

How does the project meet the challenge described in the competition scope?

Need

Reaching Net Zero goals will require Local Authorities (LAs) to engage, persuade and incorporate feedback from a range of stakeholders including funding bodies, planning officers and general public. Stakeholder and planning officer engagement is typically long and resource intensive and often leads to delays/resistance. The perceived visual impact of projects are often the cause of contention. 2-D GIS maps are the primary visual aid used in the stakeholder engagement process. These 2-D snapshots don't demonstrate to stakeholders what the project will actually look like, nor its impact on the surrounding landscape/streetscape. Due to a lack of an effective means of conveying project concepts stakeholders/planning officers often:

- have misconceptions/uncertainty about the project concept and its impact on the surrounding landscape/streetscape. This leads to resistance, delays and conservative decision making (i.e. concept rejection).
- can't raise issues or provide feedback early in the design stage which can lead to downstream (expensive) project risks

Two LA examples where stakeholder engagement is challenging include (there are many more):

- gaining planning consent/public acceptance of public EV chargers within listed and conservation areas (Oxfordshire County Council discussions). Plan refusals led to weeks of planning efforts wasted as well as delay in Net Zero progress.
- Local Area Energy Plans (LEAPs), which must be accepted by the communities which they impact. Stakeholder engagement can account for up to 50% of the cost/effort of a LEAP. The community engagement element of subsequent micro-LEAPs (below primary substation level) can be an even higher proportion leading to similar costs to a county wide LEAP (~£150k). It's estimated that the cost of these micro-LEAPs must be reduced by an order of magnitude to be scalable (Low Carbon Hub).

Solution

Space Clipper Industries (SCI) is developing a software tool to rapidly render 3-D visualizations of project concepts and the surrounding landscape/streetscape, aiding the stakeholder engagement and planning consent process for Net Zero planning.

It does this by ingesting the standard 2-D GIS files/data structures of project concepts and, via an automated tool chain, rapidly renders a high fidelity 3-D model of concept and landscape/streetscape. These renders can rapidly be updated to incorporate stakeholder feedback by altering the underlying 2-D GIS file or the 3-D model. The 3-D model can be used to output static images (from particular view points), video fly-throughs or walk throughs and even VR experiences.

It's estimated our solution could increase public EV charger consent in contested area by 15% and reduce the cost of the stakeholder component of LAEPs by ~20% and have many other use cases.

Project and Meeting Competition Scope

Our project will accelerate the planning and deployment of Net Zero projects by reducing friction/resistance to low carbon projects through effective stakeholder engagement, concept/visual impact clarity and empowering stakeholder feedback, thus aiding LAs reach their Net Zero Goals.

Within this project we will deploy and further develop our solution and conduct detailed/iterative testing and refinement with Oxfordshire Council Council as well as the 5 district councils within Oxfordshire (Customers/Users), broader stakeholder and end users (general public/planning officers). Testing will be conducted in real world environments on a mixture of historical and live projects around the specific themes of visualizing EV chargers within listed and conservation areas as well as visualizing projects within LEAPs and micro-LEAPs. These use cases are recognized priority areas for these LAs (and for many others). An iterative improvement, user-centric design approach will be used to focus R&D efforts towards addressing user and end user needs, developing an attractive value proposition and business model for both SCI and Local Authorities as well as ensuring rapid commercialization route post project.

What are the main technical challenges you are addressing?

Main Technical Challenges: Enabling

- clear communication/visualization, to key stakeholders, of low carbon project concepts and their impact of the surrounding landscape/streetscape.
- Scalability, by automating the production of 3-D project concept renders from toolset which planners use as standard.

- The approach to be performed rapidly/cost effectively so it can be used as part of standard engagement and multiple concept iteration rounds can be performed with stakeholders.

