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27th May, 2021 Thursday 3.00pm to 4.00pm SGT

WELCOME



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27th May, 2021 Thursday 3.00pm to 4.00pm SGT

Advance Ceramic Membrane in Nano Filtration

Dr Dong Xuecheng, Senior Scientist I Sustainability & Life Cycle Engineering Group



gency for science, Technology



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27th May, 2021 Thursday 3.00pm to 4.00pm SGT

Self-Assessment for Sustainability Excellence in Water Management

Ms Cadence, Research Engineer Sustainability & Life Cycle Engineering Group





Hybrid Multiphysics Approach in Wastewater Treatment

Dr Wu Weiyi, Scientist II Sustainability & Life Cycle Engineering Group





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Q&A Segment

Mr Cedric Yon, Head Urban Sustainability Solutions, A*STAR Enterprise





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03th Jun 2021, 3pm - 4pm

MABR Smart-Product-Solutions (Fluence Corp)

10th Jun 2021, 3pm - 4pm

PUB Technology Update & Sharing

16th Jun 2021, 3pm - 4pm

Sustainable Water Solutions: Efficiency in Waste Water Treatment Technologies (IWA)

24th Jun 2021, 2pm - 3:30pm

Sustainable Water Solutions: Performance Achieved Across Industries (Co-organised with Sembcorp @ SIWW)

25th Jun 2021, 2pm - 3:30pm

Green Discussion between Denmark and Singapore - Moderated Roundtable Discussion (The Royal Danish

Embassy) @ SIWW

30th Jun 2021, 3 pm - 4pm

SWA/SgWX Water Utilities Series - Dhaka WASA, Blangadesh @ SIWW



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For further queries on the event, please contact :



Singapore Water Association T: (65) 65150812 E: <u>enquiry@swa.org.sg</u> www.swa.org.sg

Ceramic Angstrom-Level Separation Membrane Nano Material Science For both water and non-aqueous Regenerate valuable solvent resources using novel material for water treatment and solvent separation No polymeric material Utilise inorganic and low-carbon material technology that is compatible with System Membrane concentrated solvent and high temperature ntegration Technology process **Applications beyond water industry** <u>ل</u> Increase organic solvent resource utilisation and circularity via close-loop continuous manufacturing via e.g. pervaporation system









Ceramic Membrane and System Integration Capabilities

Value proposition: Platform technology of polymer-free, regeneratable/renewable membrane, to recover high value solvents from water and solvent waste streams for close-loop manufacturing waste and resource

Nano Ceramic Membrane Material Technology

Ultra and nano membrane pore structure

- Ceramic substrate pore size down to 0.5 µm (micro-to-ultra filtration)
- Crystal: Silica, zeolite, silicalite, metal–organic frameworks (MOF)
- Fabrication process: seeding, growth, interface, continuous layer

Angstrom Ceramic Membrane Material Technology

Our unique crystal separation layer fabrication technology, also provides Angstrom-level filtration size comparable to reverse osmosis polymeric membrane



Crystal design, synthesis, continuous separation layer fabrication (crack-free surface)

	Microfiltration	Ultrafiltration	Nanofiltration	Reverse Osmosis
Size of Particle	> 0,1 µm > 500 000 Da	0,1 - 0,01 µm 1 000 - 500 000 Da	0,01 - 0,001 µm 100 - 1 000 Da	< 0,001µm < 100 Da
Type of Particle	suspended particles, colloidal haze, oil emulsions	Macro molecules, bacteria, cells, viruses, proteins	Micro molecular organic compounds	lons

Membrane filtration size - from micro to sub-nano (reverse osmosis)



Ceramic membrane sub-nano separation enabled by Ångstrom-level pore structure



Module design and integrated pilot system for solvent-solvent pervaporation process



Technology SIMTech

ingapore Institute of Manufacturing



GREEN COMPASS

THE EXCELLENCE FRAMEWORK FOR THE SUSTAINABLE TRANSFORMATION **OF MANUFACTURING**

Cadence Hsien Research Engineer cadence_hsien@simtech.a-star.edu.sg

Singapore Institute of Manufacturing Technology (SIMTech), A*STAR

May 2021

Why the Green Compass?

