

L2P PROGRAM

SCALING FROM BATCH TO CONTINUOUS PRODUCTION

CHALLENGES, RISKS, SOLUTIONS & POTENTIALS

How **Solid Oxide Fuel Cell** and **Electrolyzer Cell** producers can increase efficiency and throughput with two verified kiln concepts and ONEJOON's L2P-Program, designed for bridging the gap from batch to continuous production



PART 1
THE PRINCIPALS OF
THE L2P PROGRAM

TARGET GROUP & EXECUTIVE SUMMARY

Target Group

The information and case studies included in this report are directed at producers of Solid oxide fuel cells (SOFC/SOEC) or sub-components. More specifically those producers that target the KW and MW range and are considering scaling up their production by using continuous kilns and plant equipment. Our customers in this industry are typically large power generators or suppliers who use SOFC/SOEC to generate emission-free and carbon-free electricity. That electricity then can be used for various applications ranging from grid supply to highly efficient distributed power generation for stationary and mobile applications with stable and long-term power demand.

The Situation of KW and MW SOFC/SOEC producers

From a market perspective, the demand for hydrogen is expected to increase significantly in the medium to long term. Limited research and legacy infrastructure - especially in transportation - restricted both demand and supply of SOFC/SOEC, however with the transition of power generation and supply to carbon-free alternatives and advancements in hydrogen production technology, the market is set for growth. This trend gets reinforced by policies and subsidies. In 2018, for example, the European Commission and 27 European countries, adopted a European hydrogen initiative and defined hydrogen technologies and systems as a value chain of strategic interest.

Scaling up to reach industrial scale productions

However, to leverage the potential of hydrogen technologies, industry and politics need to foster a real market ramp-up. Because under the current framework conditions, the production and use of hydrogen is not yet economical. Alternatives like fossil fuels – which currently are not priced with follow-up costs of CO₂ emissions - are still significantly cheaper.

Hence, for hydrogen to become economically viable, cost degression for hydrogen technologies is needed. A rapid international market ramp-up for the production and use of hydrogen is of great importance to drive technological progress and economies of scale and to have the necessary critical mass of hydrogen available in good time. To put it in the words of Germany's Economics Minister: "laboratory scale is no longer enough". Altmaier wants to see Hydrogen being "produced domestically on an industrial scale as soon as possible".

Especially the producers of SOFC/SOEC are now confronted with the challenge of upscaling their productions. According to the Hydrogen Council's study "Hydrogen Insights 2021", companies plan to increase their hydrogen investments six-fold by 2025 and 16-fold by 2030. Above all, larger manufacturing capacities are to be built to meet the rising demand for electrolysis capacities and fuel cells.



1. Research:
Was neglected in favor of battery technology – Goal is to reduce dependency on licensing technology from other countries

2. Green Mobility:
Cars, trucks, busses, ships, trains, military, aviation and aerospace. This requires large scale factories and decreasing unit costs – e.g. Hyundai to ramp up production from 3,000 to 100,000 units per year

3. Stationary power and heat generation:
Power plants, off grid power supply, backup and emergency power generators, decentral medium sized heat sources for single family homes, appartement blocks and small companies, heat and power sources, military

4. Hydrogen production:
Electrolyzer capacity and other means to produce green hydrogen

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How to scale up efficiently, effectively and sustainable – The Activities necessary

This is the challenge a lot of our customers face when reaching out to us. So we integrated scale-up projects of SOFC/SOEC plants into our “Lab to Production program” and for the first-time developed a SOFC/SOEC-specific kiln technology.

The Program

Because upscaling from laboratory to production scale needs a lot of expertise and experience. The program was developed based on extensive data we accumulated in our 125 year-long history of thermal processing across various industries. The L2P program ensures that our customers get the support they needed depending on their readiness level in the areas (1) plant, (2) process and (3) people. When joining the program, these three areas are developed alongside four levels, depending on the maturity level of our customers in each of these areas.

The technology successfully completed the steps from laboratory to small-series scale and finally to the large-series process. The mass production of oxide ceramic fuel cells (SOFC/SOEC) and electrolytic cells (SOE) cannot be implemented with simple chamber furnaces and a few cubic meters of usable space. When production volumes increase, the result is higher reject rates, longer processing times, and high energy consumption in relation to throughput.

Two core problems are firstly insufficient temperature uniformity within a batch, which significantly affects both cell geometry and binder/gas removal and thus product quality, and secondly undisproportionate cooling capability leading to uneconomical long cycle times. Especially the central process of controlled debinding needs good process control for industry scale mass throughput. Since the reactions are usually exothermic, poor process control can lead to uncontrolled binder release and thus to a temperature rise at the product.



PRINCIPALS OF THE L2P PROGRAM

The best technology ✓

You don't want any technology. You want advanced technology that sets standards for your industry.

Fast & Efficient ✓

You want results in months and not years, so existing resources and knowledge need to be deployed in the most effective way avoiding all the pitfalls.

