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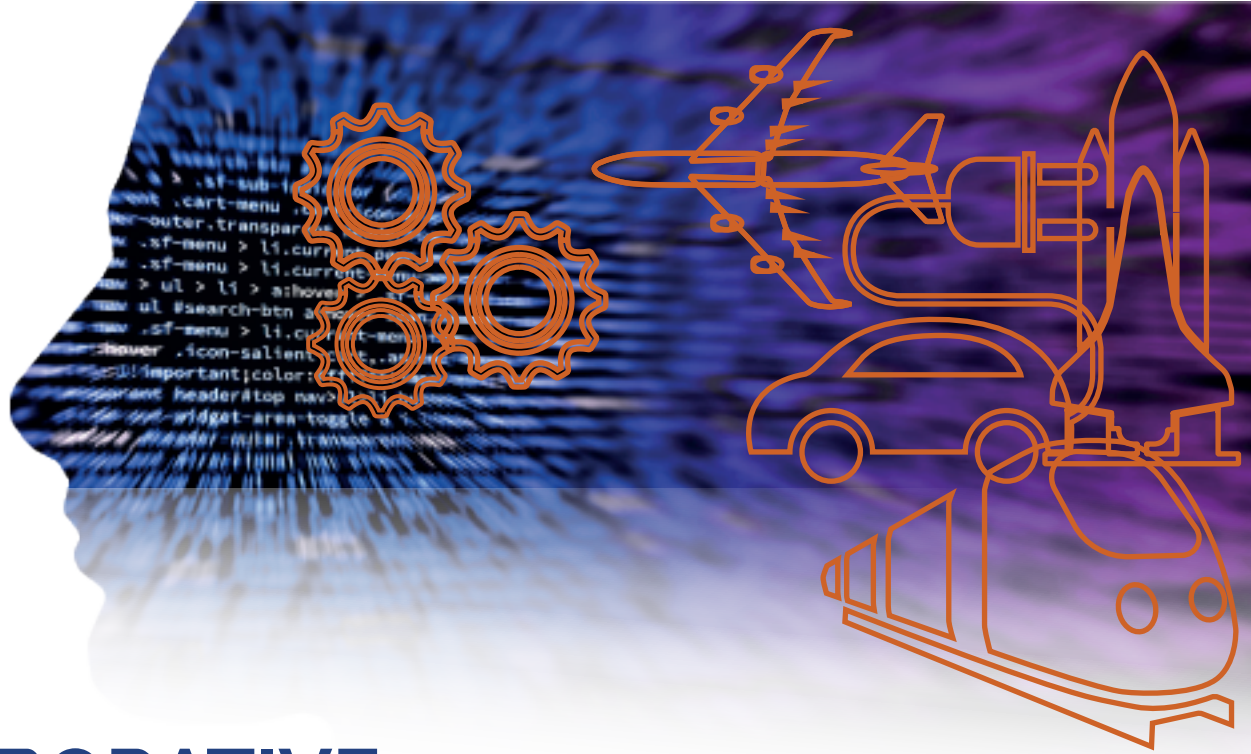
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SyntheSys
T E C H N O L O G I E S

Letter from the MD

Mark Williamson, Managing Director
SyntheSys Technologies

Summer/Autumn 2022: Issue 9

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Creating Innovative Value through Collaboration

As the UK Summer firmly takes hold, I'd like to welcome you to Issue 9 of OptimiSE magazine by commenting on what has been a successful start to the year for SyntheSys Technologies. Our new and existing customers never cease to amaze me, and I feel privileged that we collaborate with so many dynamic and innovative engineering organisations. Growth has been a real driver for us of late and it's our tenacity in reaching corners of new markets which is giving us the opportunity to speak to new and interesting organisations.

The demand for systems engineering training is at an all-time high and I thank those who have attended our training so far this year. We have delivered a record number of classroom courses in the first half of this year, most notably the training we have delivered overseas. Please see Page 4 for the remaining 2022 dates for our Introduction to Systems Engineering and International Council on Systems Engineering (INCOSE) Certification examination preparation course.