Assessment

Businesses need a systematic and standardised way to assess where they are in terms of environmental sustainability, and determine where and how they can improve. This can be achieved through the Green Compass.



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Labelling & Reporting

Learning

Benchmarking

Overview of the Green Compass

Taking the value chain and life cycle perspectives, the Green Compass aims to enable businesses and industries to transition towards an environmentally sustainable and circular economy.



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Environmental Sustainability Dimensions

The Green Compass Assessment aims to assess businesses and industries across six key dimensions.

	Energy Management	Water Management	Material Management	Carbon Management	
	in Operations	in Operations	in Operations	in Operations	
Operations	Considers all energy-related operational processes within the organisation's facilities and their environmental impacts beyond the organisation's boundaries to achieve improvement of energy consumption and efficiency for climate change mitigation within the organisation.	Considers all water-related processes within the organisation's facilities and their environmental impacts beyond the organisation's boundaries to achieve improvement of water consumption and efficiency within the organisation.	Considers all material and waste-related processes within the organisation's facilities and their environmental impacts beyond the organisation's boundaries to achieve improvement of material efficiency within the organisation.	Considers all carbon emissions-related operational processes within the organisation's facilities and their environmental impacts beyond the organisation's boundaries to achieve improvement of carbon emissions reduction within and beyond the organisation.	

Sustainable Supply Network	Considers supplier related processes, communication, and the environmental impacts of suppliers , outside the organisation's boundaries to achieve improved relationships and drive collaborative environmental initiatives between suppliers and customers, to ensure a supply network with low/ positive environmental impact .
Sustainable Product Life Cycle	Considers design and management of sustainable products and services across the product or service life cycle stages to achieve improvement of the organisation's products/services environmental performance throughout their life cycle.

Emphasis of Water Management in Operations

Assessment that focuses on domains which are relevant to driving **water management improvement** in the organization and emphasizes progression.

POLICY	INFORMATION SYSTEM	ACTIVITIES
 Determine the compliance and internal water management policies Knowledge about water management within the company Understand the targets for water efficiency improvement 	 Understand the state of measurement of water consumption in the company How water data is processed and used Understand actual water consumption and breakdown 	Determine the technologies and project implemented in the company to improve water management and reduce water consumption.

Determine the state of water management in a company and collect data about water consumption