Effective & cost-efficient ✓

You need a plant that gives you a competitive edge, so the project must reliably result in a continuous plant, that produces a high-quality and reproducible product on large scale.



The Kiln Technology

The kiln technology itself, ensures cost efficient production of SOFC/SOEC cells on a large scale. Particular attention has been paid to the controlled heating and flow of the products in the debinding process by detailed measurements and subsequent simulation studies under real-life conditions in our own test center and in a real production.

Possible consequences are cracking and bloating of the cell and, in the worst case, rejection. Furthermore, this can lead to a lack of oxygen in the process and to carbon residues in the microstructure, which leads to undesirable pore formation during sintering.

ONEJOON has put a lot of effort in the development of advanced cooling technology. This helps not only to reduce cycle time but also to enlarge lifetime of expensive kiln furniture.

What you get

Our L2P program ensures personalized, continuous, and structured support. You are guided through the development process and activities while having fast access to the required financial and technical information. From day one your development needs are made transparent to you and our experts stay on your side till you can operate the continuous plant with your trained operators. Based on the structured process, successful transitioning becomes more reliable, predictable, and fast. Grow your knowledge while avoiding the most common pitfalls your competitors might tap into. By developing your solution jointly with us, you can be sure that you get the kiln you need, instead of a kiln that a manufacturer has in store. The program has proven effective in significantly reducing time to market by following a standardized yet flexible process.

As we are a turn-key manufacturer, the interphases to our suppliers are built into the program, such that we are the only contact you need. This includes the kilns as well as equipment for cell-handling and off-gas treatment.

Finally, our developed kiln technology is proven and reliable with second-to-none temperature homogeneity based on SOFC/SOEC-optimized kiln furniture, optimal heat uniformity, and balanced conditions for better control of the heating process. If you want to find out more about the details of our kilns.

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CURRENT EQUIPMENT LIMITATIONS & CHALLENGES

Most SOFC/SOECs are debindered / sintered in batch kilns with:

- Limited throughput
- Long processing times cold-to-cold
- Poor binder / gas removal
- Limited explosion limit control
- High energy consumption in relation to throughput

As both the SOEC and SOFC industry are faced with the challenge of scaling their manufacturing facilities and techniques, they need a strong and reliable partner to do so.

We at ONEJOON offer turn-key, fully automated, continuous furnace systems, that can be rapidly deployed and guarantee the highest process stability and repeatability for optimum production yield and reduced cell to cell deviation.

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OUR COMPANY

About ONEJOON GmbH

ONEJOON is the technology and market leader for oxidation and carbonization furnaces in the core market of carbon fiber production. The company also holds a prominent position in the future markets of cathode and anode material production, as well as in the area of fuel cells.

For more than 125 years, ONEJOON has been a reliable partner and supplier of thermal equipment for the development and scaling of innovative processes. As a globally operating specialist for thermal solutions with numerous reference plants in various industries, ONEJOON delivers turnkey solutions for project sizes of up to 50 million euros.

125
YEARS
EXPERIENCE IN KILN TECHNOLOGY
1896-2021

WE'RE RIGHT WHERE YOU NEED US.



North America



Europe



Asia

Minnesota
Office USA

Bovenden (Göttingen)
Headquarter Germany

Atlanta
Office USA

Gliwice
Factory Poland

ONEJOON's plants are designed and optimized for markets and applications that require a high degree of furnace quality, system availability, process reliability, homogeneity, and product quality. Requirements which increasingly apply also to the tire pyrolysis market.

More information can be found at
www.onejoon.de

“ ONEJOON IS YOUR PARTNER FOR THERMAL PRODUCTION SYSTEMS – WORLDWIDE

ONEJOON Core Teams around the globe can handle local projects on their own with an organisation of Sales, Project Management, Basic Engineering, Commissioning, Site Management and Service.

- represented in 5 countries with 9 locations worldwide
- 240 employees worldwide (2020)
- more than 100 design engineers, researchers and developers
- quality made by ONEJOON with own factories in Germany, Korea and China
- ongoing culture of innovation ensured by German and Korea Test Center and Research & Development Department
- experienced Project Management Team with project sizes up to 50 Mio €
- thermal process equipment up to 3000 °C and turnkey thermal process production lines

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Böblingen (Stuttgart)
Office Germany South

Haining
Factory China

Shanghai
Office China

Hwaseong
Factory South Korea

Suwon
Head Quarter South Korea

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MEET OUR TEAM

You would like to learn more about our solutions for SOFC/SOEC producers?
We would be pleased to show you in a personal appointment what we
can do for you.



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The next pages introduce you to the contents and objectives of our Lab to Production (L2P) program. It was designed to support companies that want to scale up innovative thermal processes to continuous or mass production. You will learn about the developments that our customers undergo during four distinctive phases and in three different areas. If you prefer a real-world example, you can also directly go to our case study, where we discuss how this program helped one of our customers in the field of thin film ceramics. We discuss the development stages they took as well as the activities performed.