It's fair to say this latest magazine has somewhat of an 'Energy' theme to it, but we hope those from a range of industries will benefit from what may be common cross-domain engineering challenges. We put the spotlight on 'Net Zero' on Page 8 which is followed with some insights from a recent customer project.

Our Gold IBM® Business Partner status still drives much of what we do, so naturally, we have included a solution tour which gives an overview of why the IBM® Engineering Lifecycle Management suite is superior to other comparitive engineering applications.

I'd like to finalise my letter today by letting readers know that we will be exhibiting at this year's INCOSE Annual Systems Engineering Conference (ASEC), details of which can be found on Page 4. If you plan on attending, please do visit the SyntheSys stand.

I hope that OptimiSE continues to prove to be useful and enjoyable within the engineering, systems and software development communities. I welcome and encourage you to subscribe to receive future issues directly to your mailbox at www.optimiseSE.co.uk

Very best regards,

Mark Williamson, Managing Director
SyntheSys Technologies

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SyntheSys Technologies is Recruiting!

We have an excellent opportunity for a Systems Engineer / IBM® Engineering Lifecycle Management Technical Specialist.

This is a remote working role, however the work may involve on-site work for our clients within the UK and occasionally abroad.

This Systems Engineer role is customer facing, which provides enriching opportunities to work with our customer base during the pre-sales, deployment, configuration, training, and support phases of customer contracts. Experience of Model Based Systems Engineering, as supported by the Rhapsody® application would be an advantage. You will also need an understanding and experience of: the IBM® Engineering Lifecycle Management tools (DOORS®, Engineering Workflow Management, Rhapsody® and Engineering Test Management).

Systems Engineer

To register your interest in this role, or to have a more in-depth discussion about this role please contact Mr Mark Williamson on: +44 (0) 1947 821464 or send us an email at: recruitment@synthesys.co.uk.

For general information about current vacancies, visit: http://www.synthesys-technologies.co.uk/careers.html

SyntheSys Sponsors this Years 'STEAM Challenge' with Caedmon College Whitby

After a hiatus due to the pandemic, SyntheSys is delighted to announce it's continued sponsorship of this year's 'STEAM Challenge'.

The STEAM (Science, Technology, Engineering, Arts and Maths) Challenge, formally the 'STEM Challenge' was created by SyntheSys in 2018 with the aim to give talented youngsters the opportunity to impress by putting contemporary challenges and themes in the spotlight. The challenge tasks students with researching their chosen subject of interest. Then showing their findings by creating an informative presentation which will be assessed by an internal and external panel.

Since the challenge was created, we have seen growing engagement and some amazing projects along the way.

We are extremely excited to see the creative projects that this year will bring.

The competition started at the beginning of June and all entries are to be submitted by the 1st of July with the presentation of the projects occurring the week after. To keep updated with the progression of the STEAM Challenge, following our LinkedIn page: https://www.linkedin.com/company/95848/

