are heat pump ready?
   - where are the greatest savings?
   - material and labour required?
   - providing home owners with the best information?
2. Doing the job well
   - Reducing performance gap
3. Helping you manage your energy use
   - Managing the complexity
   - Stopping wated energy

Thank You & Acknowledgements

Links for further information:

- Digital Twin Animation. https://www.youtube.com/watch?v=ppi0ssQPC3I&feature=emb_logo
- London Building Stock Model https://maps.london.gov.uk/lbsm-map/public.html
- London Solar Opportunity Map https://maps.london.gov.uk/lsom/
- Description of 3DStock: Steadman, P., et al. (2020). Building stock energy modelling in the UK: the 3DStock method and the London Building Stock Model. Buildings and Cities, 1(1), pp. 100–119. DOI: https://doi.org/10.5334/bc.52.
- Smart Energy Research Lab https://serl.ac.uk/
- Centre for Research into Energy Demand Solutions https://www.creds.ac.uk/
- Active Building Centre https://www.activebuildingcentre.com/

UKRI Engineering and Physical Sciences Research Council

CREDS

Department for Business, Energy & Industrial Strategy

SMART ENERGY RESEARCH LAB
UNIVERSITY RESEARCH FOR PUBLIC GOOD

Active Building Centre

GREATER LONDON AUTHORITY

~19% of global GHG emissions come from buildings

MyHEAT

builds tools that Make Energy Visible

to enhance energy efficiency programs to enable these emissions reductions.

Remote Sensing & Machine Learning

Individual high resolution HEAT Maps are created for each roof to show areas of potential heat loss.

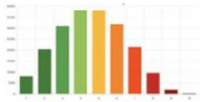
Buildings are then given a score of one to ten and shown how they compare to others in their city.

MyHEAT

myheat.ca

Thermal Atlas City Ranking

We rank cities based on a number of factors including size, population density, average age of building stock, and overall HEAT Rating. See below for cities similar to Calgary and how they compare when it comes to heat loss:

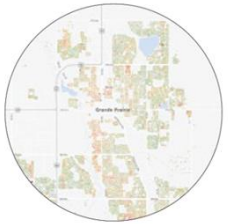


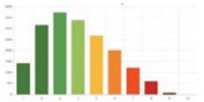
Edmonton

Overall City Rank:	55
C02 Reduction Potential:	1,325 km/sq
Energy Efficiency Programs:	
Electric Vehicle Charging Stations:	12
Average Age of Homes:	35 years

Hamilton

Overall City Rank:	40
C02 Reduction Potential:	748 km/sq
Energy Efficiency Programs:	
Electric Vehicle Charging Stations:	2
Average Age of Homes:	62 years





Grande Prairie

Overall City Rank:	30
C02 Reduction Potential:	253 km/sq
Energy Efficiency Programs:	
Electric Vehicle Charging Stations:	0
Average Age of Homes:	27 years

Homeowner Journey

Homeowners can access their personalized home profile, and instantly connect to online rebates and energy savings tips.

Governments and other stakeholders are using the MyHEAT data to:

Combat
energy poverty

Reduce consumption
& building emissions at
a mass scale

Get funding to
homeowners that need
it the most

Track change in
building thermal
efficiency

Ian Maddock

Co-founder & Chief Revenue Officer
at MyHEAT

ian@myheat.ca

Italian National Agency for New Technologies,
Energy and Sustainable Economic Development

IEA - Energy Efficiency Policy and Digital Tools Workshop

Workshop – 23 June 2021

ing. Domenico Palladino - Department of Energy Efficiency Unit (DUEE)

APP of ENEA for the Energy Evaluation and Seismic Vulnerability of Public Residential Buildings

Do not replace the Energy Audit, they allow to collect all the data required for the Energy Audit elaboration and for the Seismic Analysis

Free APP, available for tablet and smartphone, ONLY FOR PRELIMINARY ANALYSIS

SafeSchool

Condomini+4.0

School

Buildings

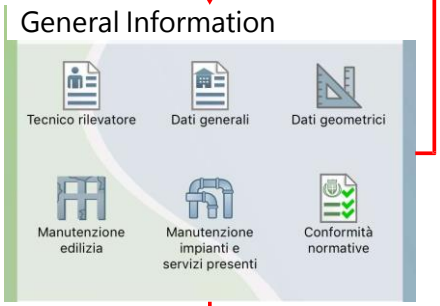
ENEA
AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE

Ministero dello Sviluppo Economico

ANDROID APP ON Google play

Download on the App Store

APP of ENEA for the Energy Evaluation and Seismic Vulnerability of Public Residential Buildings