Addressing the Challenge: Our rapid/automated 3-D visualization engine enables:

- The production of high fidelity 3-D models of low carbon project concepts and their surroundings (landscape/streetscapes) from which static images, video fly/walk throughs and VR experiences can be produced.
- Scalability, by automated rendering of 3-D models directly from 2-D GIS files or data structures (2-D maps) which are the standard outputs in planning. i.e. allowing the planners (and non-planners, engagement/investment/public consultation teams) to easily use the tool and produce outputs for multiple use-cases.
- The rapid/cost effective production of 3-D renders by passing the input 2-D GIS files, or data structures, through an automated tool chain to produce the 3-D renders, utilizing low cost and high coverage datasets to produce the 3-D landscapes/streetscapes and utilizing scalable AI approaches to build 3-D element libraries (i.e. wind turbine/E.V. chargers) which will form the building blocks of the project concept.

Innovation Overview: Our first of its kind approach uses:

- generative AI (Generative Adversarial Networks) and procedural model to produce develop 3-D element models (e.g. wind turbines, E.V. chargers)
- A 3-D geospatial visualization engine (Cesium) to create a 3-D rendered landscape/streetscape (around a proposed project extent).
- A variety of novel methods to "map and interpret" features (attributed points, lines and polygons) from 2-D GIS files to geolocate 3-D elements within the 3-D landscape

We use these building blocks to automate the production of 3-D, high-definition, interactive visualizations of low carbon project concepts from standard 2-D geospatial files (maps). Manipulated data is fed, via automated data pipelines into the Unreal games engine, which renders the high fidelity 3-D, interactive, scene and provides the base functionality to output the static images, video and VR files.

Main Technical Deliverables:

- An extended 3-D element library incorporating elements required for our live trial of the tool

- Integration with the LENZA GIS tool via an API to allow a smooth workflow with a GIS tool commonly used by local authorities for net zero planning.
- An updated workflow and coded data pipelines to render 3-D landscapes and streetscape to match the fidelity requirements and cost requirements of the local authority use cases.
- A refined User Interface and outputs which match the needs of users/end users

R&D to prove the merit of the project:

Scientific-Merit: will be proven by our 3-D model renders and outputs meeting the fidelity and accuracy requirements of our users and end users within our live trial environments.

Commercial-Merit: will be proven through validation that the tool addresses user/end user needs and pain points, a value estimation to users/end users within the live trial and validated business models from both Space Clipper and the Local Authorities(user)

Environmental-Merit: will be proven as part of the value estimation exercise via a validated estimation of the acceleration in uptake of low carbon solutions vs a base-line scenario.

Deployment Impact:

- More efficient stakeholder engagement leading to reduced stakeholder and public consultation time (20-25% initial LA estimates)
- Increased buy in from local communities and reduced downstream risk of low carbon projects through improved concept clarify and feedback from early project stages.
- A reduced rejection rate of low carbon projects in listed and conservation areas due to impact clarify to planning officers (10-15%)
- Freeing up of LA resources and budgets

Are similar products currently available in the market?

Current State of the Art and Limitations

2-D GIS maps are the standard visual output for conveying project concepts to stakeholders (potential investors/funders, the general public) and planning officers. These 2-D snapshots don't convey what the project will look like nor impact on the surrounding landscape/streetscape.

3-D Lidar point clouds or drone footage of existing projects can be used to provide an idea of what historical projects look like, but they are not specific to the project/landscape in question and different options can't be visualized.

3-D CAD can be used to draw 3-D scenes, however, they are expensive to create, not scalable and CAD expertise is not typically included in most geospatial planning teams.

There is some early adoption of games engine technologies for planning, for example through experiments with BIM integration. However, these are mainly for improved rendering over CAD models and don't allow cost and scalability benefits which our approach enables.

Product Differentiation: Our Solution:

- Fills the gap between what planning teams output as standard (2-D GIS maps) and the 3-D renders of project concepts in a 3-D geolocated landscape/streetscape by using the 2-D GIS files as an input to rendering the 3-D project concept.
- Allows for the rapid generation of new 3-D elements via generative adversarial networks or direct CAD imports allowing us to address 3-D rendering across multiple sectors at scale.
- Is cost effective and easy to use, and hence scalable, enabling it to be used in standard workflows and by existing geospatial planning teams.