IBM® Engineering Lifecycle Management (ELM)
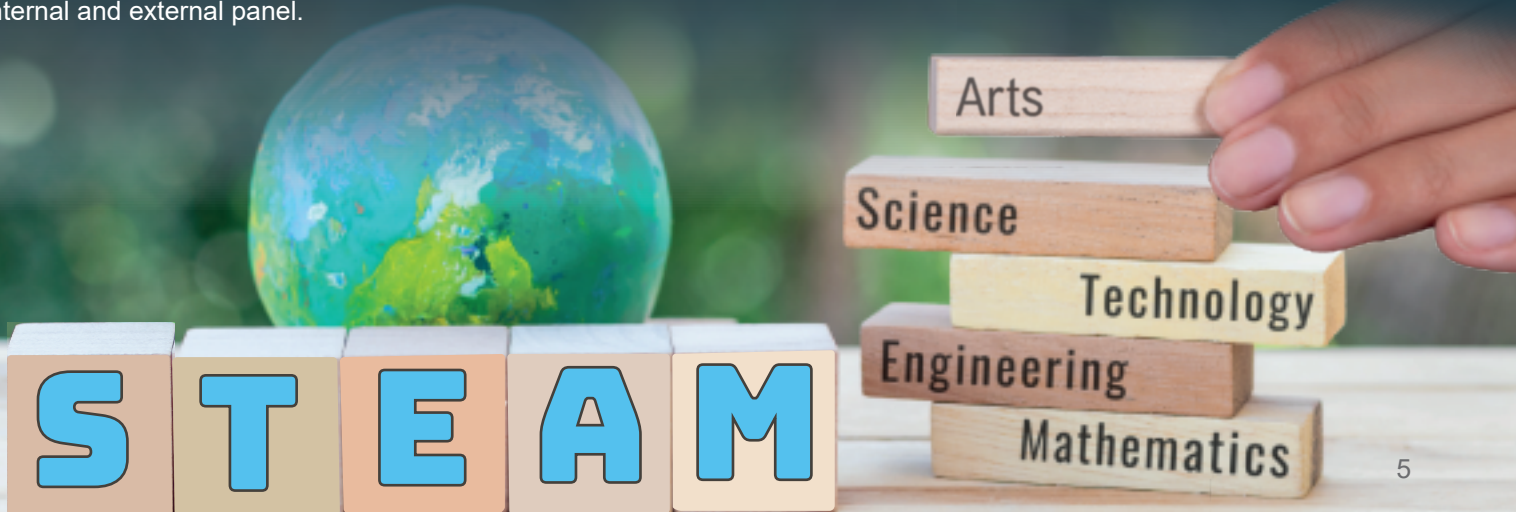
PRODUCTS & SYSTEMS DEVELOPMENT WITH ENGINEERING LIFECYCLE MANAGEMENT (ELM)

To cope with rising product complexity and significant amounts of data, modern engineering teams must improve existing methods of working whilst embracing new processes and technologies to maintain a competitive edge.

Competitive pressures to bring products to market faster, slash development costs, maintain quality standards and counter competitor innovations are forcing organisations to change fundamentally the way their engineering teams work. Customer and market demands are driving the need for companies to overhaul their old methods for newer, more agile processes that optimise the entire engineering life cycle. We partner with IBM® to supply best-in-class engineering development tools to give our customers access to robust and powerful functions which automate, accelerate, improve and adapt engineering programmes

Requirements Management: Fundamental to Successful Collaborative Engineering

Requirements Management can be defined as the subset of systems engineering concerned with discovering, developing, tracing, analysing, qualifying, communicating, planning, monitoring and controlling requirements that define the system at successive levels of abstraction. Stakeholder requirements drive the quality of your end product. In the growing face of complexity, systems engineers are faced with the challenge of managing an increasing number of requirements as an essential component of engineering development. Developing and maintaining good requirements management practices is no mean feat but it controls projects, mitigates risk and reduces cost.