When we designed the program, we took our experience and data from 125 years of offering thermal solutions and analyzed the critical success factors for transition projects. The result? When you filter all the noise, successful transitions from lab or batch to commercial productions take three Ps.

THE THREE FOCUS AREAS.

PLANT, PROCESS AND PEOPLE ARE THE MAIN AREAS FOR DEVELOPMENT ACTIVITIES THROUGHOUT THE FOUR DEVELOPMENT STAGES.

WHY THOSE THREE (AND WHAT ARE THE ACTIVITIES)?

The three focus areas Plant, Thermal Process and People emerged out of a cross-industry analysis of successfully completed scale up projects. When we analyzed more than X successfully supported scale up projects, the most successful ones shared common attributes in those three areas.

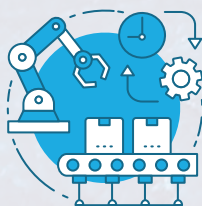
Because increasingly more of our clients need to scale up innovative processes fast, we combined all our data and knowledge in our Lab to Production program (L2P). The L2P program is designed to reduce the risk for transitioning companies while enabling efficient, reliable, and effective transitions.

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1

THE PLANT. ADVANCED INFRASTRUCTURE

This development area is concerned with the kiln(s) and the relevant periphery. For a globally optimized thermal process and plant, the kiln(s) and the periphery must be a good fit. Activities here focus on the design of specific modules (e.g., kiln components, process gas treatment and conveying systems, etc.) to achieve the requirements and limits posted by the specific process and further restrictions such as maintenance efforts, infrastructure, and more.



2

THE THERMAL PROCESS. OPTIMIZED, HIGH-QUALITY, REPRODUCIBLE.

The set of parameters and tolerances for a uniform, reliable, and reproducible thermal process is different for a continuous process, than it is for a batch process. Activities in this area focus on setting the right boundaries and establishing a realistic understanding of the limits and potential regarding the process.



3

THE PEOPLE. EDUCATED DECISION MAKERS

A high-quality, reproducible thermal process is as much dependent on the plant and process design as on the end-user and augmented project team. This area focuses on the needs of the whole project team, including managers, product and process developers, and operators. This entails gathering the needs of the different groups, as well as providing critical information (e.g., budget, timeline) in the right detail at the right time. This also entails building up the required capabilities to operate and enhance the thermal process in the future.





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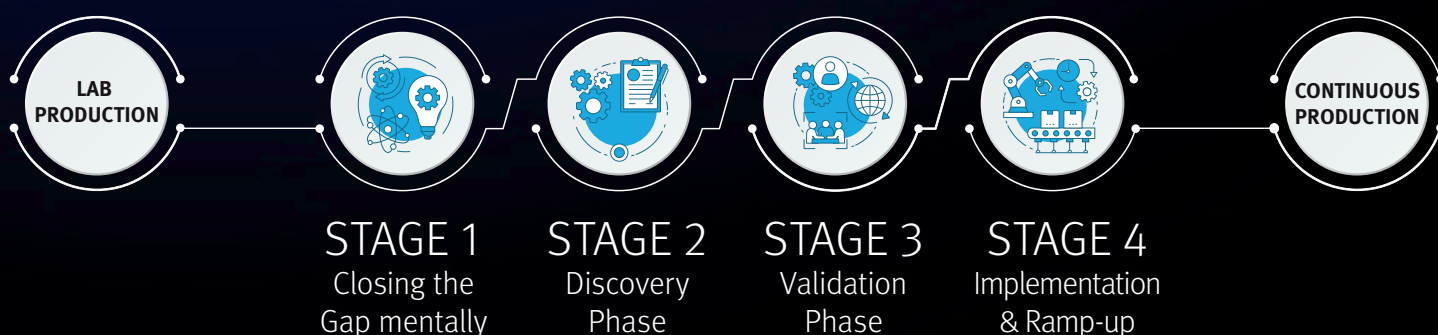
TO MANAGE THEM, ONEJOON DEVELOPED THE LAB TO SCALE PROGRAM.

DEVELOPING PLANT, THERMAL PROCESS & PEOPLE IN A 4-STAGED PROCESS

Within the program, our clients are guided through four development stages where we provide activities, resources, and knowledge to optimize their thermal process and design and build the optimal plant equipment for them. For the people dimension, we focus on developing the necessary capabilities for them to successfully operate a continuous production plant without being dependent on external help.

By incrementally developing all three areas, we reduce the risk of failure and increase the plant and process performance as well as the overall capability of the people involved to operate and manage the continuous production.

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WHAT ARE THE DEVELOPMENT STAGES? THE BIGGER PICTURE

After having discussed the three focus areas in detail, let us have a look at the overall goals and activities of the four development stages. Each stage has its milestones and its own theme. Developing through the stages means an increase in production readiness and a reduction in the risk of failure.

CLOSING THE GAP MENTALLY.