Existing IP and IP Strategy:

Space Clipper utilizes 3-D party software tools and datasets as part of its automated toolchain. Comprehensive checks have been made around license conditions, attribution, integration and commercialization requirements. These tools allow for considerable freedom to operate, integrate, contribute additional functionality (which formed part of their selection process) and commercialize the outputs. Space Clipper owns the IP and rights to it owns code base and associated documentation for the 3-D visualization engine and will own the IP produced as part of this project. It also has attribution rights for outputs created by the tool.

Maintaining Freedom to Operate: Space Clipper

- Uses clear and strong confidentially and subcontractor agreements as standard with clear statements around IP ownership, IP rights and indemnification.
- creates and maintains clear documentation and evidence of background and foreground IP

- will resolve IP disputes through a staged approach of informal resolution, mediation and litigation

A clear IP Strategy has been developed to both protect IP as well maintain freedom to operate.

Novel Concepts/New Approaches, Tools & Technologies:

Our solution incorporates a number of novel concepts, approaches and technologies:

- The ability to map 2-D geospatial features (points, lines, polygons) and their attributes to geospatially position, orientate and distribute libraries of 3-D elements on a 3-D landscape, through a mixture of rule based, analytical intelligence, procedural and AI based methods.
- The use of generative adversarial networks (as well as other approaches such as procedural methods or CAD imports) to rapidly create 3-D elements to populate our element libraries.
- Via our novel approach the ability to apply games engine technology across multiple planning sectors at scale.

These approaches enable high-fidelity, cost effective and scalable rendering of 3-D project concepts and the surrounding landscape/streetscape as well as a user friendly approach to 3-D Model generation and integration into the existing planning process

Describe your project plan and identify the main milestones.

Key Resources: Critical Senior roles/human resources have been identified including key Local Authority (LA) roles. Project resource requirements have been provisionally incorporated into company resource forecasts. Key datasets/data routes have been identified and access assured. Scalable compute infrastructure is in place.

Main Success Criteria (SMART milestone links in appendix):

- User/end user needs/pain points have been addressed proving the value proposition
- The delivered User Interface/Outputs meet user/end user needs
- The refined tool is proven to deliver significant user/end user value in live trial environments
- There is an integrated workflow with LA existing GIS tools

- A clear business plan is developed for Space Clipper and LAs

Project Management Processes:

Space Clipper employs a comprehensive project management and reporting system that is robust, flexible and responsive to changes in project scope, opportunities, challenges and learnings from our agile continual improvement process.

The wider team will hold bi-weekly delivery meetings and sub-teams will update daily on technical progress, providing regularity of feedback and clear management reporting lines. Tasks are "ticketed" and formally tracked through web-based GitLab task-management system, providing a full audit trail of tasks, linked to 12 key milestones, KPIs, deliverables and risks.

Leads for each work package have been assigned. The project manager will form the focal point of reporting having oversight through clear/transparent/regular communication/documentation channels. Project assurance and problem escalation will be delivered via our project board.

Demonstrating Technical & Commercial Feasibility Plan: 12 project SMART milestones have been defined(see appendix). Technical feasibility will be demonstrated through development of high fidelity 3-D landscapes/streetscapes(MS4), 3-D element generation(i.e. E.V. chargers/electricity pylons)(MS6), integration with a GIS platform (LENSA) to prove scalability and integration with existing work flows(MS7), culminating in the ultimate test via live trials in a real environment(MS9).

Commercial feasibility will be assessed via a validation that the tool addresses user needs/pain points(MS10), evidencing the value to users/end users, business models created by both Space Clipper and LAs as well as a clear commercial roll out plan(MS11).

Development in a Real World Environment Plan: is assured in Work Package 6 (See appendix) where the visualization engine will be tested on 2 Oxfordshire County Council (OCC) Projects, with the tool outputs being actively tested, evaluated, refined and validated by users/end users in both planning and public consultation environments. Insights collected will inform value creation estimates, value proposition validation and the commercialization plan(work package 8).

Risk Management Approach: A comprehensive risk management process will be utilized allowing individual risk events and overall project risk to be understood and managed proactively, optimizing success by minimizing threats and maximizing opportunities and outcomes. Key risks are scored in the appendix.

Key Risks Summary:

Technical: high data costs leads to too higher price point and a lack of integration with existing workflows leads to lack of uptake/scalability

- Mitigation: engage users to find the right balance of fidelity vs price point and we have subcontracted Advanced Infrastructure Technology to integrate with GIS platform "LENSA" which many LAs use.