Water Management in Operations

company the company Visionary Outstanding Industry Average Elementary Rudimentary Initial I evel 1 Level 2 Lovel 3 I ovol A Lovel 5 A water management system is in place to reduce methodically and The breakdown of water consumption is done throughout the The organisation is involved in setting new industry continually absolute water consumption within the organisation. The Water consumption and effluent discharge are monitore organisation, beyond known hotspots. Commitments to prote standards and is known for innovations related to wate ganisation is part of collaborative initiatives and/or R&D projects that air ithin the organisation. Different types of water sources have the environment through water consumption reduction are usage efficiency, recycling of water, and/or water to improve water consumption performance. Improvements of water Description of level of sustainability in Water Management Water management is not considered within Water consumption and effluent discharge are tracked as p been identified over key areas/facilities/machines. Water nade. Additional water consumption reduction targets are an nsumption reduction. Additionally, the organization sho efficiency, reduction of water consumption, and water recycling rate an Operatio the organisation of operational costs. consumption at these areas are individually measured. Wat water efficiency are set, to improve beyond initial absolute water stewardship. The organisation is on track to achiew targetted within the organisation. Water recycling and reuse and/or reduction targets are set. The results are communicated reduction targets. The concerpt of water recycling and reus water consumption reduction and water recycling target ternate water sources are part of the organisation's water system. Wat internally or externally. within the organisation is known. The results are regularly (based on local water availability and science-based targets are set to achieve environment protection based on local water communicated internally and externally targets). availability and science-based targets. Policy Fop management (Management leadership eg CE p and middle management (CEO/ Facility/ water manage n addition to Level 4, organisation considers custome Who is responsible for and/or Managing Director/ C-suite executives or other top king level management (eg department manager) take In addition to level 3, working level management engage suppliers. Management Responsibility Health, Safety and Environment (HSE) manager or feedback and feedback from engaged professionals or fluences water related issues in th There is no person in charge anagement in the organisation) is/was confronted w e of this responsibility, with the support of top and mic artners and internal staff for feedback and collaboration to improve wate issue but has not formally taken action nor assign mmittee) are given the responsibility and authority to mal regulators in charge of certifications or standards, regarding management efficiency or water consumption reduction organisation? changes regarding water management in the organisation water consumption responsibility n addition to level 4, the organisation continually improve A targetted and systematic approach is used to identify wat addition to level 3, water consumption and water recycling targets a How does the organisation set wate The organisation does not have water verall water consumption reduction and meeting the quali tion of key machines/ a and achieves set targets for water efficiency and sumption hotspots (machines/ facilities/ areas/ process processes are measured and targeted to set absolute reduction targets. Targets of trade efficient water discharge are attempted with the sumption in context of global climate change mitigation set in context of local water availability and science-based targets. consumption reduction targets? consumption reduction targets Targets are set to methodically improve water efficiency at intention to reduce operational costs. targets, and is now a target/ role model for other reduce absolute water consumption at these areas organisations. The organisation has undergone water auditing. The result is The organisation is not aware of the legal Regulations (aside from the Mandatory Water Efficiency here is internal water consumption and effluent discharm addition to level 4, the organisation is part of initiatives of What regulations, standards and/o The organisation has a certified water management system and/or ommunicated internally and externally. The organisation has egulations regarding water consumption and Management Practices) regarding water consumption and eporting. The absence or presence of water consumption R&D projects that have specifically developed standards o environmental management system (i.e. ISO, SS) that places emphasi Compliance certifications does the organisation a water efficiency management plan. Where required, the effuent discharge that are relevant to the effuent discharge are considered and abided by the reporting results have been communicated internally or best practices for water and wastewater management in organisation abides to Mandatory Water Efficiency conform to? on or evamines water management organisation organisation. externally operations within their industry. Management Practices. Training about water management in the organisation is There is a structured water management training programme addition to level 3, training about water management in the organisatio imited to environmental team/water manager and functions What training about water is extended to all departments, teams and functions (i.e. procurement, n addition to level 4, there are proactive steps to incorporat that adopts an approach of continuous learning, to enable the There are opportunities for water management training, There is a cohesive statement to the environmental team management is available within the There is no training for water management constant learning, re-learning, and improvement of new and product development, sales & marketing), based on level of expertise requirements for future and innovative water