The first stage is about conceptual and mental readiness for the transition to a continuous thermal process. What we saw in many of the companies requesting a continuous kiln and with the clients that completed our program, is that they are often unaware of the different set of restrictions and potentials a continuous process has compared to batch production.

For the customers that come to us with a very broad range of specifications, finding one plant that suits all their needs often isn't economical. Most of the time, it then is a question of priorities. What is required, what is expected, what is desired, and what is nice to have? How likely is the event? What percentages are we talking about? What is the frequency?

When customers come to us they sometimes give us requirements with tolerances and specifications that are extremely narrow or even contradict each other. Then it becomes uneconomical to find equipment and ways to handle the process. These tolerances often come from experiences with a batch process, wrong assumptions, bad experiences or a wish for being on the safe side. We then dig deep to uncover the reasons behind the specifications items, offer alternatives, indicate the cost of overengineering or just find ways to reduce the risk for all parties.

... reconsidering the solution space creates the biggest impact.

” WRONG ASSUMPTIONS CAN BE COSTLY TO MAINTAIN

In the past, this has led to a misalignment of plant technology and process requirements. The materializations of this misalignment vary, but the root causes can be grouped along two dimensions.

1. One fits all approach (Problem space too broad)
2. Over engineering (Specifications are too narrow)
3. Thinking too small. (Restrictive assumptions about what is possible)

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More often than not, however, the problem is not what they want, rather what they think is possible. Customers often hold outdated and restrictive assumptions due to limited or wrong information. In the past, they may have been offered kilns that do not fit their needs. They are unaware of the wide variety of kilns that exist, each having its own set of advantages and limitations. They are also unaware of the advancements in thermal processing technology and the impact on their process and product. This then translates to changes in product attributes, process efficiency, and process performance they didn't consider possible.

It then is our job to explore the solution space and open it wide up again. Due to our wide product range, we can expose them to a lot of different concepts, provide them with a specialist and show them the different kilns in our test center.

... clear documentation and successive exploration are the how.

Hence, this step is all about establishing a mutual understanding of the different sets of attributes between a lab and a continuous production. This requires getting a mutual understanding of the existing (lab) process, the desired outcomes, and the assumptions held by the clients. This all is then documented in a structured way. After having defined the project starting point, a clear vision of the end state will be developed. This includes the challenges ahead

and the activities and resources needed in the three areas to successfully transition to continuous thermal processing. As the vision is unique for every customer, we use design thinking methods and a structured exploration approach to fully comprehend the steps towards a reliable, reproducible, and high-quality continuous production. Especially to validate or falsify assumptions, it has proven helpful to document the things already known as well as uncovering issues and opportunities unknown, tacit, or unconscious. The central deliverable of this phase is a clearly defined and comprehensive requirement sheet for process and plant and a time schedule for the complete Project until Start of Production. Having the problem space defined clearly, we then transition to opening up and then quickly narrowing down the solution space in the discovery phase.

DISCOVERY PHASE.

The discovery phase takes the requirement sheets from the previous stages as the point of departure and results in an application-specific, fully optimized plant concept. To get there, we collect the missing data for finalizing the requirement sheets and conduct explorative experiments to quickly improve the technical understanding of the potentials and restrictions of the thermal process.

Leveraging a multi-source approach to data

No matter how well the database of the customer or how good the understanding of the lab process, when transitioning to a continuous process complementary information is needed.

For the data collection process, we utilize a multi-source approach. The client's data are complemented by data from our database, from our partners, and 3rd party providers.

Additionally, we will perform trials and measures to validate the data with the actual process. This step will either be done in our test center, at one of our trusted partners or at the customer's facility. The step is more than just a necessary evil to obtain the data as it is an educational experience for the relevant members of the client's project team. They play a significant role in the explorative and iterative development process, carry out tests, and sit in meetings where the results of the analysis are presented. They have full access to the relevant documents and are guided through all steps by our engineers and process developers. This has proven effective for building up capabilities, ensuring a deep understanding of the information needs, and establishing awareness for the interrelations between process requirements and plant specifications.



Once data saturation has been reached, we will leverage our analysis models, experience, as well as our CFD and FEM simulation tools to develop a customized concept plant concept. The concept regards all the equipment necessary for process and product handling as well as the kiln itself. Frequent review meetings are the basis for communication of this phase. In those, the results are explained, and the progress of the concept is discussed.

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THE EXPERIMENTATION PHASE CREATES EVIDENCE AND BUILDS UP THE NECESSARY CAPABILITIES IN THE PROJECT TEAM

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For the financial part of the project, two important factors in plant and process design are adequate production costs and competitive investment costs. Already during the project planning phase, we are able to create comprehensive TCO analyses with you and thus ensure that the upscaling will be a complete success from an economic perspective as well.

Layout. PID. Budget.

