RetroKit
Sustainable Energy
Retrofit Planning Toolkit

RetroKit

A Software Development Journey From Concept to Cloud-based Platform

Supported by seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Introduction

The challenge

Our answer

The people behind RetroKit

The journey

Our supporters

RetroKit

The Challenge

70% of Irish homes still considered in need of energy retrofit

Energy poverty affects an estimated 28% of Irish households

Poor energy performance in housing impacts health and well-being

500,000 homes to be upgraded to B2 by 2030

Our answer

RetroKit is a cloud-based software platform developed to support housing professionals to plan and implement their energy renovation projects.

This report presents the results of a research and development project undertaken by XD Sustainable Energy Consulting Ltd (XDC) and its team during 2019 to develop RetroKit from proof-of-concept to a cloud-based solution ready for commercialisation. This RDD project was funded by Sustainable Energy Authority of Ireland through its National Energy Research programme.

This follows on a previous research project funded by SEAI, RetroKit 1.0, which resulted in the release of a proof-of-concept tool combining Microsoft Excel spreadsheets and Python scripts. Having successfully tested and applied RetroKit 1.0 across a range of case studies and consultancy projects, the aims of this second RDD project were to develop the full software stack as a cloud-based application, suitable for use by the technical staff and decision-makers of social housing providers.

RetroKit

Home Products & Services Our Clients About Us Contact

RetroKit supports housing professionals to make evidenced-based investment decisions for energy renovations, meaning they can strategically plan their projects.

We empower our clients to reduce the carbon footprint in housing, to alleviate fuel poverty and improve the health and wellbeing of householders.

Click  here for a quick animated introduction to RetroKit (on www.retrokit.eu)

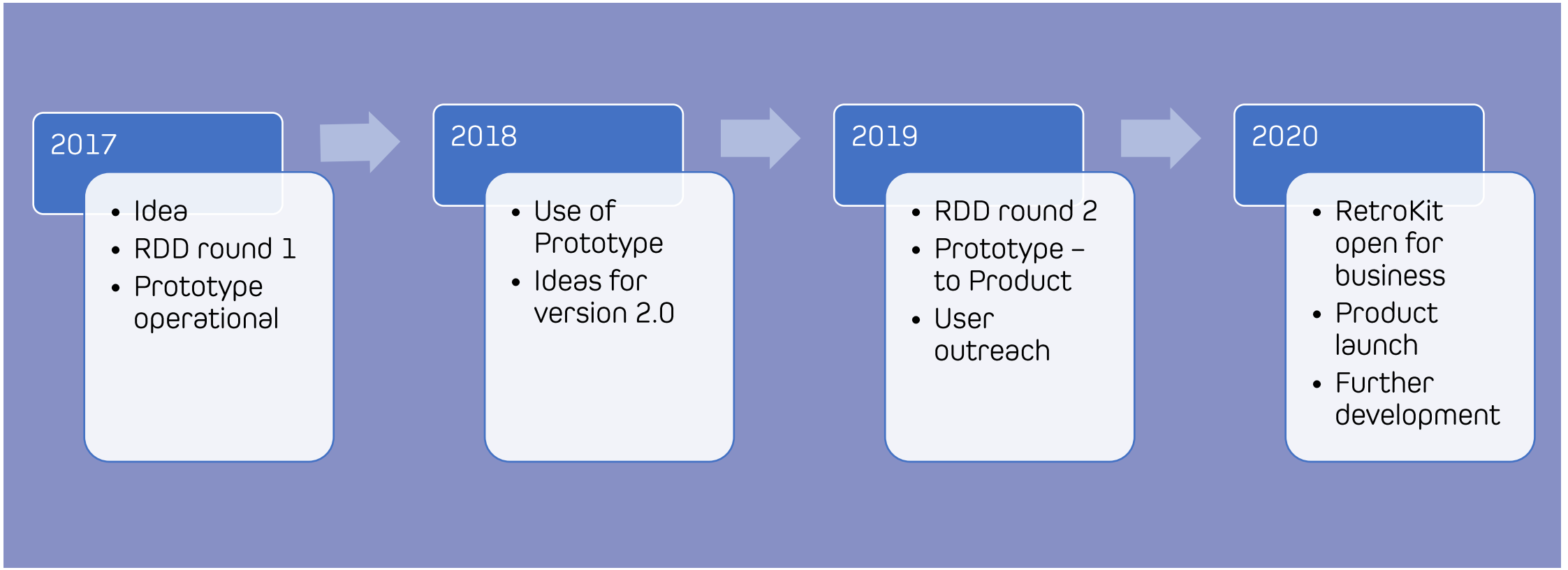
The people behind RetroKit

Brought to you by
XD Sustainable Energy Consulting Ltd

Energy engineers, specialists in data analytics, GIS, IT software architecture & development, GDPR, UX, business development

..and many more

Timeline


2017
Idea
RDD round 1
Prototype operational
2018
Use of Prototype
Ideas for version 2.0
2019
RDD round 2
Prototype – to Product
User outreach
2020
RetroKit open for business
Product launch
Further development

With support from and thanks to:

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Oifig Fiontair Áitiúil Local Enterprise Office

Rubicon

Cork County Council Comhairle Contae Chorcaí

LIT ACTIVE LEADERSHIP IN EDUCATION, ENTERPRISE AND ENGAGEMENT

Ireland's European Structural and Investment Funds Programmes 2014-2023 Co-Funded by the Irish Government and the European Union

European Union European Regional Development Fund

CIT CORK INSTITUTE OF TECHNOLOGY INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

ENTERPRISE IRELAND where innovation means business

teamwork.

Comhairle Cathrach Chorcaí Cork City Council

Co-designing RetroKit 2.0

Co-designing the minimum viable product

Overarching principles

Empathy mapping and the User’s Golden Path

Mapping out the MVP pathway

RetroKit

Designing the MVP (Minimum Viable Product)

User Centered Product Development

The RetroKit team used the lean start up approach, focusing on a rapid cycle of development from idea to code to testing to measuring and learning, back to idea. In that framework, the team embarked on a user centered product development process combining in-team brainstorming and customer engagement workshops. The first step was to identify overarching principles underlying the business proposition and the software solution, empathy mapping with key stakeholders, and laying out of the golden path we aim to bring our software user on leading to the definition of our minimum viable product pathway.