Getting stakeholders to articulate their needs can be a difficult and lengthy process. Half the time – even more if the buyer isn't the same person as the one with the technical need – they don't even know what they want themselves. No process can pull information out of the void when it doesn't exist, but systems engineering takes a robust and scientific approach to requirements management that cleanly and specifically identifies ambiguities and gaps in stated stakeholder needs. The best way to get a straight answer is to ask a straight question, and the systems engineering process is very good at
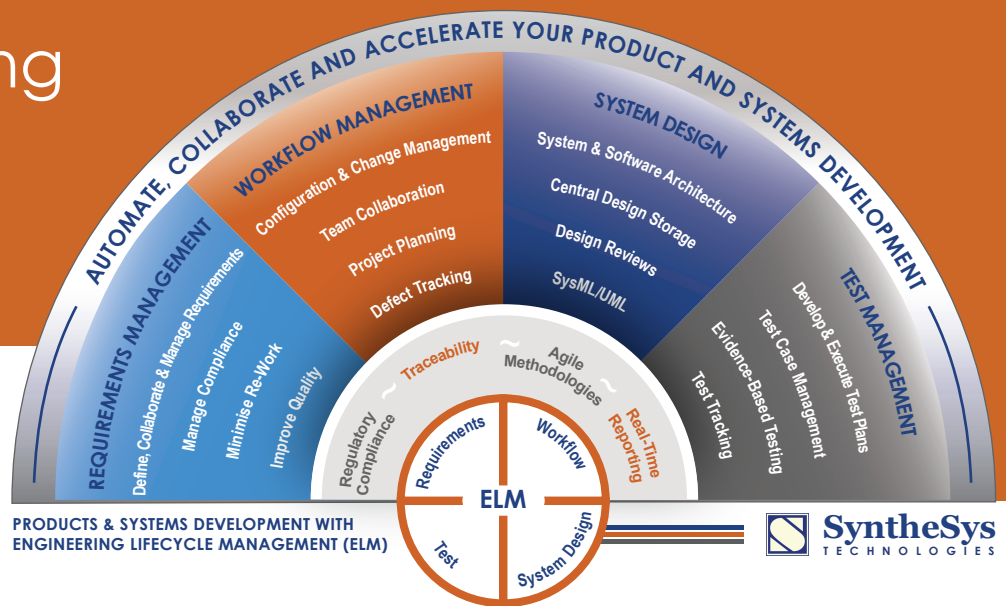
generating straight questions. Working with vague or incomplete requirements doesn't just lead to a risk of building the wrong product, it can also risk building the right product badly. Effective projects run individual management tasks rigorously and efficiently, and the ability to follow a rigorous process is severely hindered by a lack of robust inputs. Problems that arise in this way only multiply over time, as knock-on effects are generated and start introducing chaos of their own.

IBM® DOORS® Family is a Requirements Management application which provides an effective way to manage requirements, improves efficiency and enhances overall project output. The tool automates the requirements management process and enables your teams to concentrate on building the right product, not spending time on manual tasks and rework. This scalable solution provides functionality which allows teams to communicate, document, collaborate and verify stakeholder requirements whilst handling real-time version control and change management.

Design Management: Clarity Through Models, Prototypes and Simulation

Model-Based Systems Engineering (MBSE) has long been recognised as an effective method of mitigating risk, reducing costs and increasing agility and as products become more interconnected and software intensive, more organisations are waking up to the benefits. Prototyping and modelling your system design provides a reliable and seamless way of understanding the architecture and behaviour of your products and services which enables you to adapt to changing market and customer requirements whilst improving your overall productivity. The early validation of requirements is critical to the overall effectiveness of your system design. The rising complexity in industries such as Aerospace, Rail and Defence is evolving the types of challenges seen by engineers.

These challenges are causing many organisations to integrate new systems and software engineering solutions which automate MBSE whilst also providing tools which give end-to-end management of the engineering life cycle. Model-Based Systems Engineering gives clarity of information whilst reducing costs.

IBM® Engineering Systems Design Rhapsody® and associated tools provides proven functionality for modelling and design management. The tools automate the way in which you check for consistency and offers continuous validation through models and prototypes. The suite of tools offers development, design and test environments for software and systems engineers and teams.

Workflow Management : Collaborating Teams, Managing Projects

Managing tasks, project status and plans is a critical component to any engineering development. Teams must adopt a flexible and adaptable approach in order to achieve faster release cycles.

IBM® Engineering Workflow Management facilitates individuals and teams to collaborate to build better software and systems by aligning development environments. The tool provides an all-in-one common platform where users can manage workspaces and software version control more effectively whilst facilitating development support. Available in the cloud or on premise, IBM® Engineering Workflow Management unifies work teams to allow them to work faster and smarter, on the right task, by linking plans with software development. Project reporting is simplified and automated to provide a 'single source of truth' throughout internal and external environments.