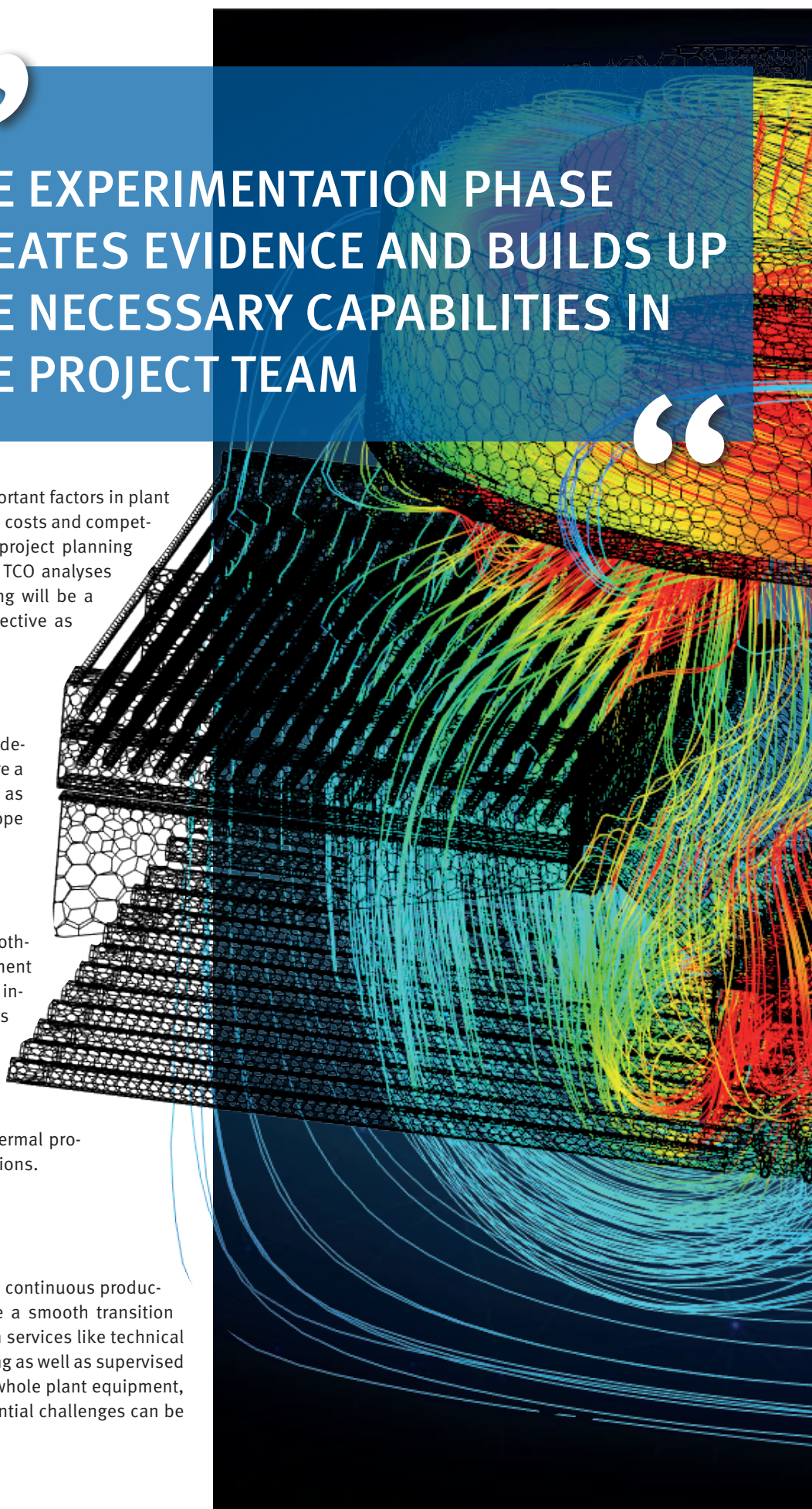
Different kinds of deliverables conclude this development stage, the most important ones are a detailed plant layout, cross sections as well as a detailed budget with a clearly defined scope of delivery.