Overarching Principles → Empathy Mapping → Golden Path → Define MVP

Setting out RetroKit's Overarching Principles

Principle 1: EVIDENCED BASED

Decisions will be made through the use of the best available evidence from multiple sources.

INCLUDING: **Asking:** translating a practical issue or problem into an answerable question / **Acquiring:** systematically searching for and retrieving the evidence / **Appraising:** critically judging the trustworthiness and relevance of the evidence / **Aggregating:** weighing and pulling together the evidence / **Applying:** incorporating the evidence into the decision-making process / **Assessing:** evaluating the outcome of the decision taken to increase the likelihood of a favorable outcome.

Principle 2: IMPACTFUL

Retrokit will be ambitious, scalable and have a powerful and positive impact on climate change.

Principle 3: ADDS VALUE

Retrokit will solve a problem, be relevant, integrated, action orientated, and commercially viable.

Principle 4: FAIR

Retrokit will be cost effective / affordable, ethical and equitable.

Principle 5: EFFICIENT

Retrokit will be simple and intuitive, achieving maximum productivity with minimum wasted effort or expense.

Principle 6: ATTRACTIVE & INVITING

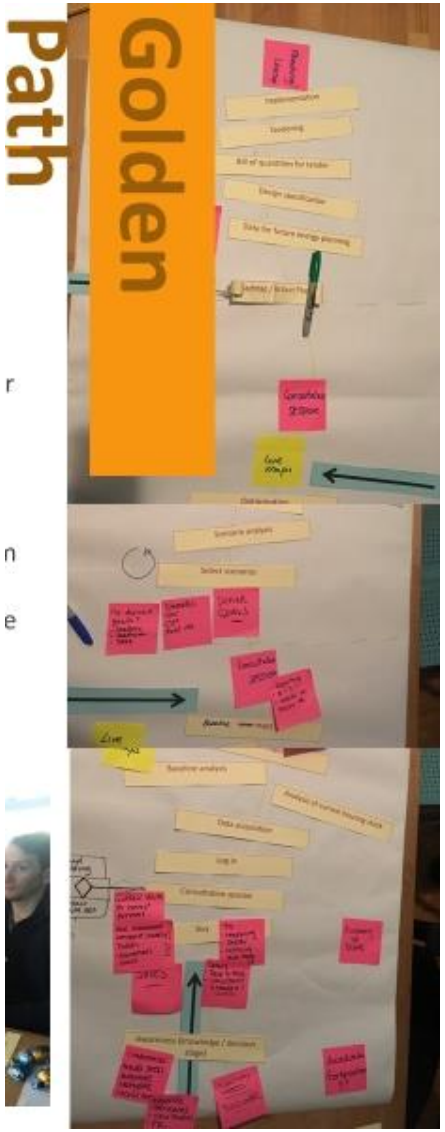
Retrokit will be user friendly, empowering, customer centered and contemporary.

Empathy Mapping & Golden Path

User 2: Consultants

BER Assessors, Energy engineers, Project managers, Architects.

Thinking: Efficiency / competitiveness / Construction / Compliance / Liability / Efficiency / Competitiveness (Price, Quality / Added Value)
Motivation: Job satisfaction, innovation, learning, business income
Speaking: Knows best / Boasting / Size of car / Clients / Business as usual / Little evidence
Hearing: Standards / Regulations / Specialist mags
Seeing: Growing opportunities, time saving
Holding: Skills, computer literate (not expert), analytical,
Heart: Credibility / financial / making a difference / Doing a good job (Pride v ego)
Pockets: Passes on cost / low overheads
Barriers: Time (required to learn new skills / understand the evidence / deal with new opportunities



- Awareness and knowledge
- Buy
- Consultation session
- Login
- Data acquisition
- Analysis of current housing stock
- Baseline analysis
- Baseline maps
- Consultation session
- Select scenarios (Define goals)
- Scenario analysis
- Optimisation
- Live Maps
- Consultation session
- Roadmap / action plan
- Data for future energy planning
- Design specification
- Bill of quantities for tender
- Tendering
- Implementation

→ Conferences / Trade Press / PR / Networking / Social media / advocates / Website / Case studies / Student projects

→ P.O / Tendering / invoicing / milestone payment / sales reps / consultants / face to face? E-tenders

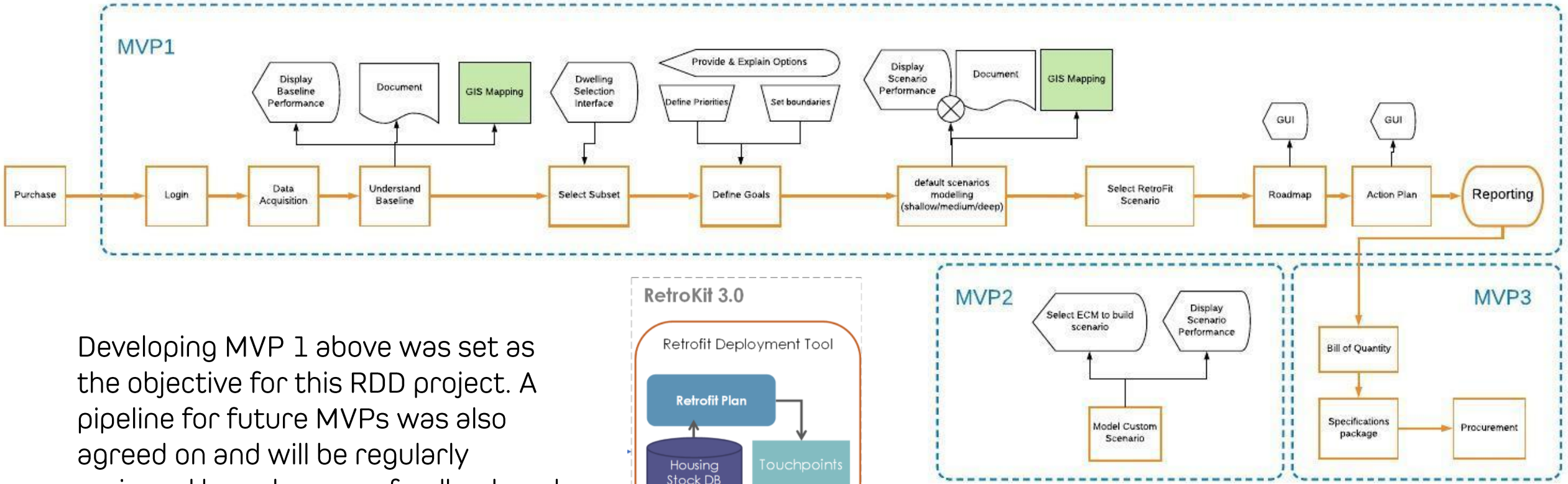
→ Gather data in correct format. BER assessment / Consent / Fields / Aspirations / Goals