Test Management: Integrated and Continuous Testing

Testing, in an engineering context goes hand in hand with quality management, but a high-quality output is only one of the benefits of adapting robust and effective testing regimes and tools. In addition to maintaining the quality of your products and services, testing helps engineering teams meet project deliverables and go-to-market faster. But as technology advances, so does a testing requirement which relies more heavily on testing processes which are integrated at each element of the engineering life cycle. Traditionally, testing is seen as one of the last steps in the engineering development process and therefore is often under scrutiny when budgets and schedules are tight. In recent years, it has become more widely explored and accepted that this view of testing no longer presents a competitive position, and that testing as early and as often in the development process as is possible, reduces cost, increases quality and accelerates time to market. To achieve quality driven software and systems, development teams need to collaborate, share information and

adopt a level of automation throughout the software and systems development process.

IBM® Engineering Test Management is an end-to-end test and quality management tool which provides test planning and asset management functionality across the entire engineering life cycle. IBM® Engineering Test Management offers test planning, test construction and test artifact management functions, which helps quality assurance teams collaborate, automate and govern more effectively. The tool automates collaboration and information exchanges across engineering development teams to allow them to deliver superior quality on time, every time. The robust reporting features provide real-time data to inform release decisions and mitigate risk.

Lifecycle Optimization: Manage Documents, Extract Data, Optimize Development

Creating, publishing and connecting high-quality engineering documentation can be a challenge. Engineering teams need easy access to documentation which relates to the overarching engineering development process, and perhaps more critically, to each other. Organisations need a seamless and elegant way to trace documents, track data and mitigate risk. Adaptability is key and development engineers need methods for creating a variety of different output formats taken from multiple different sources.

IBM® Engineering Lifecycle Optimization - Publishing offers powerful, automated documentation generation functionality which helps organisations generate documents for inhouse review purposes, contractual obligation, or compliance with standards. The tool automates document generation and report production across your deployed Jazz™ and other engineering tools, and enables engineering teams to produce quality reports and requirements traceability matrices in user-friendly formats such as PDF, HTML, Word, Excel and XSL. Data can be extracted from various sources to automate manual processes and reduce errors, whilst the ready-to-use templates and drag and drop features will improve your overall project delivery. Document styles are flexible and support hyperlinks which provide unique navigation between documents.

As an IBM® Gold Business Partner, we offer licence sales, software installation, training and support services.

To talk to us about the IBM® ELM toolset, contact our Customer Engagement Team by emailing: cet@synthesys.co.uk

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Engineering the 'Net' in 'Net Zero'

Carbon Capture and Storage

The experience of living in the modern western world is one of everything having been hyper optimised for our comfort and convenience. If you're reading this at your desk, it is worth reflecting on how many hours of work and flashes of hard-won creativity went into engineering, even the most innocuous item on your desk, and which was quite probably manufactured half a world away.

With the spectre of climate change looming large, we must now turn our attention to decarbonising the economy and moving to 'net zero'. Carbon Capture and Storage (CCS) is a key technology in this transition, and engineers will play a vital role in making CCS a reality. CCS involves capturing carbon dioxide emissions from power plants and other industrial sources, and then transporting and storing them underground. This presents a huge technical challenge, but it is one that we must meet if we are to avoid ongoing - and catastrophic - climate change.

As we've seen time and time again, our economy is vulnerable to disruptions. Whether it's a change in the operating environment or an unexpected zigzag in a variable, even the slightest change can have a big impact. But, despite all the challenges we've faced, we've always found a way to rebound and come back stronger than before. In fact, this century has been one of the most prosperous periods in history.

Looking forward, we need to build an economy that is resilient to disruptions and can thrive in any operating environment. That means moving towards a zero-waste, zero-carbon economy - an economy that is powered by clean energy and produces no pollution or waste. It's an ambitious goal, but it's one that we must strive for if we want to ensure a prosperous future for all.
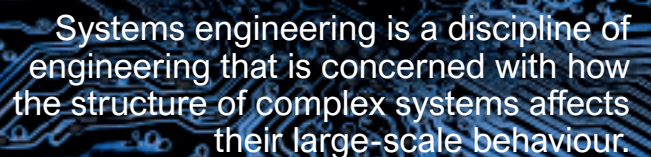
The natural world is amazing. For centuries, life has found ways to survive in a changing environment. But, with the discovery of climate change, we realised that these two complex systems could no longer be treated as independent. We have to understand the natural world and how it works if we're going to protect it. Hence the commitment to achieve zero net emissions by 2050. It's a daunting task, but it's one that we have to tackle head on if we want to preserve the planet for future generations. We know it won't be easy, but together, we can make a difference.