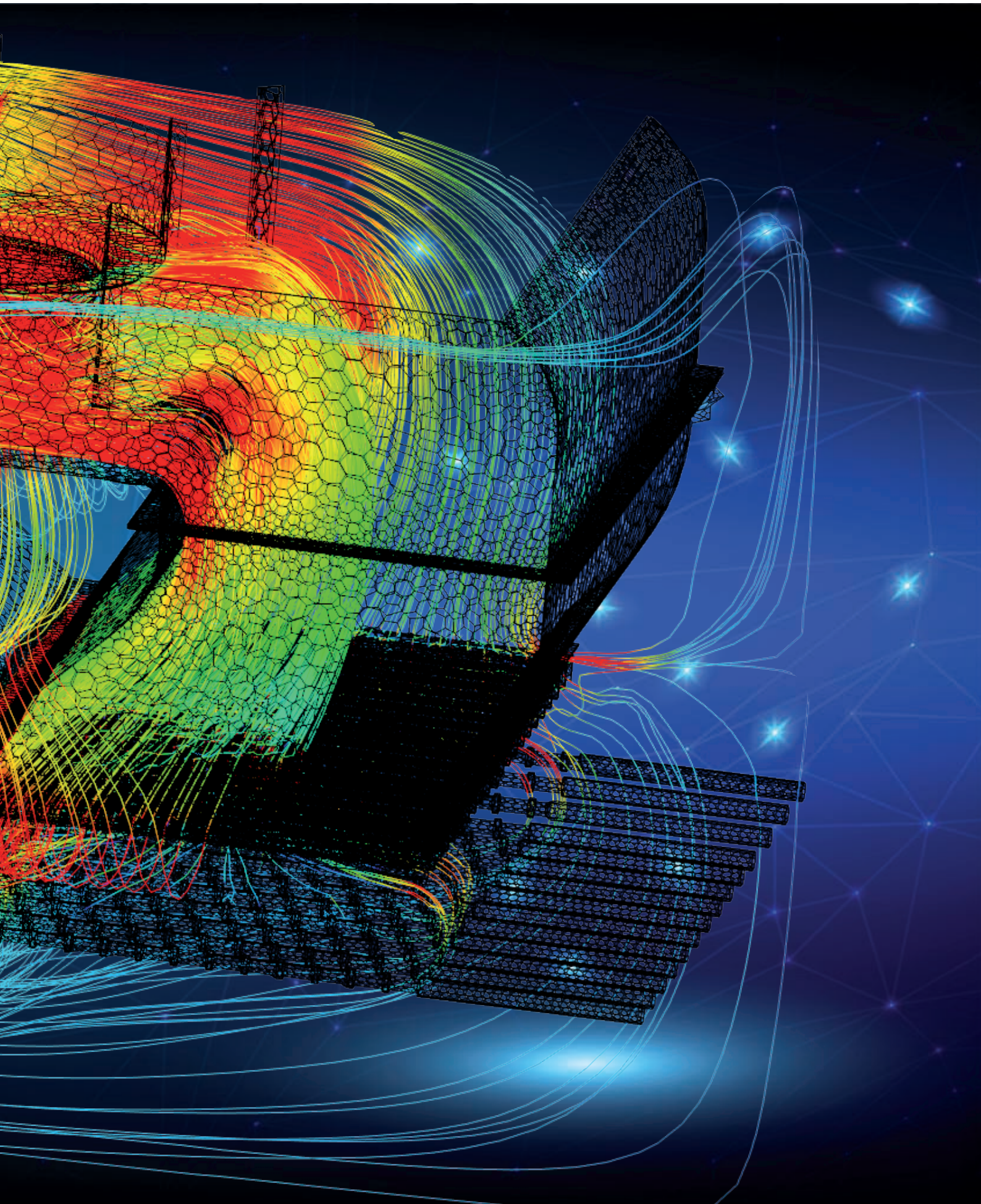
PROOF OF CONCEPT.

Validation of concepts, knowledge, and hypotheses to finalize the explorative development phase. Two paths will be taken, either the installation of a pilot plant at the customer's facility or long-term, real-life simulating trials with an existing and modified kiln. Focused elimination of uncertainties and risks, by establishing evidence on the process and concept performance regarding thermal process quality, operations, and process conditions.

IMPLEMENTATION AND RAMP-UP.

Designing, implementing, and launching the continuous production and working with customers to ensure a smooth transition from ramp-up to normal operations. Through services like technical consultation, operations support, and training as well as supervised ramp-up and single point of contact for the whole plant equipment, the customer always is supported, and potential challenges can be eliminated quickly.





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BRINGING IT ALL TOGETHER: YOUR JOURNEY THROUGH THE PROGRAM.





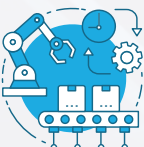

THE L2P PROGRAM CONSISTS OF FOUR STAGES & THREE FOCUS AREAS, DESIGNED TO CLOSE THE GAP FROM LAB TO PRODUCTION OPERATION.

...it guides customers transitioning from lab to continuous production, by systematically developing capabilities, reducing risks, and implementing continuous plant equipment for uniform, reliable, and reproducible thermal processing.