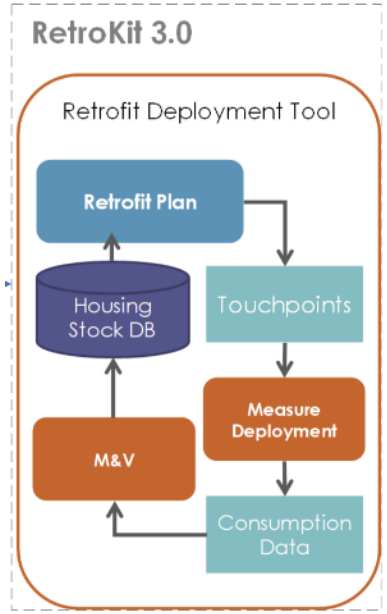
→ Reporting / 1-2-1s / exploring areas to focus on

→ Pre-defined goals (shallow / medium / deep) Cost / CO^2 Fuel use

→ Monitoring / learning / improving

Mapping out the Minimum Viable Product Pathway





Developing MVP 1 above was set as the objective for this RDD project. A pipeline for future MVPs was also agreed on and will be regularly reviewed based on user feedback and market opportunities.

An insight into the RetroKit User's Journey

From login to data upload

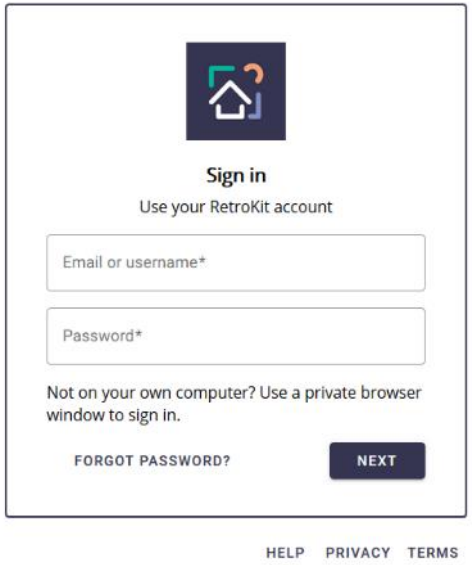
Baseline analysis of the housing stock's energy performance