As any engineer will tell you, zero is a tough number to achieve. But when it comes to the zero net emissions of greenhouse gases by 2050 that are necessary to avoid catastrophic climate change, zero is precisely what we must aim for. That means zero emissions from all sources, including those from forestry and agriculture. It also means zero emissions from deforestation, land clearing, and other land-use changes. And it means zero emissions from international aviation and shipping. In other words, it means achieving net zero emissions across the globe. But zero *is* achievable. We have the technology and the know-how to get there. What we need now is the

political will to make it happen. Systems engineering is a discipline of engineering that is concerned with how the structure of complex systems affects their large-scale behaviour.

Systems engineering is about drawing on the science of finding patterns in organised complexity, and the analysis of the emergent behaviour of systems. It can provide many insights into how this sort of complexity can be zeroed, predicted, managed and addressed. The systems approach is an important tool for managing net zero projects because it allows for the identification of project objectives, requirements, and risks. It also helps to create a baseline for measuring progress and determining whether the project is on track to meet its goals. In addition, it can help to optimise resources and improve communication between team members. With these principles, we can create better systems that are more efficient, resilient, and adaptable to change.

This thinking process is about much more than just energy or water conservation. It's about understanding how all the different parts of a system interact with each other, and how changes in one part of the system can impact other parts of the system. It's about finding ways to make the system as a whole more efficient and effective, while also reducing negative environmental impacts.

> Systems engineering is a discipline of engineering that is concerned with how the structure of complex systems affects their large-scale behaviour.

Systems thinking is an important tool for anyone who wants to create lasting positive change in the world. By understanding how systems work, we can find ways to make them work better for everyone involved. We can create more efficient systems that use less resources, and we can find ways to eliminate waste and pollution altogether. We can also design systems that are more resilient to external shocks, such as climate change.

We often think of the journey to zero as a difficult one, full of sacrifices and difficult choices. However, it is important to remember that many of the technologies and practices that we need to adopt in order to achieve zero emissions are already available to us. It is simply a matter of making the commitment to act and work together towards our goal.

There are many challenges ahead, but by working together and staying focused on our goal, we can achieve a zero-carbon future. Trying to engineer a route to the end goal is a costly task. Using systems engineering within your processes allows businesses to future proof their projects and drive down potential costs. Having a greater understanding of a project's life cycle creates an environment that welcomes integration of innovation. Being able to manage configuration in such a way means that advancing technologies can be integrated smoothly.

Better Process

Systems engineering techniques are fundamentally about finding ways to analyse, model and plan the behaviour of a system as a whole. The context above and beyond the details of individual components. By having a suite of processes and tools designed to model and anticipate the structure of a system, projects start out with the right solution being built in the right way, and that solution will interact appropriately with its context. This drives down cost by reducing the risk of mistakes and unanticipated defects, while simultaneously driving up quality, tying engineering activity more closely to precisely defined stakeholder needs.

The energy sector is looking at ways to integrate systems engineering as the route towards tackling forever growing complexity. Although there's a good understanding of net zero goal, it becomes hard for companies to face challenges on their way through this process due to managing change which can be both time-consuming and expensive. Both of these headwinds are undesirable to teams making progress with what needs to be done now. Having an established system that understands these issues would help everyone involved move faster, while staying safe throughout any storms ahead. This creates an environment where your team can be confident when there are challenges, and integrate innovations efficiently.