Commercial: LAs do not perceive the tool to have sufficient value to purchase it.

- *Ensure accurate LA needs/pain points capture, continuously testing/refining our solution with LAs to ensure these are addressed.*

Environmental: LA budgets are further constrained leading to less budget to purchase software tools

- *Within the project we will calculate and disseminate cost/efficiency improvements by tool use vs tool cost*

Engagement: LA stretched resource leads to reduced commitment and an incomplete capture of pain points.

- *We have subcontracted OCC to ensure time commitment. Multiple LAs have been engaged and agreed to provide time commitment. A robust, engagement plan will ensure work loads will be spread across LAs with redundancy across roles.*

Who is in the technical team?

Organizations Involved & Time Commitments:

Space Clipper Industries (SCI): Lead: 153 days: Developing, testing, refining the 3-D visualization tool and commercialization approach.

Oxfordshire County Council (OCC): Subcontractor: 21 days: Beta tester of the tool across 2 live trials. Developing the business case from the local authority viewpoint. Facilitating access to stakeholders and end users. Providing key input datasets.

Insight6: Subcontractor: 8 days: Providing specialist stakeholder engagement and business development support and to de-risk and help upskill SCI's new business development hire.

Advanced Infrastructure Technology (AIT): Subcontractor: 28 days: Enabling integration into LENZA GIS tool, the current GIS tool many local authorities use for net zero infrastructure planning.

Local Authority (LA) Partners & Commitment Level

The roles of OCC is outlined above with subcontractor commitment from OCC, ensuring input from the Energy systems, engagement and Zero Emission Vehicles teams.

2 clearly defined use-cases have been established with the LAs being both users/customers of the tool (with additional potential use-cases identified. e.g. Local Nature Recovery Plan stakeholder engagement)

OCC have provided a clear intent to integrate the tool into its workflows and utilize its outputs. OCC facilitated the onboarding of subcontractor AIT to enable integration with existing GIS tool LENZA. The business models developed in the project will determine the procurement route.

OCC will facilitate wider LA involvement to ensure maximum uptake/impact across LAs.

End User Access: OCC will facilitate access to end users both within the live trails and more generally across the project. Support will include credibility association, direct introductions, workshop facilitation, sit in sessions as well as direct output testing & feedback.

Skills/Capabilities/Experience

A highly capable, experienced and well balanced team has been assembled for project delivery. A skills matrix was used to assess key skills requirements (including soft skills). Members were selected based upon skills fit, experience in project delivery and required role, resource availability, skills redundancy and company policies.

Project Manager / AI Lead: Andrew Allen (SCI): 10 years experience leading, project managing, delivering a diverse set of R&D projects across roles. Expert in AI, developing approaches used in 3-D for element generation & high fidelity landscape data infilling. (60 days)

Technical Lead: Bob Merrison-Hort (SCI): Experienced full stack developer, developing software products from inception, through testing and operational deployment. Highly skilled/experienced across UI/UX, games engine development, data pipeline build out & integration as well as user testing. (55 days)

Stakeholder Engagement/Commercialization Lead: Rhian Huxtable (Insight6): 15 years experience across stakeholder research, customer insight & business development. (8 days)

Business Development Researcher: New Hire (SCI): Mid-level BD researcher to aid developing and operationalizing the SCI business case. The role will be de-risked via subcontractor insight6 helping to upskill the new hire. (43 days)

GIS Integration Lead: Lily Cairns-Haylor (AIT) & Team: (28 days): LENZA product lead with specialist expertise in user centric design, integration and practical functionality.

Energy Systems & Investment Manager: Mark Saunders (OCC): Leads Energy Systems project coordination and Local Area Energy Planning (LAEP) at OCC. Mark & his team will act as beta tester of the tool and facilitate the LAEP stakeholder engagement live trail) (11 days)

Zero Emission Vehicle (ZEV) & Energy Integration Lead: Paul Gambrell (OCC): Leads the ZEV team and their integration to energy systems at OCC. Paul & his team will act as beta tester of the tool and facilitate the E.V. charger impact in listed can conservation area live trail) (11 days)

What is the commercial potential of your project?