Energy retrofit scenario analysis

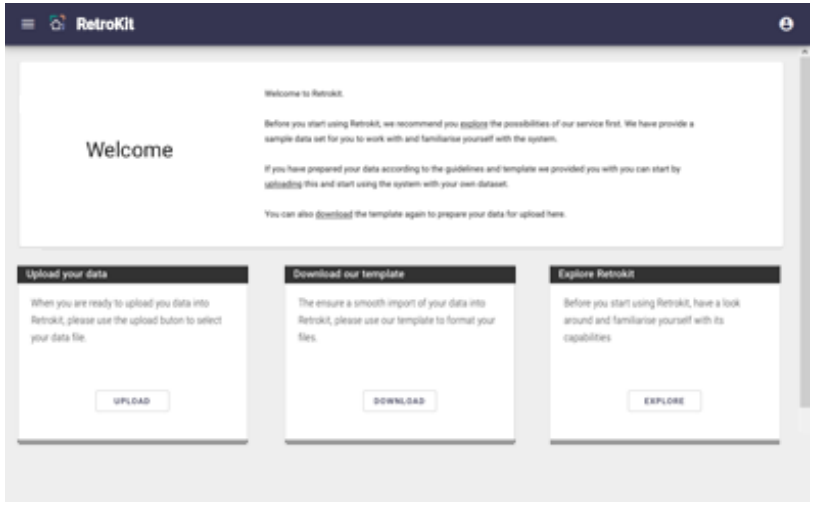
Scenario comparison

Action planning

RetroKit

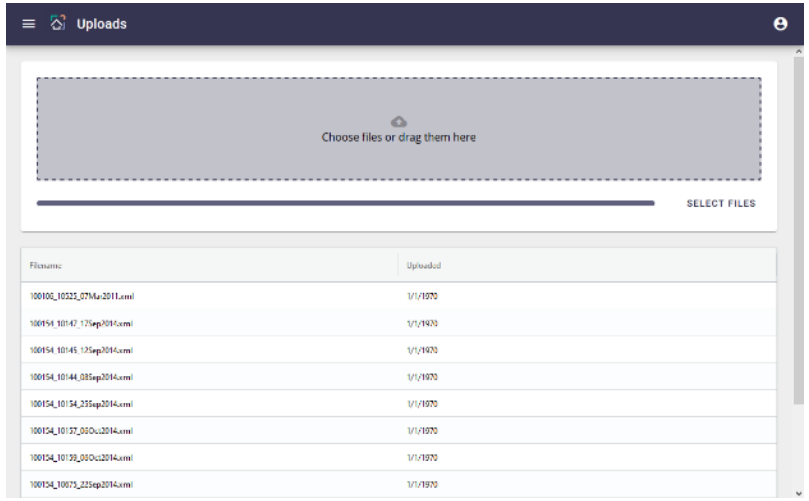


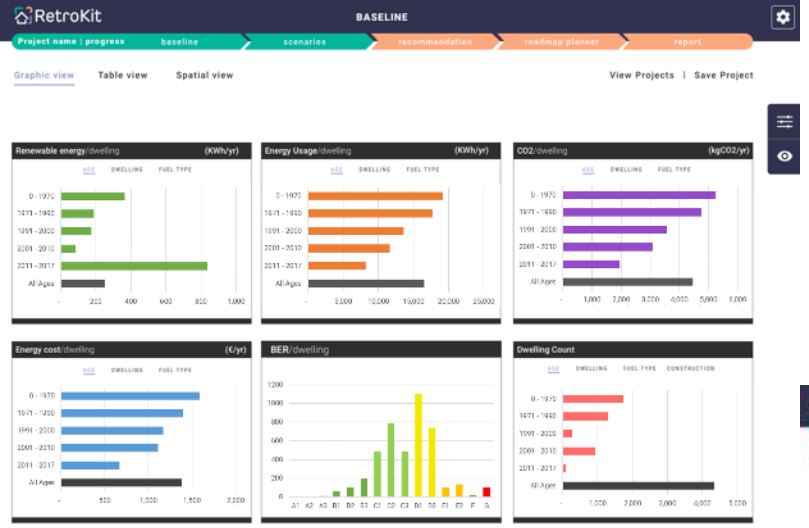
Sign in page from hyperlink on the RetroKit corporate website



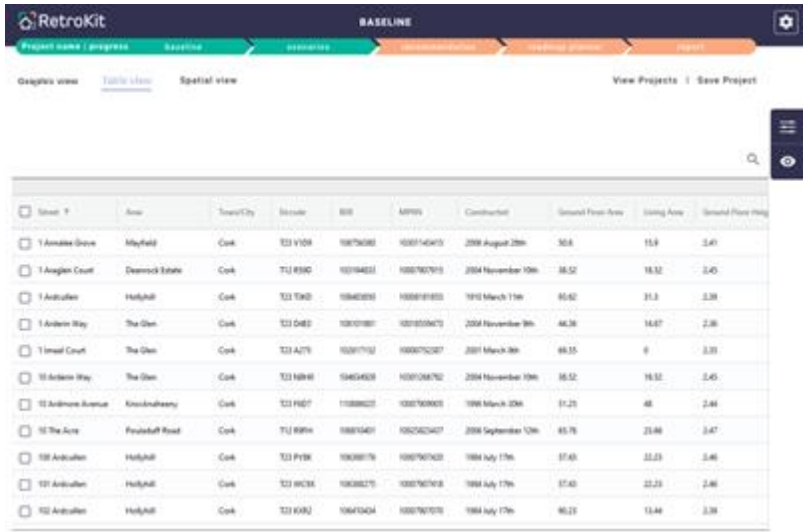
Once logged in, the user will land on a welcome page offering the options of a) uploading their data, b) download a template housing stock inventory form, c) explore RetroKit through a tutorial.

The user uploads an asset list with locational data (address, eircode) used by RK to geocode the dwellings. The user then adds housing stock BER data (XML files) which are paired with their respective dwellings in the asset list to compile the stock's energy performance database.



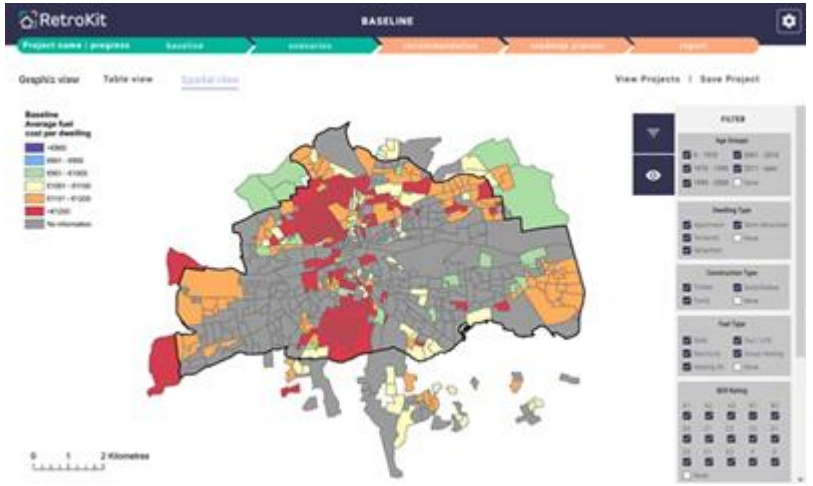


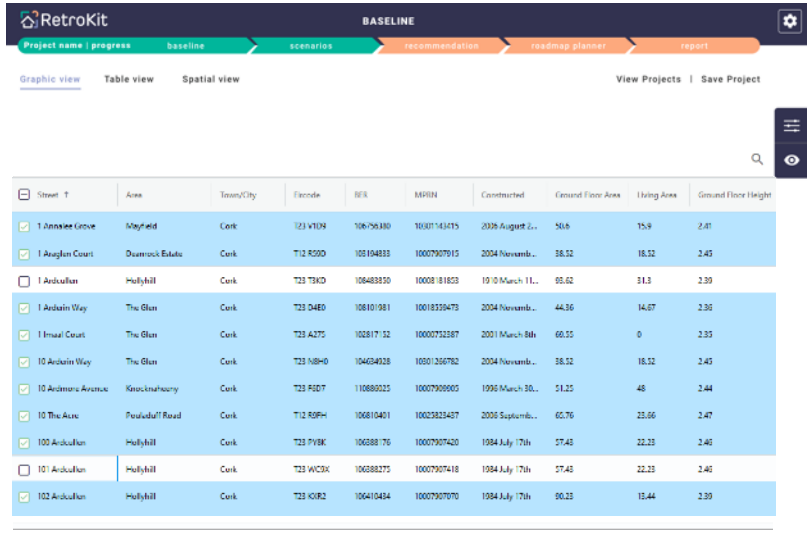
After adding their assets & XMLs, the user is presented with the homepage dashboard. This provides overview graphs for quick analysis of the entire stock using KPIs such as renewable energy output, energy usage, CO2 emissions, energy costs, BER rating spread, etc.