management Competence subject to management approval, and limited to immediate regarding water management in the organisation. There is a organisation? within the organisation. existing skills. Select staff who require skills related to water required. Formal feedback channels are in place to allow water skillsets and enabling cligital tools into organisation's training benefit to the organisation's operations. curriculum in the aspect of water management, and management are identified, and training programmes are management training programmes to be jointly curated and updated b curriculum supporting tools that is integrated with organizational employees HR and business teams offered to them jectives, talent attraction, and career development pathways Information System Overall water consumption information is collected from Water consumption is monitored by all departments/ facilities Where and at what physical level is water consumption hotspots (machines/ facilities/ areas/ throughout the organisation, to acquire/ record and store water In addition to Level 4, the central automated monitoring the water consumption and effluent Water consumption and effuent discharg Verall water consumption and effluent discharge information A monitoring system is in place to acquire and store detailed water processes) identified by the organisation, to supplement consumption data. This is done beyond known water tem consistently collects data across the organisation discharge data tracked in the information from water supplier is known from main meter devices and/or utility bills, and th onsumption data at a machine level in the organisation. Information ab consumption data from the main water meters and/or utility nsumption hotspots (machines/ facilities/ areas/ process The data is suitable for use in future projections. organisation? acknowledge during utility bill payments. information is collected. water discharge to different locations is collected. bills. Information about water discharge to different locations. identified by the organisation. Information about water Measurement is collected discharge to different locations is collected Annual, monthly and/or weekly water consumption is Annual, monthly, weekly and/or daily water consumption is In addition to Level 3, water consumption is digitally monitored via How and at what frequency is water Annual and/or monthly total cost of water Annual and monthly water consumption and trade effluen In addition to Level 4, the central automated monitoring anually tracked based on a standard operating procedure digitally measured and collated via an automated water automated water monitoring system that has real-time communicator consumption tracked in the purchased and trade effluent discharge is discharge is manually tracked via main water meter and/o system consistently collects data across the organisation monitoring system. Trade effluent discharge is digitally Annual, monthly and/or weekly trade effluent discharge is capability, with higher frequency for targetted areas/machines. Trade tracked via utility bills. utility bills The data is suitable for use in future projections organisation? manually tracked. measured or manually tracked. effuent discharge is digitally tracked. Data from the digital water monitoring system integrates real-time water Water data collected is automatically analysed to manage (Data from the digital water monitoring system is manually. consumption and trade effluent discharge data across control water consumption, water recycling, and Vater consumption data is manually processed and analysed analysed and used to compare water consumption data across ses/machines with proven automated data processing methods, fi How is water-related data processe Water consumption and trade effluent discharge data is Processing Water consumption and trade effluen to find water consumption hotspots, which are targetted for the firm, to target low hanging fruit and set water efficiency targetted water consumption and trade effluent discharge improvement. rovement targets, using artificial intelligence or big data duction. The organisation uses heuristics to process data to analytics. The organisation uses water data for on-going and used? discharge data is not processed/used processed for the payment of utility bills targets and identify water recycling opportunities. The The processed data can be used for collaboration and/or R&D projects to R&D efforts to improve water efficiency, with proven results reduce water consumption organisation has a standard operating procedure to process prove the organisation's ongoing efforts in achieving water consumption in improving the organisation's water efficiency. data to reduce water consumption reductoin and water recycling Activities At water consumption hotspots (machines/ facilities/ areas) Within or beyond the organisation, initiatives are planned and What water management resources nere are basic technologies, knowledge and/or skills relate processes) as identified by the organisation, initiatives are emented to systematically reduce water consumption and wastew The organization leads the industry in water efficiency There is acknowledgement of water consumption from the and/or activites are implemented in There are no initiatives to reduce wate o reducing water consumption within the organisation. The mplemented to target and reduce water consumption and generation and increase water recycling beyond those in level 3. The performance through developing innovative technologie organisation's activities, but no organisation-wide initiative of your organisation? consumption omanisation has embarked on initiatives to reduce water wastewater generation. There are industry-standard organisation has developed best practice knowledge, technologies, and methods. Reuse and recycling of water is an important mperative to reduce water consumption consumption chnologies and knowledge related to water consumption of methods, tools and/or skills. Collaborative R&D and/or product/service part of the water supply in the organisation wastewater generation reductions within the organization innovations are implemented