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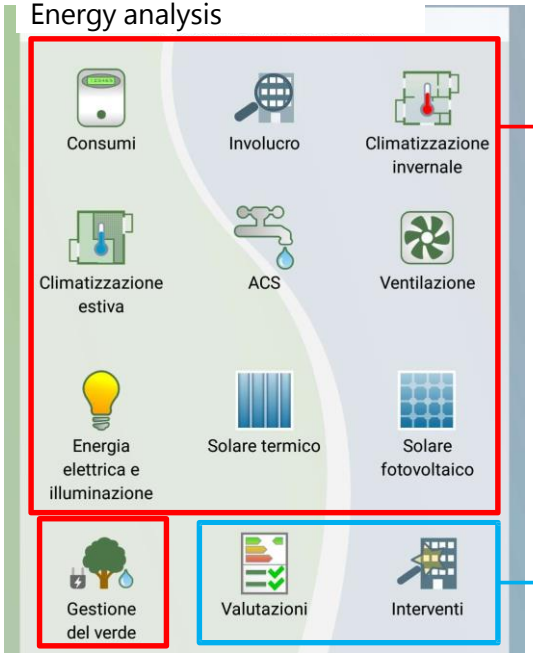


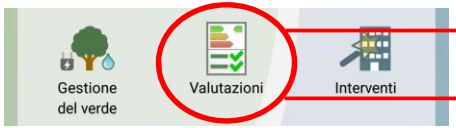
input

- Energy consumption (bills)
- Building envelope
- Technical building systems:
  - Heating
  - Cooling
  - Domestic hot water production
  - ventilation
  - Lighting
  - Other electrical consumption
  - Solar thermal collectors
  - Photovoltaic
- Green area

output

- Energy assessment
- Energy improvements

APP of ENEA for the Energy Evaluation and Seismic Vulnerability of Public Residential Buildings



Energy class level for Heating - IEN_R

Energy class level for Electric Energy - IEN_E

$$IEN_R = \frac{C \cdot F_e \cdot F_h \cdot F_{ta}}{V \cdot GG \cdot F_{mr}}$$

$$IEN_E = \frac{E \cdot F_h \cdot F_{us}}{S_u \cdot F_{me}}$$

C = annual consumption [Wh_t]

F_e = correction factor based on S/V

F_h = correction factor based on the real heating turn-on/off

F_{ta} = correction factor based on the indoor air temperature

V = volume of buildings

GG = Heating Degree Day

F_{mr} = correction factor based on the real heating period

E = annual consumption [e

Fh = correction factor based on the real heating turn-on/off

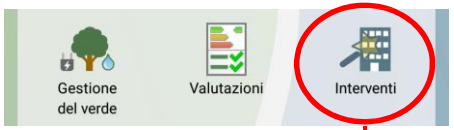
Fus = correction factor based on special use

Su = useful area of buildings

Fme = correction factor based on the real period of use

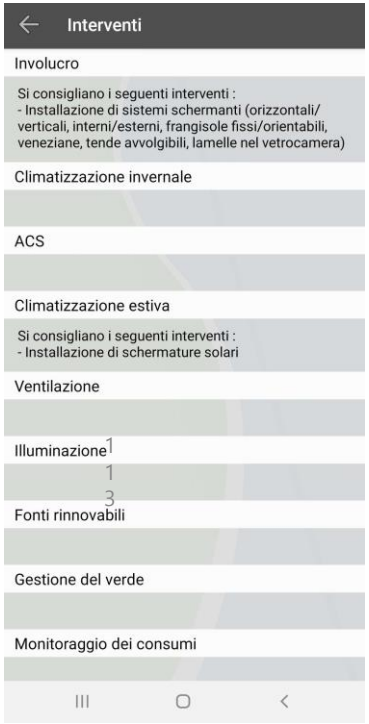
1
1
2

APP of ENEA for the Energy Evaluation and Seismic Vulnerability of Public Residential Buildings



Energy Improvement solutions

Parameter	Variable	Improvement solution	Energy Class Level for heating
External Wall	poor	Thermal coat	Medium or insufficient
Climatic Zone	D, E, F		
External Wall	Without insulation		



APP of ENEA for the Energy Evaluation and Seismic Vulnerability of Public Residential Buildings

1. Survey Report
2. Energy Class Level of Buildings
3. Energy Class Level of the Energy Measures to improve the energy performance
4. Vulnerability of the structure
5. Priority Level to improve the building security

http://italiainclassea.enea.it/safe-school-4-0-app/

https://www.enea.it/it/efficienza-energetica/enea-rende-disponibile-app-per-misurare-la-vulnerabilita-energetico-strutturale-degli-edifici-scolastici

http://italiainclassea.enea.it/condomini4-0/

https://www.enea.it/it/efficienza-energetica/condomini-4.0/

Thank You For Your Attention

ing. Domenico Palladino

domenico.palladino@enea.it