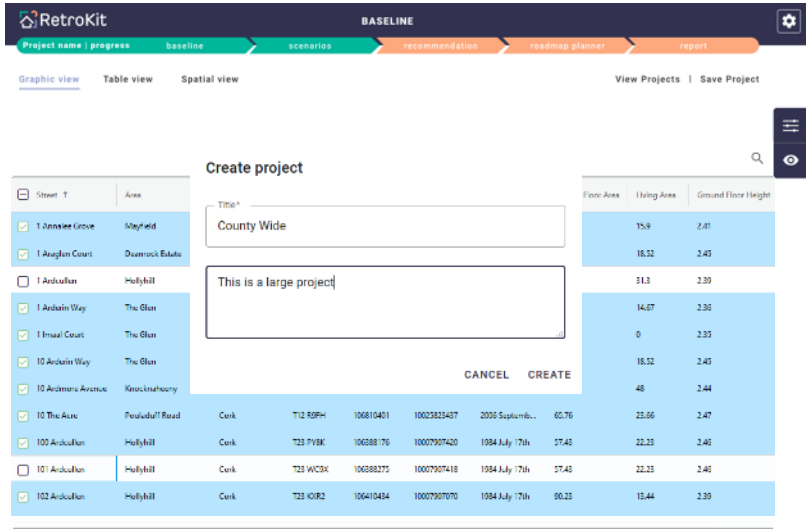
The table view provides a more detailed method of investigating your housing stock database, which can be searched using the bar near the top, filtered in the same way as in the graph view. Table columns can be easily sorted, re-organized and/or removed.

The map provides another useful way to view the housing stock
A selection of houses can be made by drawing a shape on the map
Each individual point on the map can be selected to see quick house info
Each district can be selected to see average info across that district. KPIs can be mapped at different spatial resolution (small area, electoral districts, city/county, etc.
The stock can be filtered by archetypes such as Age, Dwelling type, Construction Type, Fuel Type. The maps/graphs/tables update instantly to reflect the current selection of housing stock



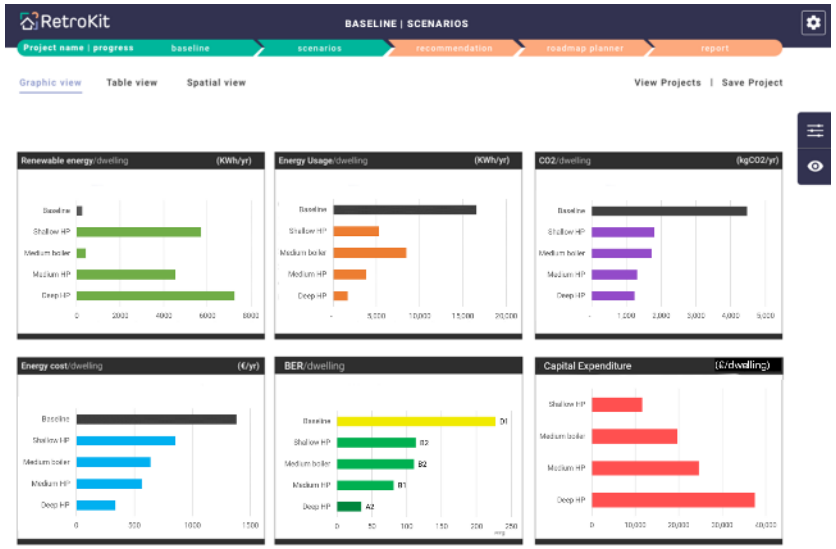


After making a selection of houses
- either using the table or the map
- the user can then either add their selection to an existing project or create a new project

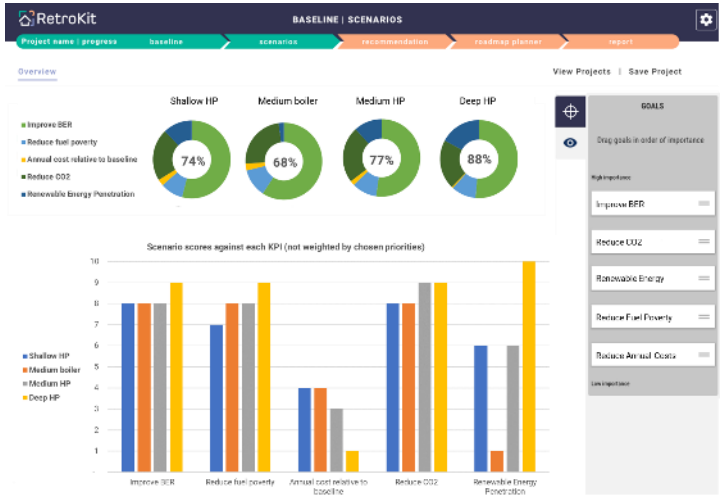


Each project is created and managed from the homepage dashboard. Here the user is adding a project title and brief description

The project management screen provides a quick way to manage all user projects. It is accessible from anywhere on the homepage dashboard

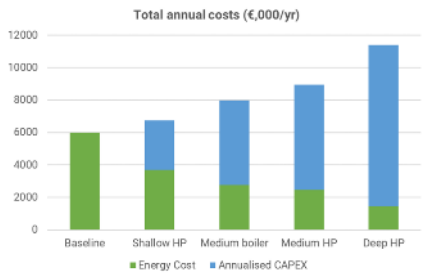


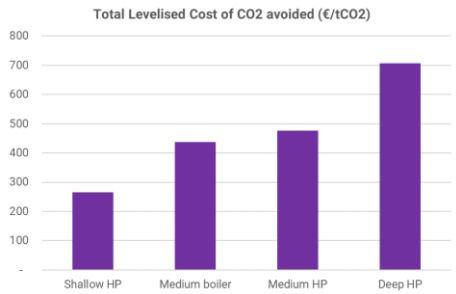
The next step was to analyse different energy retrofit scenarios and measure their impact against the housing stock baseline energy performance. Default retrofit scenarios (Shallow, Medium and Deep) can be customized to reflect the user's particular requirements.