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OBJECTIVES & ACTIVITIES OF THE 4 DEVELOPMENT PHASES

 Lab Production		This is your status quo. Just come as you are, we take care of the rest.	
Closing the Gap conceptually	 Closing the Gap mentally	Establishing a mutual understanding of the lab process and documenting the relevant process, plant, and operation parameters. Creating a clear vision of the challenges ahead and the activities needed in the three areas to transition successfully to continuous thermal processing. Use of design thinking methods and a structured approach to fully comprehend the activities performed and resources used. Documenting things already known and uncovering issues and opportunities unknown, tacit, or unconscious. Clear specification of the problem space to develop the optimal solution on the next level. Setup of a realistic time schedule for the complete project until Start of Production.	
	 Discovery Phase	Targeted explorative test for the development of an application-specific, fully optimized plant concept. Complementation of data, specifications and target states from previous steps by data from our database, measurements, trials, simulations and process models in our test center, at our partners or at the customers' facility. Incremental development of an globally optimized concepts, leveraging analysis tools, creative engineers and test facilities.	
	 Validation Phase	Validation of concepts, knowledge, and hypotheses to finalize the explorative development phase. Two paths will be taken, either the installation of a pilot plant at the customer's facility or long-term, real-life simulating trials with an existing and modified kiln. Focused elimination of uncertainties and risks, by establishing evidence on the process and concept performance regarding thermal process quality, operations, and process conditions.	
	 Implementation & Ramp-up (Execution, Implementation and Ramp-Up)	Designing, implementing, and launching the continuous production and working with customers to ensure a smooth transition from ramp-up to normal operations. Through services like technical consultation, operations support, and training as well as supervised ramp-up and single point of contact for the whole plant equipment, the customer always is supported, and potential challenges can be eliminated quickly.	
 Continuous Production		Congratulations. You have crossed the gap successfully and are now operating a reliable, high-quality, and reproducible continuous thermal process	







PLANT DEVELOPMENT LEVELS

Milestones Entering	Milestones Leaving	 Lab Production
The lab equipment is known to the customer. He knows the relevant equipment configurations, specifications, and limits for producing a high-quality product under lab conditions.	Relevant plant specifications and configurations for lab production are documented. The customer has a comprehensive understanding of the plant equipment necessary for an end-to-end continuous process. He has a detailed requirement sheet and understands the potentials and restrictions of the equipment. It is clear to him what information needs to be acquired during concept phase. He has a budget quotation specifying cost, timeline and scope.	 <p>Closing the Gap mentally</p>
The customer has decided to move on and is aware of the required information needs to complete the specification sheet for the plant's equipment.	The customer has a detailed plant layout and drawings as well as supporting documents from tests and simulations specifying the customized and optimized plant equipment. Due to his involvement in the process, he knows exactly which optimization led to which equipment configuration and design.	 <p>Discovery Phase</p>
The customer has a detailed plant layout, including supply limits and requirement sheets. He is ready to finalize the explorative phase by validating the concept with a pilot plant or long-term trials.	The customer gained evidence on the equipment's performance and operations as well as the potentials and restrictions. He has reduced significant risk and uncertainties leveraging proven technology and proxy trials. He has all documents and information needed to order the production equipment.	 <p>Validation Phase</p>
The customer decided on placing an order with the design specifications for the plant equipment. He has all files and information to directly start the design phase.	The customer operates a continuous, customized plant. The equipment utilizes proven technology complemented by advanced equipment proven effective in trials and simulations. He was closely supported by the design team and site managers and understands the equipment's key characteristics. A maintenance plan and service support was agreed, and he knows what to do or whom to call for support.	 <p>Implementation & Ramp-up</p>
		 Continuous Production

PROCESS DEVELOPMENT LEVELS

Milestones Entering	Milestones Leaving	 Lab Production
The lab process is known to the customer. He knows the relevant process parameters and additional influencing factors to reach optimal product quality under lab conditions.	All relevant process specifications and configurations for lab production are documented. The customer gained a comprehensive understanding of the relevant process characteristics for a reliable & high-quality continuous process. He obtained a comprehensive requirement sheet and understands the potentials and restrictions of a high-performance continuous process and the implications for his material.	 <p>Closing the Gap mentally</p>
The customer has a requirement sheet, specifying most of the process parameters, tolerances, and limits. He is aware of the process parameters that need to be explored during the concept development phase.	The customer has temperature profiles, process descriptions and drawings as well as supporting documents from tests and simulations specifying the customized and optimized thermal process. Due to his involvement in the development process, he knows exactly which information and restrictions led to which process configuration.	 <p>Discovery Phase</p>
The customer has clear documentation of her process with all supply limits and relevant parameters. The customer is ready to validate the process using a pilot plant or long-term trials.	The customer has evidence that the process works under the specified conditions and has eliminated a significant part of risk and uncertainty. He has all documents and information to order the production equipment.	 <p>Validation Phase</p>
The customer decided on placing an order with the specified, optimized, and realistic process parameters, tolerances, and limits. All files and information to start the design phase are complete.	The customer successfully operates a stable continuous and optimized process, that produces high-quality products in a reproducible manner. The implementation and ramp-up phase was concluded with the help of process experts and on-demand support. Relevant process scenarios are known as well as the correct measures. He knows exactly what to do or whom to call for support.	 <p>Implementation & Ramp-up</p>
		 Continuous Production

