CivicAI

BLUEPRINT #3/3

Participatory energy

CivicAI is a project exploring how AI can enhance collective intelligence to help communities respond to the climate crisis through three near-future use cases. **Read more at civic-ai.org**

Participatory energy explores how communities could adopt Augmented Collective Intelligence to help set-up, operate, maintain and model the financial and social outcomes of community energy projects.

The *Blueprint* outlines how people and machines could collaborate in this area. It provides an overview of opportunities for implementing community-led AI systems, as well as a framework for connecting organisations who share common challenges or are developing potential solutions.

Dark Matter Labs
Lucidminds
Nesta

September 2020
civic-ai.org

STAGES

1 PLANNING

The process of planning and setting up a community energy project can be made less resource intensive and less risky by integrating ACI.

2 FINANCING

ACI can help to streamline project financing by forecasting revenue and social impact and linking investments to smart contracts.

3 OPERATING

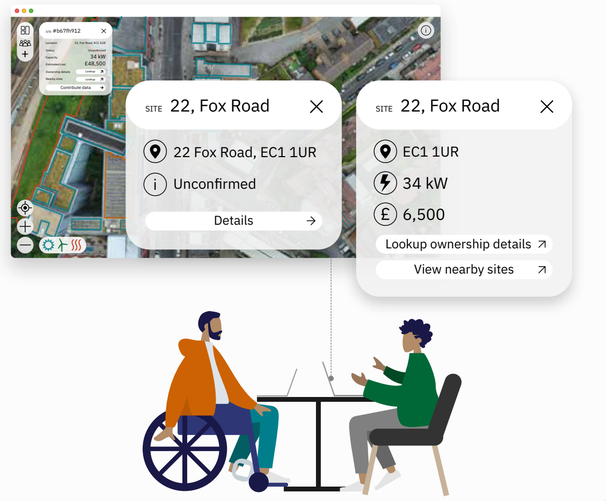
During the operating phase of a project, AI agents can help people to balance local production and use of energy, as well as guiding participatory maintenance based on data from distributed sensors.

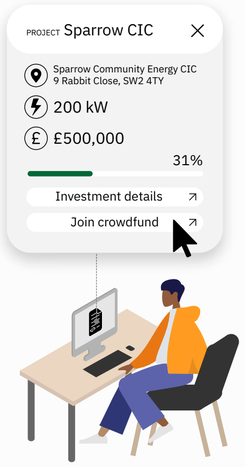
4 MODELLING

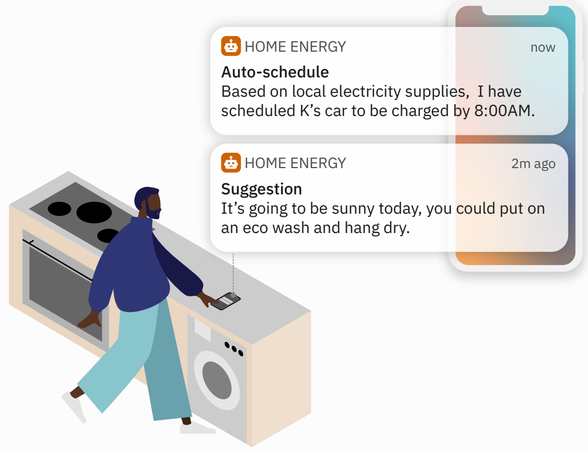
Lifetime revenue and social impact of individual community energy projects can be modelled to measure and evidence aggregated impacts across multiple projects.

