FuturEnergSystems (FES) vision for Digitally Engineered Solutions for Clients
Liam G O'Sullivan 30th March 2024

Hard and soft benefits of Digital Design, Engineering and Construction Methodology Assessment

Digital by Design - The BIM 'eSCape' Lifecycle Infographic -
ExergInc/FuturEnergSystems Digital-Engineering Infographic

THIS DOCUMENT SERVES AS A SHORT AND NON-EXHAUSTIVE BRIEFING NOTE ON THE DIGITAL ENGINEERING JOURNEY WE HAVE BEEN ON AS PROFESSIONALS IN OUR CURRENT ROLES AND IN OUR COLLECTIVE CAREERS TO DATE.

It outlines the current use and application of these tools and our future journey and road map to become an 'intelligent contractor', intelligent client, and intelligent partner.

The '4th industrial revolution': the key enabler for releasing untapped benefit - the use of digital engineering techniques applied to our built environment from the initial production of preliminary sketch-ups for awareness and visibility to the full build out of a digitally mastered design for construction, operation and maintenance – created and designed with construction and delivery as a critical aspect of the output and design of the schemes and layouts for new and existing asset development and design.

All future designs would also have this key outcome reinforced – thoroughly and robustly design tested constructability and deliverability validation – ALL as part of our offering.

In addition, as outlined, our aim and roadmap is to provide:

Fully digitally engineered solutions to c. BIM L4 - **4D/5D** ~ 10D digital twinning (with operational and maintenance attributes), including:
- Grid Integration – studies, physical, connection, attribute level.
- Augmented virtual reality.
- QR etc. code mapping.
- Integration to asset registration systems. Attribute linked assets to asset register.
- Design and operational documents asset linked – available in the field to operational ENGINEERS AT THEIR FINGERTIPS.
- Phased construction AND BUILDABILITY sequencing analysis and DEPENDING ON THE ABILITY AND MATURITY - BoQ's as an output etc.
- Integrated trades design in 4D not just flat design.
- Integrated E/HV layout design.
- Point to point cabling design and arrays, linked to:
    Schematics, key line diagrams/single line diagrams, multicore block diagrams, integrated core sheets, terminate schedules and wiring diagrams involving all field, auxiliary and balance of plant.
- Full physical attribute tracing, mass, volume, length etc.
- Defect mapping and tracing, technical limitation.
- Obsolescence, defect maintenance tagging and location.
- Snagging list tagging and location to precise location – regret and rework costing information.
- Significant cost optimisation and reduction in costs across the full life cycle design, construction and implementation.

- 3rd party and emergency services immersed familiarisation. Reduce response times and risk profiles.
- **4D** clash detection – reduce design rework costs and site works rework costs.
- Specific asset attribute civil and structure design – e.g., optimised rebar, structure and column placement, and materials selection for optimised designs.
- Better scheme drawing traceability and coordinated control, issue and reissue, viewing, comment marking etc.
- Reduction in future maintenance and operation costs – no wasted visits and all assets are attribute linked. Optimised fix, and fit and forget renewal and replacement strategies.
- Whole-life asset lifecycle – robust adherence and compliance with HSE Regs, CDM Regs, through to decomm and reuse, upcycle. Asset tagging for life means lower risk and inherent, and residual asset value. Reduction in Insurance premiums.
- Robust value assessment and evidence for asset value and asset write off/run down valuations – Regulated and unregulated business requirement.
- Reduced insurance premiums.
- Inherent, latent and ongoing risk management, allocation, optimisation and understanding.
- Retrieval, incontrovertible and immutable robust evidence to Ofgem on the cost, price and value of assets at build stage, and throughlife regulatory cycles leading to ED3, 4 etc surety and confidence.
- Optimised HSF inclusion and completion which is NEVER lost!

4D: We can use a variety of packages to integrate design and construction execution models with say an Enterprise Microsoft Project programme, Primavera P6 schedule, Advantages of this are many. This is just a favour.

5D: Revit gives us the ability to produce all sorts of schedules but generally in a messy format. We have not explored the add-ons that for example generate an SMM6 style BoQ - we have inhouse Civil & Structural Engineering and Quantity Surveying capability, with ECI (early contractor involvement) then we can work with the in-house surveyors to see what value we can lever out of the model. For example, steelwork fabricators already take our Revit models and/or our Tekla Structural Designer models and input them into their Tekla fabrication package to automatically generate steelwork quantities. If you extend that to other parts of the project, then will you get keener pricing as they carry no measurement risk and don't have to spend time 'taking-off'. The last benefit is huge with as-builts. We can add a lot of inherent intelligence from the model to output at the as-built stage. Simple example: clickable links in pdfs etc.

3D: Using Revit, we produce **3D** models which will be as close as we can get to a Digital-Twin of the future substation. We will issue simple to use viewers so people can cut their own sections or isometric views, they can virtually walk round the substation and at a glance see and understand the proposal without having to first study a pile of detail drawings though these still have a place in the review process.