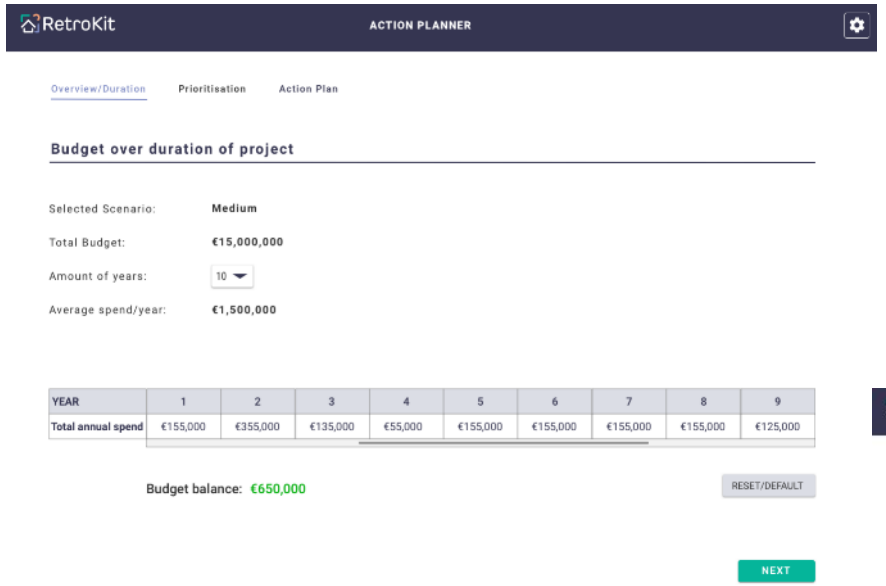


RetroKit's Scenario Optimiser enables a multi-criteria analysis of the scenarios. KPIs for each scenario are benchmarked against the baseline with a 1-10 score. The KPI scores are then weighted according to the order of priority given by the user to 5 goals reflecting environmental, economic and social objectives. An overall weighted score of 1 to 100% allows to quickly identify the optimal scenario given the user's decision-making priorities.

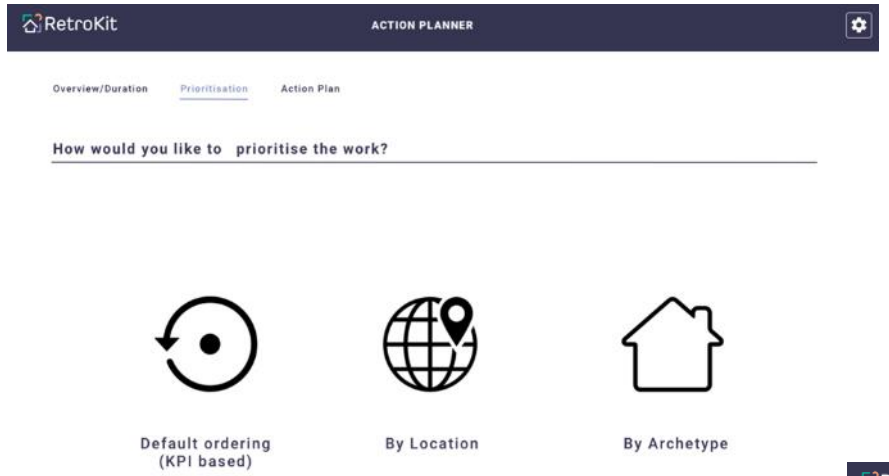
The user has the ability to download different datasets at different stages of the planning journey and carry out specific analysis e.g. annualized capital + energy cost comparison, levelized cost of CO2 avoided, etc.







Once a retrofit scenario has been selected by the user, RetroKit's Action Planner facilitates the creation of an action plan for the renovation of the housing stock over a period of time selected by the user (e.g. 10 years leading to 2030). The overall capital expenditure attributed to the selected scenario is distributed annually over the project duration, equally by default, or annual spend programme can be specified by the user.



The Action Planner then allows the user to prioritise the works across sub-groups of the housing stock to fit the annual budgets. The prioritisation can be done based on KPIs score, by location or by archetype.

The Action Planner then generates content which can be compiled into a work programme by the user including a) graphs showing annual progression of the retrofit plan and its impact b) tables listing the dwellings to be retrofitted each year c) maps showing the spatial distribution of workflow over the life of the project.

Case Study:
Housing Energy Retrofit Master Plan for Urban District in Cork City-North

Introduction to the housing stock

Baseline energy usage of the housing stock

Energy retrofit scenario analysis

Initial conclusions

RetroKit

Available on request: info@retrokit.eu

Case Study:
Housing Energy Retrofit Master Plan for Urban District in Cork City-North

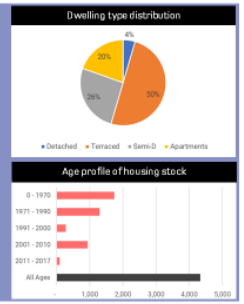
Overview of the housing stock

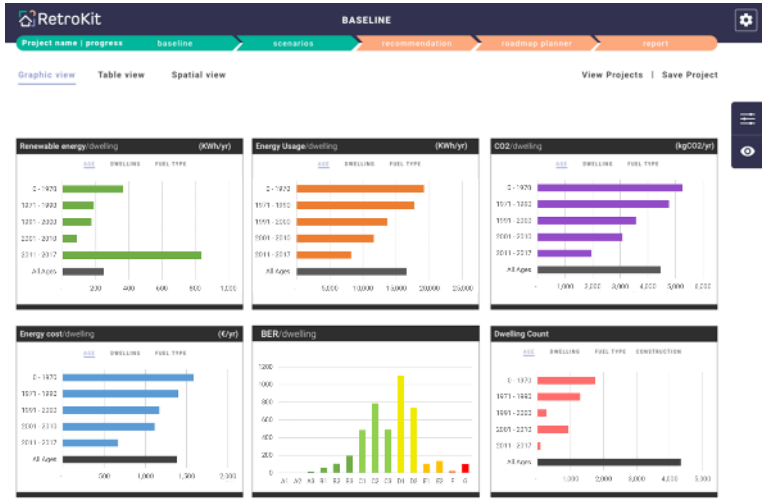
Population: 10,127
Pobal Deprivation Indices: 2 out of 4 electoral districts (50% population) classified as "disadvantaged"

Total housing stock: 4,333 dwellings, of which 27% is rented by the local authority and 2% by Approved Housing Bodies.