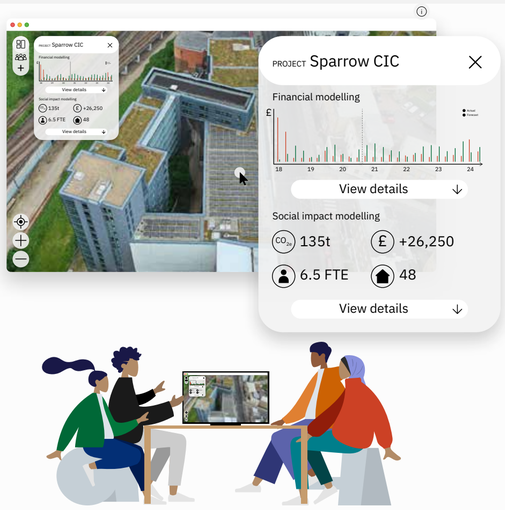
SCENARIO

INTERACTIONS



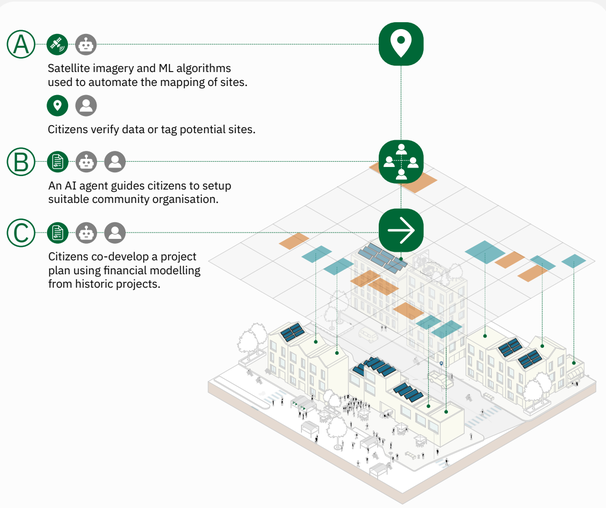


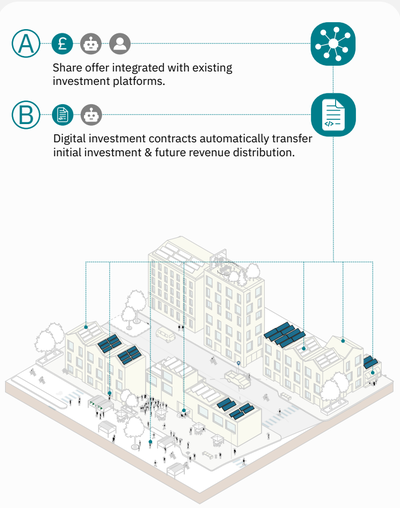


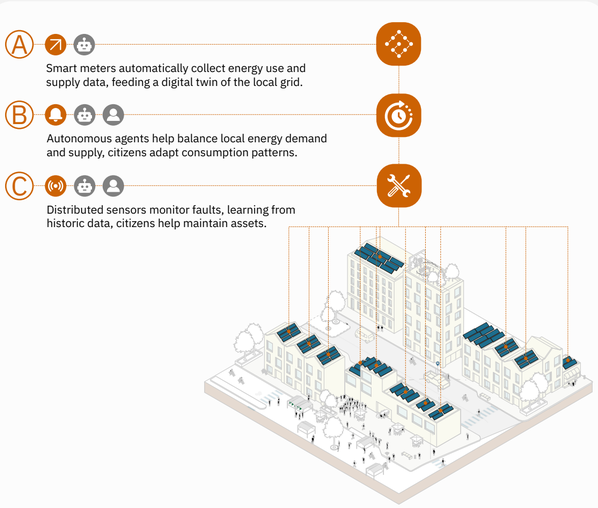


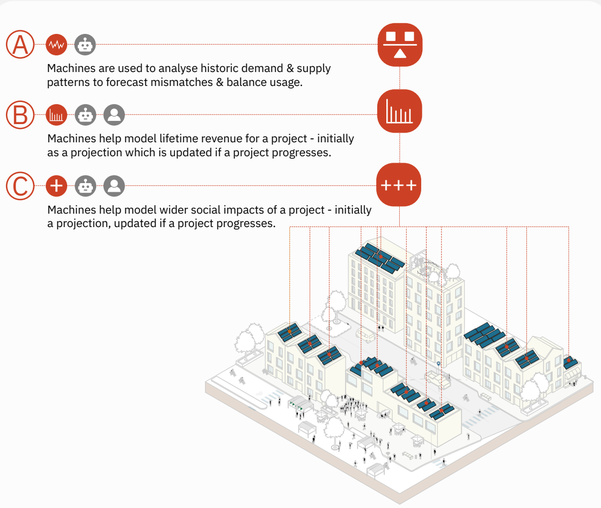
COMPONENTS

- People doing tasks
- Machines doing tasks









DETAILS

	A) Mapping sites	B) Organisational setup	C) Developing plan
KEY CHALLENGE(S) *for organisations working in this field, which ACI can help to address*	Time consuming and resource intensive to do manually. Creating consistent datasets that are easy to verify.	Process is time consuming, paper based and not easily replicated. Currently requires specialist and context specific legal advice which is expensive.	Reducing admin costs and dependence on volunteers. Funding the pre-financing work.
DESCRIPTION *of ACI proposal*	AI helps to automate mapping potential sites for community energy projects - identifying rooftops suitable for PV panels; land suitable for wind turbines or ground source heat pumps etc. Land ownership data is retrieved from the Land Registry.	A replicable process for setting up a community energy organisation using easily replicable and adaptable legal templates, appropriate for a range of contexts. Integrating smart contracts and linked datasets to automate data collection.	Machines help develop a local energy plan identifying: potential capacity; site ownership or lease details; required investment; technical feasibility; financing strategy and social impact.
ACI PROCESSES *Overview of activities performed by machines (AI) and people (HI)*	**HI** People tag potential sites, verify automatically identified sites and map existing energy infrastructure. **AI** MV and ML algorithms used to automatically process satellite images and calculate site production capacity. An AI agent proposes energy generation potential to land owners or potential investors.	**HI** People provide context specific information such as organisational rules, members and their positions and bank account details etc. **AI** An autonomous agent guides people through the community organisation setup process. ML used to learn most appropriate organisational structure for given contexts.	**HI** People provide context specific information such as historic energy use, existing available funding and building details etc. **AI** AI agents analyse contextual data - no. of houses, total historic energy demand, location etc. to help specify technical requirements.