We want the **3D** process to form part of the review process from an early stage as it will significantly contribute to making sure that the building fulfils the Client's needs over the next 40 to 60 years. Building it virtually also means that it can be assessed for buildability, optimisation and efficiency so much easier.
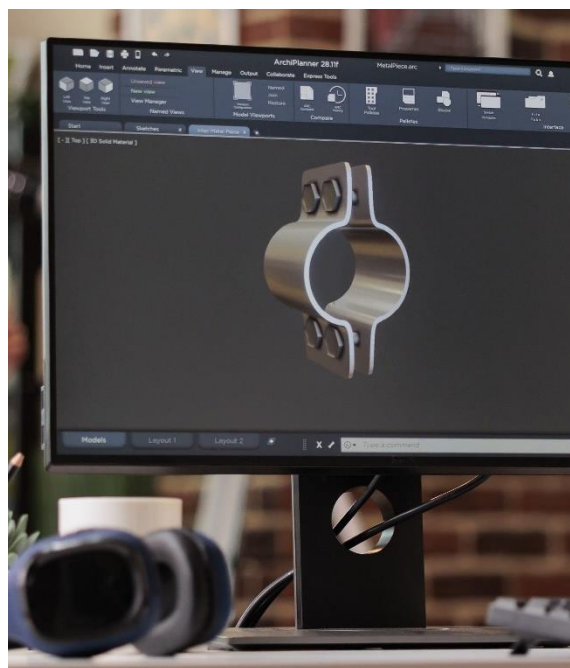
From our standard Revit model, we can produce schedules showing quantities, volumes, weights, materials, fire rating, finishes, etc. Any data that is required for the design or construction. We can perform clash detection to find clashes between models produced by different disciplines and create federated models that are parametric and quick to amend whenever necessary. We can produce flyovers, renders and walk-throughs for commercial purposes. With the help of Lidar scanning, we can model site terrain with high accuracy to calculate volumes of excavated soil. With point cloud survey we can create an accurate model of existing site conditions (existing buildings etc.) and see how the new structure will be situated within the existing environment. Creation of documents for compliance with ISO 19650 such as: BEP, EIR, OIR, MIDP, TIDP, etc.

If required and decided as beneficial and value effective, we can take the whole process further moving into **4D** or **5D** BIM.

With **4D** we can create a construction time simulation of a complete site model with individual buildings and site equipment. This will provide invaluable information for design team meetings where the overall process can be discussed, assessed and made more efficient. Thanks to **4D** design we can determine critical path, create construction sequences and speed-up the construction process. Overall product: Gant graphs with construction programme for site & project managers - would require the purchase of an add on such as Bentley Synchro (we can link that into MS Project).

With **5D** - We can feed data into systems such as iTWO costX to produce data input for more detailed cost estimates (this would require the cooperation of the Quantity Surveyor or Estimator). Revit has powerful scheduling tools, with add-ons we should be able to work with your Estimators/ Quantity Surveyors to produce bills of quantities, there is the potential for two way links so that you can more closely follow how the cost changes during the design phases as amendments are implemented and to follow how the money is spent during the construction phase. We can use this tool for value engineering. Coordination – Implementation of CDE and coordination platform such as BIM 360 to provide smooth coordination between site, management and design team. Tracking changes, communication and responsibilities for the entire project. RFI's recorded and connected to the specific **3D** element in a **3D** model. Latest drawings and models available at any time to any designated member. No more lost or forgotten design changes as drawings are moving across communication channels.

As-Builts: with model and modern IT systems which are developed enough, Revit does enable us to embed a lot of intelligence in the model and in drawings. A simple example would be that we can make all sections clickable so when you are looking at a PDF plan and click on a section marker then the pdf drawing with that section opens. This can be extended to embed plant information etc. providing that the IT system can keep up. This is unique and powerful for immersed site inductions and at various stages of the build, leading to better control and mitigation of risks.

We at FES are looking to develop our solution so that control engineers and DMS systems can integrate with the as build models for awareness, ESQC Regs adherence, and fault and error awareness and detection – to enable appropriate and priority response to a control system alarm, creating a more intelligent response and optimised and efficient manner to manage assets on the network. This area is particularly exciting: full asset and systems integration across the ecosystem and ecospace for a DNO, enable truly smart networks for the transition to DSO.

Full asset data becomes uniquely valuable, not just for the electrical assets but also for the physical assets in which they are placed, which is an enabler to the lifecycle to own, operate, maintain and decommission and remove – as valuable as the asset itself? Link this with Edge Computing, AI and Machine Learning – what could we achieve? What could we develop? This is very attractive to a number of industries also with electricity transmission, and distribution, and energy systems as a whole.

Digital by Design - The BIM 'eSCape' Lifecycle!

Bold Ambition - this is what sets ExergInc and FuturEnergSystems (FES) apart from ALL our colleagues and competitors!!

WHAT ARE WE WAITING FOR!!??