Typical suburban/urban dwelling type distribution with 50% terraced houses, 26% semi-detached and 20% apartments. The average treated floor area is 90 m2, compared to 120 m2 for the national average.

The main wall type in the study area is cavity wall construction (54%) and solid walls or hollow blocks (42%). Over 70% of the housing stock was built prior to the introduction of Building Regulations Part L (energy conservation) in the 90's.





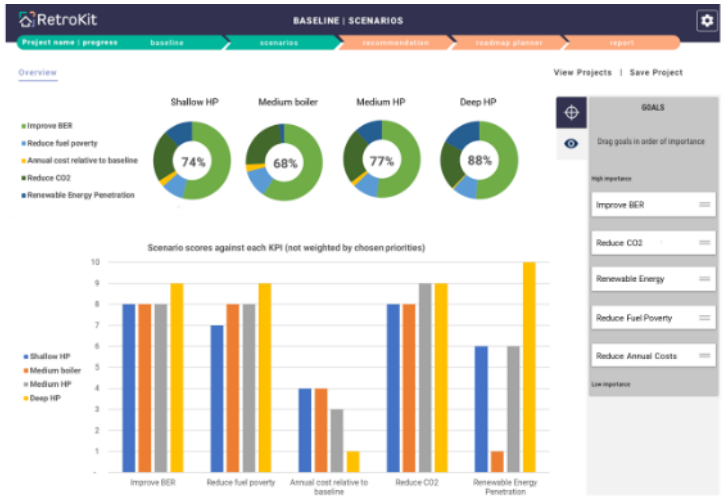
Energy Renovation Analysis

The next step was to analyse different energy retrofit scenarios and measure their impact against the housing stock baseline energy performance. While RetroKit generally presents the user with 3 default retrofit scenarios (Shallow, Medium and Deep), four customised scenarios were created to reflect different combinations of the measures funded by the Energy Retrofitting Programme of the Department of Housing. The objective was to achieve the B2 BER target or better, and to test the wide deployment of heat pumps in the housing stock of the study area. The table below presents the key measures included in each scenarios.

The next slide presents a screenshot of RetroKit's scenario analysis, comparing the post-retrofit performance of the housing stock post-retrofit with the baseline and between scenarios. Key impacts of the four scenarios are also highlighted.

	Insulation	Air tightness	Windows /Doors	Ventilation	Heat source	Heat Distribution Controls	DHW	Other
Shallow HP	Cavity walls/attic	Basic		Natural	ASHP	New rads and controls	New cylinder	New stove and LEDs
Medium boiler	External wall insulation & attics	Basic	Double	Natural	New condensing boiler	New controls	Lagging jacket	New stove and LEDs
Medium HP	External wall insulation & attics	Basic	Double	Natural	ASHP	New rads and controls	New cylinder	New stove and LEDs
Deep HP	External wall insulation & attics	Deep	Triple	Demand control	ASHP	New rads and controls	New cylinder	PV & New stove and LEDs

Multi-criteria Scoring of Scenarios



Initial Conclusions

	Price tag
Shallow fabric upgrade + heat pumps: • Can achieve B2 target • Most cost-effective approach • Risky in terms of thermal comfort & running costs	€12,000
Fabric first approach (medium scenarios): • Comfortably achieves B2 target • Big impact on fuel poverty (more than halves energy costs) • Big impact in terms of thermal comfort • Climate-proof with air source heat pump (B1)	€20,000 w. boiler €25,000 w. HP
Deep Energy Retrofit: • Eradicate fuel poverty • Full regeneration of your housing stock to NZEB standard (A2)	€40,000

Given these capital cost estimates, the current budgets for social housing retrofit fall below the ambitions of the Climate Action plan. Hard economic & climate policy decisions will have to be made to address the challenge.

The next steps

Dissemination activities

Kick starting commercialisation

Machine learning experiment

Future R&D plan

Dissemination Activities

Plenty of PR online and in print

Pitching to potential customers

Demonstrating building renovation passports

iBRoad
Individual Building Renovation Roadmaps

Contributing to the planning of the EU framework for national renovation strategies

IGBC
IRISH GREEN BUILDING COUNCIL

BUILD UPON²

WORLD GREEN BUILDING COUNCIL

ADVANCING NET ZERO

International networking

Presentations at conferences

Marketing Strategy


Strictly Private & Confidential
RD Sustainable Energy Consulting Ltd

RetroKit
Sustainable Energy Retrofit Toolkit

Business Plan 2019

Prepared by Susan O'Flaherty & Xavier Dubuisson – 19th August 2019

Contact: Xavier Dubuisson
Tel: 086/0476124
Email: xavier@xdconsulting.eu

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***Social Media**: LinKedIn, Twitter, Blog driving traffic to website (www.retrokit.eu)*

Referrals: We will work closely with our beta-customers and ask them to refer us to colleagues through direct referrals as well as generating interest through testimonials and case-studies;

Demo version (on-line):, initial demonstration rather than face-to-face meetings. We anticipate we would have to follow up with a face-to-face meeting;

Trade Fairs: a good way to meet potential customers especially in the housing association sector;

Conferences: As above - case studies could be showcased by customers at different conferences; The short explainer video on the website will be a useful tool to introduce RetroKit at Conferences and Trade Fairs