CIVIC ASSETS *Open ecosystem of components*	**TANGIBLE** Energy generation sites **INTANGIBLE** DATA Satellite image data - sites Site boundary data Citizen data - energy use Weather data	Solar exposure data AI ML site algorithm AI agent SOFTWARE Citizen dashboard Open Site Registry	FRAMEWORKS Org. setup templates Smart legal contracts Open data standards

	A) Share offer	B) Investment contract
KEY CHALLENGE(S) *for organisations working in this field, which ACI can help to address*	Attracting local investment. Minimising admin costs. Collecting relevant data to link to investment contracts.	Minimising admin costs and paperwork required. Adaptable for different types of financing - crowdfund, bond, grant etc.
DESCRIPTION *of ACI proposal*	An investment dashboard shows potential returns and impact for each project, using open APIs to integrate with crowdfunding platforms. If funded, smart investment contracts are automatically created.	Smart investment contracts identify: an individual's investment and corresponding ownership; future purchasing agreements; revenue distribution details. They are linked to a site and transferable with lease or ownership transfer.
ACI PROCESSES *Overview of activities performed by machines (AI) and people (HI)*	**HI** People coordinate marketing of project and opportunity for local investment. **AI** Simulations used to model scenarios that consider both financial returns, environmental and social impact.	**HI** People sign investment contracts. **AI** The platform features automated identity verification and management of participants. All automated processes are transparently implemented so they can be audited and interrogated if necessary.
CIVIC ASSETS *Open ecosystem of components*	**INTANGIBLE** DATA Financial model Social impact model AI Impact simulation SOFTWARE Investment dashboard	FRAMEWORKS Smart investment contracts Open data standards