Systems engineering has developed a wide range of processes and tools for modelling and simulation, requirements analysis, scheduling, and all parts of the life cycle, tailored to better manage the development of complex systems. Although not designed with any particular industry in mind, it has been in longest use in the aerospace and defence sector, where complex interdependent systems have been standard for decades. These methods are particularly well adapted to circumstances in which requirements change during a development process, as they can much more straightforwardly assess the impact of those changes on the system as a whole.

Systems engineers can use their models and plans to anticipate many of these issues, like a system's positives or arising negatives. They also help prevent you from generating significant sunk costs by taking an approach that includes whole life cycles, only to end up needing to make massive updates to older versions - midlife upgrades will be much simpler this way.

Managing Configuration

The process of systems engineering is often used in order to determine the requirements for a system. A 'baseline' set of configurations will be created and any deviations from this - such as changes or additions - will be incorporated to reflect impacts on future outcomes

on an ongoing basis so that robust decisions can be made for years of any system's lifespan. When you need to reuse requirements, you don't have to just duplicate the entire set of requirements. You can reuse those components that are already defined. This will save time and effort. In an energy context, being able to track the changes in project requirements and configurations over time means that your engineers don't have to start from scratch every time they work on a new project. They can use the knowledge they already have to get started more quickly and efficiently.

Setting goals is the first step in turning the invisible into the visible. Tony Robbins zero-ed in on this when he said, "If you don't set a goal, you can't score." And yet, even with this zero-based approach to setting goals, many people still struggle with the logistics of putting their goals into writing and creating an actionable plan to achieve them.

The key to success lies in thinking like an engineer; systems engineering provides the framework for thinking about and designing complex engineering systems. In systems engineering, the whole is greater than the sum of its parts; it's an iterative process that takes into account all aspects of a system to optimise it for a specific purpose or goal. For example, if your goal as an engineering function is to provide your customers with a modular product, systems engineering gives you that capability. Having a system that supports flexibility within standardisation to suit the customer requirements boosts efficiency of the configuration management process.

In other words, systems engineering provides a roadmap for achieving your goals. So, if your goal is to achieve net zero emissions, systems engineering can help you get there by zeroing in on the most efficient and effective way to design and operate. Furthermore, in an environment where compliance and certification drive a lot of engineering decisions, this modular approach to requirements management enables you to apply those constraints consistently across multiple engineering projects without having to solve the same problems repeatedly.

What This All Means

Carbon capture and storage is vital to mitigating climate change, but it's also a complex process. That's where systems engineering comes in. Systems engineering can help integrate many different types of projects, making the whole process more efficient and less likely to run into problems. At SyntheSys, we're experts in working at the intersection of two large-scale projects and we're interested in helping you do the right things to get closer to net zero in your business.

If you're looking for help getting your project right first-time with flawless execution, don't hesitate to get in touch.

Systems engineering is a discipline of engineering that is concerned with how the structure of complex systems affects their large-scale behaviour.

Renewable Energy Meets Engineering Workflow Management

A Shifting Energy Market

The green agenda is at the heart of many organisations and this shift towards renewable energy brings untold amounts of engineering complexity. Systems Engineering is acting as a catalyst across the energy market from decarbonisation initiatives to engineering new renewable infrastructure.

Wind Energy Systems are widely considered as the most efficient technology in producing energy in a safe and environmentally sustainable manner whilst providing broader social value. The following article explores the role that 'Tool-Supported Systems Engineering' is playing across the Energy market, with an emphasis on our latest customer commission.

SyntheSys Technologies Delivers Value

SyntheSys Technologies has been working in partnership with a Renewable Energy team on an exciting project, developing a workflow management solution based on the IBM® Engineering Workflow Management (EWM) Application.

Whilst the project roll-out is in the initial phases, we recognise that this project may be of interest to the wider user community and that there is value in sharing some of these early experiences.

System Engineering Challenges

Defining requirements early in the project process is key to successful project delivery. Our customer's problem statement was that they captured managed project requirements and tasks in very complex Excel spreadsheets.