Commercial Potential (Public, Private, Domestic/International Markets)

Initial Target customers: Local Authorities(LAs) for stakeholder engagement/visual impact assessment on Local Area Energy Plans (LAEPs) and Public E.V. charger deployment.

Follow on Target Customers: Renewable Energy Planners, Energy System Operators (ENOs), Public E.V. Charge Point Planners in domestic/international Markets.

End users include: Local Authorities/Government planning officers, the public, investors, land-owners

LAEPs Broader Market to 2035: ~330 LAs * £150,000 (per LAEP) = £49m

Public Charge Point Deployment Planning (PCPDP) to 2030: ~ 225,000 (Gov target) * £6,000 / 10 (chargers per plan) ~ £135m

Renewable energy broader market to 2030:

- UK (Clean Power 2030 Action Plan, wind + solar) ~16% CAGR. 43GW additional capacity = ~£50bn (~£10bn p.a.)

- International (S&P Insights, wind + solar) ~14.8% CAGR. 4.5TW additional capacity=~\$1000Bn (~\$200bn p.a.)

Addressable Market:

Initial Target:

- LAEP addressable stakeholder engagement ~10% ~ 4.9m to 2035
- PCPDP: 5% in contested area with 15% application improved outcome ~£1m to 2030

Follow on Renewable Energy: Community engagement/Communications, marketing, landscape assessment, due diligence cumulatively account for ~0.5% of Capital/installation costs. Upper-bound addressable UK Market ~£50m p.a. International ~\$1.Bn p.a.

Short Term Delivery Plan (Months Post-Project)

- Month 3: Private finance raised for team build out.
- Month 5: Improved LENSEA integration compete with supporting schema updates/broader 3-D element libraries
- Month 9 : Live trail round-2 complete with new LA testing end-to-end service with documentation/support services.
- Month 10: 3-D element request service deployed allowing user to request particular 3-D element generation
- Month 12: Two project led sales to LAs complete (Space Clipper operating the tool). Customer willingness to pay validated (MRL-6)
- Month 14 post project: Tool deployed for limited use-cases

Expected Route to Market

Initial Targets Markets/User: as defined above

Distribution/Sales Channels: Through

- introductions from LAs, via attending/marketing at relevant events and inside sales through demos/webinars.
- leverage our LENSEA GIS platform integration to use Advanced Infrastructure Technologies (AIT) existing channels (e.g. Energy Network Operators)

Pricing: Strategy be will refined in this project and follow on testing. Value added/cost saving estimates will provide the upper pricing band per use case. Penetration pricing will be used to gain early market traction. Customers will pay a basic monthly subscription, then pay additional fees to unlock bundles of 3-D element models.

2-year post project: 40 LAs onboarded & ~30 Renewable Project Planners and 1 ENOs. Revenue~£400,000 p.a.

5-year post project: 7 integrations with GIS providers in both domestic/international markets. High penetration into domestic LA projects, larger renewable energy projects and ENOs. 70% revenue from international private sector sales. Revenue~£8million p.a.

Competitive Advantage: Our Solution

- Bridges the gap between the standard outputs that geospatial planning teams produce and what stakeholder engagement, public consultation and marketing and sales teams need through the conversion of 2-D GIS maps into 3-D high fidelity immersive content of project concepts and the surrounding landscapes/streetscapes.
- Allows this 2-D to 3-D conversion to be done cost-effectively by utilizing an automated tool chain, high coverage & cost effective datasets as well as a novel process for 3-D element creation.
- Allow this to be done in a scalable way through an easy to use automated process (which existing planning teams can use), integration with existing workflows and GIS tools, and use of games engine technology to allow efficient 3-D rendering of projects of multiple scales.

Existing Commercial Relationships:

- Oxfordshire County Council is being onboarded into our beta testing community (and potential customer base) which also includes Treestory, Heart of England Forestry and Lighthouse Planning Ltd (The latter being a renewable energy project planning consultancy).
- AIT is being onboarded to develop a strategic partnership with an existing GIS provider who provides geospatial planning tools to LAs.