	A) Data collection	B) Load balancing	C) Remote maintenance
KEY CHALLENGE(S) *for organisations working in this field, which ACI can help to address*	User engagement. Management of data. Data privacy and security considerations.	Increased complexity from managing demand and supply at a local level. Coordinating behaviours of multiple stakeholders to manage energy demand.	Additional investment in sensors and meters. Data privacy and security considerations.
DESCRIPTION *of ACI proposal*	Automated data collection of local energy demand and supply, using open data standards. Automated billing, accounting for community use vs export to grid.	Autonomous agents help enable demand-side response, balancing supply and demand through auto-scheduling electricity usage or prompting behaviour change.	Distributed sensors help to monitor electricity patterns to remotely and diagnose faults. Data is fed to a digital twin of the energy system which enables predictive maintenance schedules to minimise downtime. Citizens conduct simple maintenance.
ACI PROCESSES *Overview of activities performed by machines (AI) and people (HI)*	**HI** People see their consumption patterns compared to available supply so they can alter consumption accordingly. **AI** Smart meter data feeds a digital twin of local demand and supply, with automated billing.	**HI** People adapt energy consumption patterns with help from automated feedback and task scheduling to meet personalised targets that are pooled at the community level. **AI** AI agents help to automatically balance demand e.g. when an electric vehicle is charged or used as battery; or prompt behaviour adaptations to match fluctuating supply.	**HI** People participate in maintenance practices - cleaning PV panels, replacing components etc. Technicians conduct skilled maintenance and repairs. **AI** ML algorithms learn from production and consumption patterns to help identify faults. AI agents prompt citizens to maintain energy assets, with collectively set rewards for those conducting maintenance.
CIVIC ASSETS *Open ecosystem of components*	**TANGIBLE** PV panels Batteries/energy storage Heat pumps Smart meters In-home interfaces Computing network	**INTANGIBLE** DATA Energy consumption data Energy production data Fault data AI ML fault detection algo. AI DSR & maintenance agent	Digital twin - energy system SOFTWARE Energy usage dashboard Maintenance dashboard DSR app FRAMEWORKS Maintenance guides Open data standards

	A) Forecasting	B) Revenue	C) Social impact
KEY CHALLENGE(S) *for organisations working in this field, which ACI can help to address*	Open data standards. Computationally resource intensive.	Unpredictability of lifetime costs and revenues; fluctuating energy prices.	Difficult to measure aggregated impact across multiple community energy projects. Currently no incentives for community projects to supply social impact data.
DESCRIPTION *of ACI proposal*	Data modelling to forecast energy demand and supply by analysing historic supply and usage patterns and weather forecast data. Live data fed from digital twin.	Modelling lifetime costs and revenue; and simulating alternative investment and financing strategies, both before a project is implemented, as well as throughout a project.	Modelling wider social impacts both before a project is implemented, as well as throughout a project. Calculating emission reductions; support of local economy; social impacts etc. to provide evidence to attract social impact funding.
ACI PROCESSES *Overview of activities performed by machines (AI) and people (HI)*	**HI** People can see forecasts and can adapt consumption patterns accordingly. **AI** ML used to analyse historic demand and supply patterns. Resulting forecasts of short and long term energy balance help to identify and prevent potential blackouts. MV used to identify solar panel locations and track cloud movements for short-term forecasting.	**HI** People use simulations to help make investment decisions. **AI** Simulations are run to model a project's lifetime revenues based on analysing the outcomes of similar existing projects, helping to create synthetic data for alternative implementation approaches.	**HI** People use simulations to help make investment decisions and provide evidence for social impact oriented funding. **AI** Simulations are run to model social impacts based on analysing the outcomes of similar existing projects, helping to create synthetic data for alternative implementation approaches.
CIVIC ASSETS *Open ecosystem of components*	**INTANGIBLE** DATA Financial data Social impact data Weather data AI ML forecasting algorithm MV- cloud tracking	ABM - production & usage ABM - impact model SOFTWARE Impact dashboard Simulation dashboard FRAMEWORKS Decision-making framework Open data standards	

Technology Readiness Levels of components

- Deployment (TRL 7-9)
- Development (TRL 4-6)
- Research (TRL 1-3)
- Focus for MVP

ACRONYMS

ACI	Augmented collective intelligence	MV	Machine vision	TRL	Technology Readiness Level
AI	Artificial intelligence	ML	Machine learning	MVP	Minimum Viable Product
HI	Human intelligence	ABM	Agent-based modelling	DSR	Demand Side Response