Machine learning experiment

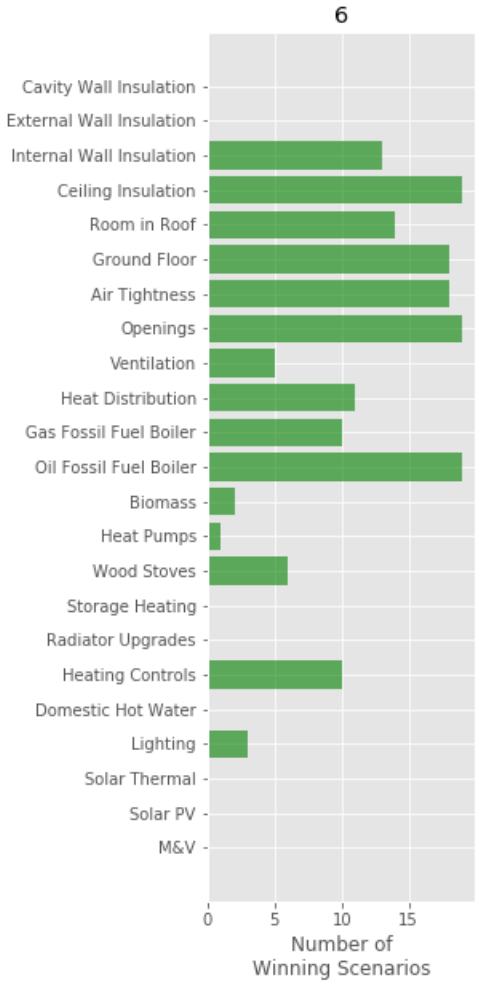
Scenario Optimisation Algorithm Development

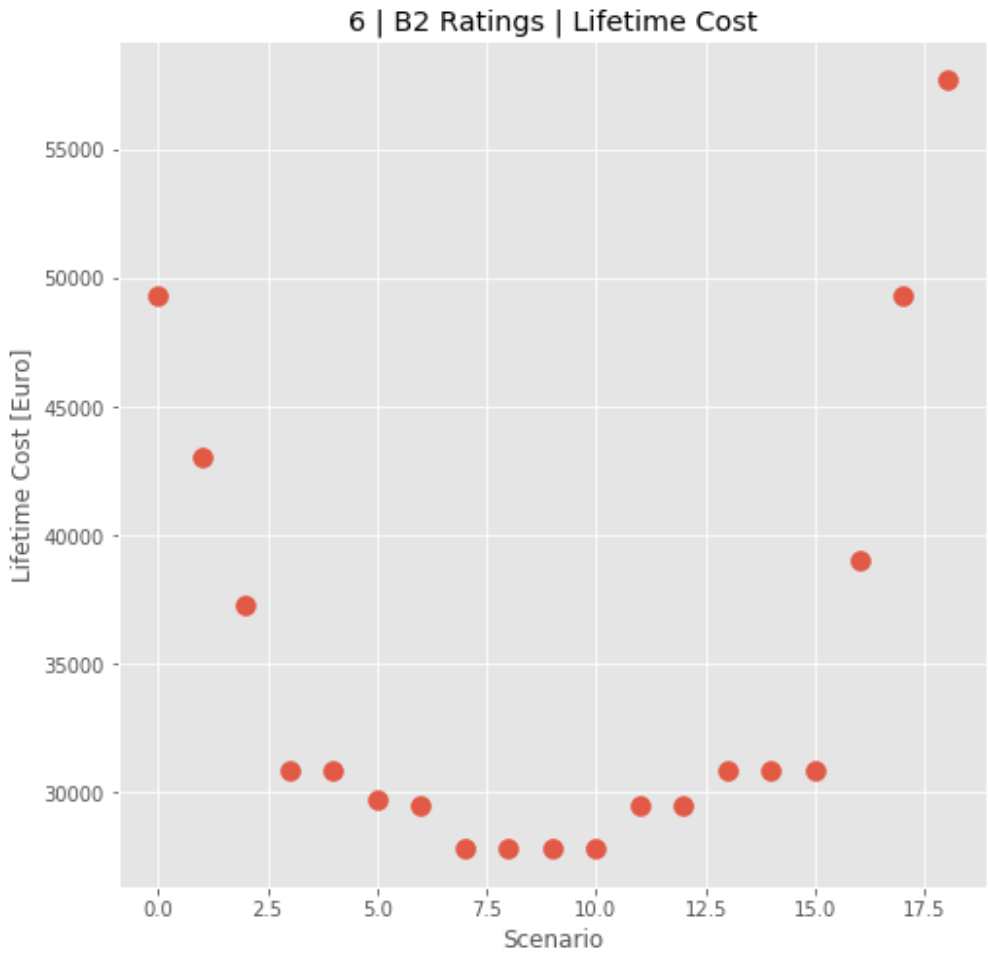
- Incorporating elements of Artificial Intelligence into the system
- Specifically relating to quickly identifying the ideal scenario for a house
- Use of Genetic Algorithms to perform Metaheuristic Optimization
- **E.G. – What's the optimal way to achieve a B2 rating?**

What is the Optimal Way to Achieve a B2?

Example Home ID -> 6

Age Band 1970 - 1990
Type Semi Detached
Heating Fuel Gas Heating
Wall Type Cavity Wall
Baseline Rating €2091pa
Baseline Opex F





Commentary: The graphs above show the top scenarios generated by the genetic algorithm.
The algorithm focus on fabric measures with a range of heating upgrade options (this includes switching from gas to oil).

Future RDD Plan

Integrate Heat Pump Readiness Indicator as a KPI in RK2.0

Based on successful testing as part of case study work

Scenario Customisation User Interface

Based on successful testing as part of case study work

Procurement Support Tool

Building on RK's bill of quantity to simplify retrofit works procurement

Progress Tracker

Monitoring project implementation & reporting (KPIs, spend, etc.)

Adapt to other EU countries

UK with integration of SAP and EU with other relevant EPC datasets

To find out more...

www.retrokit.eu
info@retrokit.eu

LinkedIn: https://www.linkedin.com/company/retrokit/about/
Twitter: @RetroKit_EU