PEOPLE DEVELOPMENT LEVELS | OPERATORS

Milestones Entering	Milestones Leaving	 Lab Production
Operators know how to operate the lab plant to produce a high-quality product under lab conditions.	Operators have a comprehensive understanding of the equipment and process behavior. They know the assumptions and rationales behind the relevant requirement sheet specification items, parameters, tolerances, and limits. The project team includes at least one operator who will support or carry out the explorative test. The project team has an in depth understanding of the milestones and roadmap.	 <p>Closing the Gap mentally</p>
Operators are a significant part of the project team. They are aware of the objectives for the different trials and simulations and know which data need to be acquired at which quality.	Operators were a substantial part of the explorative and iterative development process, carried out tests, and understand the analysis results, models, and resulting concepts. They have gained a comprehensive understanding of the interdependencies between process performance and plant equipment.	 <p>Discovery Phase</p>
Operators know how to operate the pilot and which configurations to test to analyze and validate process performance and equipment configuration.	Operators feel comfortable operating with the plant equipment and have experienced some of the scenarios they will encounter during ramp-up and ordinary production. They are aware of the relevant protocols and plant conditions.	 <p>Validation Phase</p>
Operators know about the particularities of continuous thermal processing with the specified plant equipment and are aware of the upcoming tasks during implementation and ramp-up.	Operators comfortably operate the continuous thermal process. They were part of the integration process and carried out the ramp-up with the support of ONEJOON's site managers. They are capable of mastering ordinary operations on their own and know potential scenarios and their respective decision-making rules and activities. They are aware of whom to call for support.	 <p>Implementation & Ramp-up</p>
		 Continuous Production

WOULD YOU LIKE MORE INFORMATION ABOUT THE ONEJOON L2P PROGRAM?

In the 2nd part we report on case studies of successful projects with solid oxide fuel cell & electrolyzer cell producers.



Get your free copy of Part 2!

Just scan the QR code or visit our website at www.onejoon.de/sofc-soec to get the 2nd part.

You would like to learn more about our solutions for SOFC/SOEC producers?
We would be pleased to show you in a personal appointment what ONEJOON can do for you.



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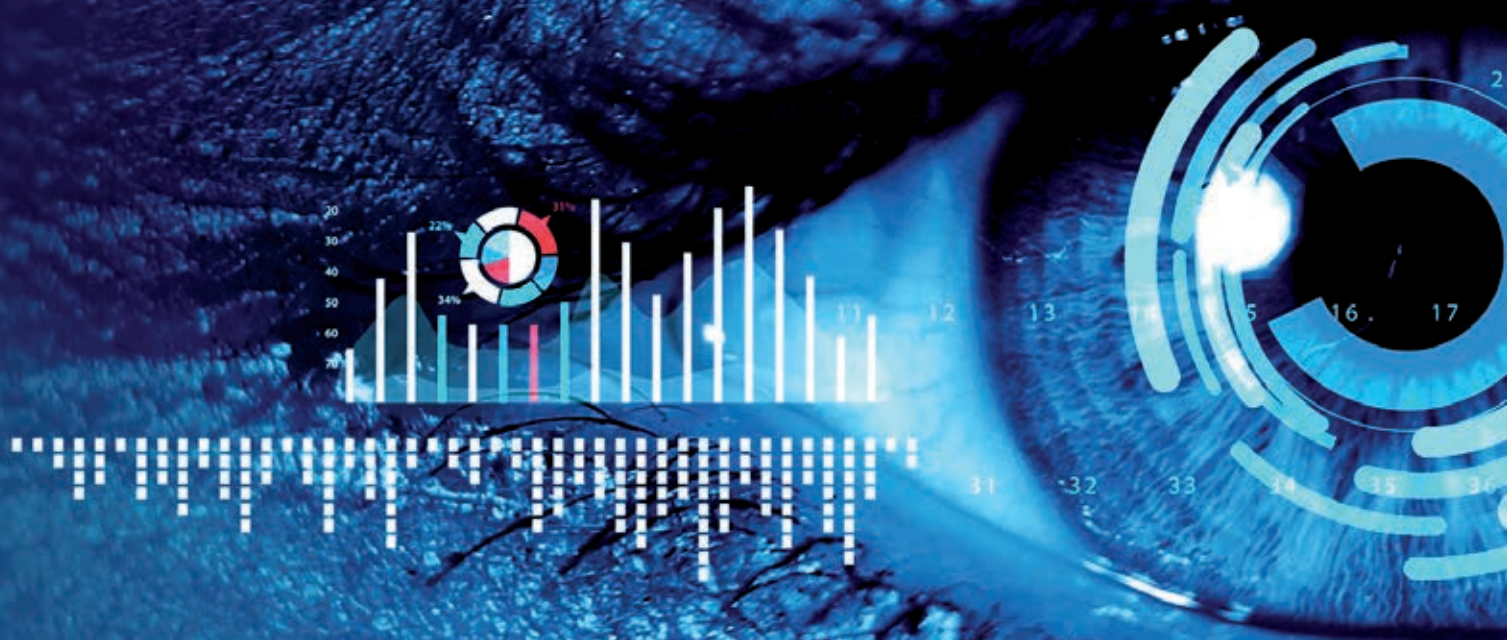
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