Identify suitable description for your

Qualitative questions about

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Water Management in Operations

Progression of a company's water management

			Rudimentary	Elementary	Industry Average	Outstanding	Visionary
		Initial Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
Description of level	of sustainability in Water Management Operations	Water management is not considered within the organisation	Water consumption and effluent discharge are tracked as part of operational costs.	Water consumption and effluent discharge are monitored within the organisation. Different types of water sources have been identified over key areas/facilities/machines. Water reduction targets are searce an end/oxidy measured. Water reduction targets are set. The results are communicated internally or externally.	The breakdown of water consumption is done throughout the organisation, beyond inown hotspots. Commitments to protect the environment hrough water consumption networks are made. Additional water consumption networks are and water efficiency are at, to improve begron initial absolute networks targets. The concept of water neopling and near within the organisation is shown. The nexts are negative communicated internally and elemally.	A noter management system is in place to reduce methodically and continually about evanter consumption which the organization. The organization is part of collaborative initiatives and/or RBD prejects that and to improve native consumption pathomatics. Improvements of native targeted within the organization. Water recepting and reuse and/or targeted within the organization. Water recepting and reuse and/or targeted within the organization. Water recepting and reuse and/or targeted are set to achieve environment protection based on local water manual targets and the organization water protection based on local water manual targets and the organization of target and on local water	The organisation is involved in setting new industry standards and is known for innovations related to water usage efficiency, recycling of water, and/or water consumption reduction. Additionally, the organization show water setwardship. The organisation is on tank to achieve water consumption reduction and water recycling targets (toteed on local water availability and science-based targets).
Policy	1		Too management (Management leadership og CEO)				
Management Responsibility	Who is responsible for and/or influences water related issues in the organisation?	There is no person in charge.	Managing Director/ C-suite executives or other too management in the organisation) is/was confronted with the issue but has not formally taken action nor assigne responsibility.	Top and middle management (CEO/ Facility/ water manager Health, Safety and Environment (HSE) manager or committee) are given the responsibility and authority to make changes regarding water management in the organisation.	horking level management (eg department manager) takes charge of this responsibility, with the support of top and middle management.	In addition to level 3, working level management engage suppliers, partners and internal staff for feedback and collaboration to improve water efficiency or water consumption reduction.	In addition to Level 4, organisation considers customer feedback and feedback from engaged professionals or regulators in charge of certifications or standards, regarding water consumption.
Targets	How does the organisation set water consumption reduction targets?	The organisation does not have water consumption reduction targets.	Overall water consumption reduction and meeting the quality of trade effluent water discharge are attempted with the intention to reduce operational costs.	Non-sensumption of key machines/ areas (in week) processes are measured on an argement to set absolute reduction targets.	A targetted and systematic approach is used to identify water consumption hotspots (machines/ facilities/ areas/ processes). Targets are set to methodically improve water efficiency and reduce absolute water consumption at these areas.	In addition to level 3, water consumption and water recycling targets are set in context of local water availability and science-based targets.	In addition to level 4, the organisation continually improves and achieves set targets for water efficiency and consumption, in context of global climate change mitigation targets, and is now a target role model for other organisations.
Compliance	What regulations, standards and/or certifications does the organisation conform to?	The organisation is not aware of the legal regulations regarding water consumption and effluent discharge that are relevant to the organisation.	Regulations (aside from the Mandatory Water Efficiency Management Practices) regarding water consumption and effluent discharge are considered and abided by the organisation.	There is internal water consumption and effluent discharge reporting. The absence or presence of water consumption reporting results have been communicated internally or externally.	The organisation has undergone water auditing. The result is communicated internally and externally. The organisation has a water efficiency management plan. Where required, the organisation abides to Manatory Water Efficiency Management Practices.	The organisation has a certified water management system and/or environmental management system (i.e. ISO, SS) that places emphasis on, or examines water management.	In addition to level 4, the organisation is part of initiatives or R&D projects that have specifically developed standards or best practices for water and wastewater management in operations within their industry.