They accepted that the spreadsheets they relied on were difficult to control and could not be used to manage large scale projects or provide the necessary audit and traceability trails.

They needed a robust system and process that allowed their team to:

- **Input data efficiently using a common interface;**
- **Capture Project Scope and Design requirements;**
- **Provide links between related work items and ultimately to traceability links to requirements;**
- **Track all work item changes throughout the project life cycle;**
- **Capture review and impact responses from the project stakeholders within each work item;**
- **Review the impact of changes to work items;**
- **Collaborate with all project stakeholders via external reporting and dashboards.**

The Solution

SyntheSys is working in partnership with IBM® to develop a solution based on the IBM® Engineering Workflow Management Application for the customer.

A customised workflow process has been developed that allows work items to progress from initial data entry to implementation and then on to resolution. The option of reopening a work item and viewing related impacted work items is also included. Work item Artifacts have been developed to cover Design Assumptions/Decisions, Interfaces and Change Management activities. Audit history of each work item type is tracked automatically.

Dashboards have been developed that allow project stakeholders to monitor and progress work items. These dashboards provide a view of upcoming, late and on-time work items throughout the workflow process.

SyntheSys and IBM® see this partnership as a long-term relationship and are fully engaged with the Customer's Team in developing the EWM Application to meet their future needs.

If you have found this article useful, and would like to hear more about how your organisation may use systems engineering to better embrace change, visit: www.synthesys-technologies.co.uk or contact us on: cet@synthesys.co.uk

If you are looking for ways to expedite time-to-market, ensure business agility, and deliver high-quality smart products while cutting costs, this is the book for you!

Compliments of IBM IBM Limited Edition

Systems Engineering FOR **DUMMIES**

Learn:
- What systems engineering is
- How systems engineering can help you develop smart, connected products
- How to expedite time-to-market, ensure business agility, and deliver high-quality smart products
- How to cut costs

Cathleen Shamieh
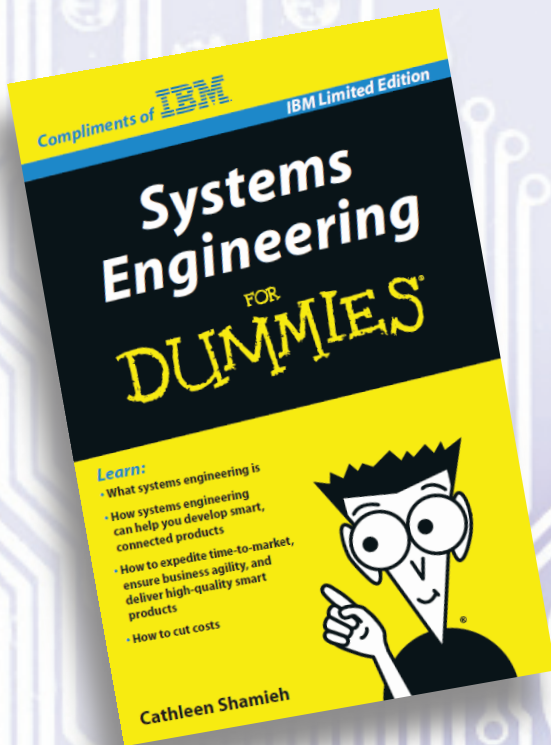
Courtesy of IBM® we are able to offer readers this clear and concise foundation level publication which is a key resource to add to any desktop or company library.

Systems Engineering For Dummies, is an IBM® Limited Edition E-BOOK explaining what systems engineering is and how it can help you harness the complexity inherent in developing smart, connected products.

To download the FREE E-BOOK visit:
http://resources.synthesys.co.uk/cloudbase/systems-engineering-for-dummies.pdf

Again, courtesy of IBM®, we are able to offer readers this foundation level publication which aims to explore what is meant by 'Continuous Engineering' and the merits of continuously improving complex product designs.

The useful E-BOOK shares methods for anticipating and responding to markets and clients and suggests ways of getting the most out of your engineering resources.

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Cathleen Shamieh

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