Competence	What training about water management is available within the organisation?	There is no training for water management within the organisation.	There are opportunities for water management training, subject to management approval, and limited to immediate benefit to the organisation's operations.	There is a structured water management training programme that adopts an approach of continuous learning, to enable the constant learning, relearning, and improvement of new and existing skills. Select staff who nequire skills related to water management are identified, and training programmes are offered to them.	Training about water management in the organisation is fimiled to environmental learn/water manager and functions. There is a cohesive statement to the environmental learn regarding water management in the organisation. There is a curriculum in the appet of varies management, and apporting tools that is integrated with organizational dejectives, labert attanctor, and career development pathways of the statement.	In addition to level 3, training about water management in the organisation is extended to all departments, teams and functions (i.e. procurement, product developments, size 8, markinging), based on level of opertise required. Formal feedback channels are in Jace to allow water management training programmes to be jointy curted and updated by employees, HR, and business teams.	In addition to level 4, there are proactive steps to incorporat requirements for future and innovative water management skillsets and enabling cigital tools into organisation's training ourriculum.
Information System			1				
Measurement	Where and at what physical level is the water consumption and effluent discharge data tracked in the organisation?	Water consumption and effluent discharge information from water supplier is acknowledge during utility bill payments.	Overall water consumption and effluent discharge information is known from main meter devices and/or utility bills, and the information is collected.	Overall water consumption information is collected from water consumption hotspots (machines/ facilities/ areas/ processes) identified by the organisation, to supplement consumption data from the main water meters and/or utility bills. Information about water discharge to different locations is collected.	Water consumption is monitored by all departments' faolities throughout the organisation, to acquire/ record and store water consumption data. This is done beyond known water consumption hotspots (machines/ faoilities/ areae/ processes) identified by the organisation. Information about water discharge to different locations is collected.	A monitoring system is in place to acquire and store detailed water consumption data at a machine level in the organisation. Information abou water discharge to different locations is collected.	In addition to Level 4, the central automated monitoring system consistently collects data across the organisation. The data is suitable for use in future projections.
	How and at what frequency is water consumption tracked in the organisation?	Annual and/or monthly total cost of water purchased and trade effluent discharge is tracked via utility bills.	Annual and monthly water consumption and trade effluent discharge is manually tracked via main water meter and/or utility bills.	Annual, monthly and/or weekly water consumption is manually tracked based on a standard operating procedure. Annual, monthly and/or weekly track effluent discharge is manually tracked.	Annual, monthly weekly and/or daily water consumption is digitally measured and collated via an automated water monitoring system. Trade effluent discharge is digitally measured or manually tracked.	In addition to Level 3, water consumption is digitally monitored via automated water monitoring system that has real-time communication capability, with higher frequency for targetted areas/machines. Trade effluent discharge is digitally tracked.	In addition to Level 4, the central automated monitoring system consistently collects data across the organisation. The data is suitable for use in future projections
Processing	How is water-related data processed and used?	Water consumption and trade effluent discharge data is not processed/used.	Water consumption and trade effuent discharge data is processed for the payment of utility bills.	Water consumption data is manually processed and analyses to find water consumption hotspots, which are targeted for reductor. The organisation uses heuristics to process data to reduce water consumption.	Data from the digital water monitoring system is manually analysed and used to compare water consumption data across the firms, to target low harging fault and set water efficiency targets and identify water recycling opportunities. The organisation has a standard operating procedure to process data to reduce water consumption.	Data from the digital water monitoring system integrates real-time water consumption and tradie effluent discharge data across progression inductive data procession productive traditional discharge and the system of the system of the traditional discharge and the system of the improve the organisation's ongoing effects in achieving water consumption reduction and water recycling.	Water data collected is automatically analysed to manage o control water consumption, water recycling, and improvement targets, using artificial intelligence or big data analytics. The organisation uses water data for on-poing 280 efforts to improve water efficiency, with provin results in improving the organisation's water efficiency.
Activities	1		1		1		1
	What water management resources and/or activites are implemented in your organisation?	There are no initiatives to reduce water consumption.	There is acknowledgement of water consumption from the organisation's activities, but no organisation-wide initiative or imperative to reduce water consumption.	There are basic technologies, knowledge and/or skills related to reducing water consumption within the organisation. The organisation has embanied on initiatives to reduce water consumption.	At water consumption hotspots (machines) facilities/ areas/ processes) as identified by the organisation, initiatives are implemented to target and reduce water consumption and wastewater generation. There are industry-standard technologies and inovelodge related to water consumption or wastewater generation reductions within the organization.	Within or beyond the organisation, initiatives are planned and implemented to systematically reduce water consumption and waslewater generation and increase water requiring beyond these in level 3. The organisation has developed best practice knowledge, technologies, methods, tools and/or skills. Collaborative R&D and/or product/service innovations are implemented.	The organization leads the industry in water efficiency performance through developing innovative technologies and methods. Reuse and recycling of water is an important part of the water supply in the organisation.

The journey help companies assess, target, plan and implement sustainability measures.





- Employ strategies to improve sustainability management
- Cost reduction through improvement in resource use efficiency
 Transparency
- Transparency through reporting

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Organisations assess their sustainability, to learn how they can improve sustainability within the company.



operations and development
 ✓ Quantify KPIs quantified and review operational efficiencies

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		Informati	on System		
informat data tha develops has ante within ar data col	ton systems is I can be used to ment of an organisation organisation ection, which in	an integrated set of compone y the organisation to generate mationic information system is to use to make decisions re information system to suppo- fluences the level of detail of	nts or procedure and disseminat reflects the dat garding environ rt excitorments the data, and ho	In cohereing, straving, and processing and all officers, the strave strave strave strave and all officers, the strave strave strave strave strave strave strave strave strave strave strave constrave strave	
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		1	-	Full Assessment: Energy Management Dimension	
Measure organica Piezze S	rtion?	and at what physical level is t that most describes your erg	te energy con	Readiness and Maturity Models - Quartitative Queetion 3 (Band 3)	
	Level D	Energy information from t payments.	he energy skipl	What was your total energy consumption (electricity, diesel, other sources) within the prescription in the last reporting way?	
	Level 1	Overall energy consumption utility bills and is collected	in information L	Verse and used	
	Lavel 2	Overall energy consumptio (machines) facilities/ area devidied by the organisat power renter and/or utility	in information o/ processes) ion, to supplier bills.		
	Level 3	Energy consumption is ma importantion, to ocquire/ r beyond known physical an algolificant energy consum	onitored by all secord and stor eas (machines ption stient/fe	What was your total energy consumption within the organization from non- renewable sources in the last reporting year?	
	Level 4	A monitoring system is in place to acqui data at a machine level in the organization		Your antever	
0	Level 5	The central substrated me organization. The data is a	ciltorling system autable for use	List the top areas/facilities/machine of energy consumption in your organisation.	
				Your statien	

Assessing sustainability of a company through **qualitative descriptors** and validate the sustainability level of a company via further qualitative and **quantitative questions** (e.g. breakdown of water consumption).

	Initial	Redmentary	Elementary	industry Average	Outstanding	Visionary
	Level 0	Level 1	Level 2	Level 3	Level 4	Lavel 5
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Understanding the state of sustainability across different dimensions.



Organisations can learn about sustainability techniques, collect their data and identify key improvement opportunities.

The journey help companies assess, target, plan and implement sustainability measures.





A Corporate Accounting and Reporting Standard

The results of the Green Compass are presented in a sustainability report. Sustainability report can be used to comply with NEA or other investor regulations and requirements.



PRIORITISE & PLAN

- Identify improvement opportunities and targets
- · Prioritise areas of improvement
- Develop sustainability improvement plan and roadmap
- ✓ Plan for more sustainable business
- Be ready for future \checkmark sustainabilityoriented regulations and business trends.





Identify improvement opportunities.

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Organisations implement technologies best suited to their needs .







Organisations can implement technologies to reduce resource consumption, such as the Energy Efficiency Monitoring and Analysis System (E²MAS) and Collaboration Platform for Industrial Symbiosis.





Example technologies include a water monitoring and analysis system (top), or a logistics planner (middle) for reducing transportation resource consumption.



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Hybrid Advance Oxidation Process

Applications: Chemical-free solutions for municipal wastewater treatment for urban green industry and residential needs.



Electrochemical Advanced Oxidation (EAOP)



Conventional pyrolysis method

29.87 µm 22.57 µm 26.03 µm

Wet coating method

Cost-effective coating process for mass production of advance anode for EAOP, with higher energy efficiency and improved service life.

Hybrid Multiphysics Wastewater Treatment Process





wastewater

90 min FAOP



90 min hybrid EAOP

The hybrid multiphysics process exhibits great synergistic effect to improve the treatment efficiency of organic contaminants in wastewater.

Hybrid Multiphysics Wastewater Treatment Line



Tech Features:

- Non-chemical process with configurable and scalable modules for sustainable wastewater treatment.
- Synergistic effects of different modules to achieve better performance and reduce cost.
- Self-cleaning of system and reduced membrane fouling.
- Digital ready in the future from sensor, data acquisition, connectivity, data analytics and predictive control.

Portfolio

Integrated Water Line



Ideal water line for sustainable treatment Non-chemical, configurable and scalable



Pilot scale test bed for new technology Assessment and evaluation simply by "plugin and play"



Digital ready in future From sensor, data acquisition, connectivity, data analytics and predictive control





