Virtual Visit
Experimental Power Grid Centre (EPGC)

WELCOME

18 September 2020

1000hrs – 1100hrs

(Complimentary)

Organised by :

SPECS
Smart Grid + Power Electronics
Consortium Singapore

SWA
SINGAPORE WATER ASSOCIATION

1000 - 1002hrs	**Opening & Housekeeping**	**Singapore Water Association**
1002 - 1010 hrs	**Welcome Address**	**Singapore Water Association**
1010 - 1020hrs	**Overview of EPGC - Megawatt scale Grid Facility**	**Smart Grid & Power Electronics Consortium Singapore (SPECS)**
1020 - 1035hrs	**Video tour of multiple testing platforms**	**Smart Grid & Power Electronics Consortium Singapore (SPECS)**
1035 – 1045hrs	**Capability and Use Cases**	**SPECS**
1045 - 1055hrs	**Q & A**	**Moderator : Dr Marcus Koh**
1055 – 1100hrs	**Closing**	**Singapore Water Association**

Housekeeping

- ✓ To ensure a smooth session, please mute your microphone and turn off the camera. You may communicate with us after the event.
- ✓ Please share your questions in the chat where we will try to provide answers where possible in the Q & A Segment.
- ✓ Do identify yourself so we can respond to any unanswered questions
- ✓ We will be recording this session and reserve the rights to the video
- ✓ Please complete a post event survey which upon return, we will forward the recording and presentation deck to the respondents.

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Disclaimer

- All information shared is for general information only and does not contain or convey any legal advice or administrative assistance.
- Information shared today is true and accurate as of publication date.
- SWA and SPECS reserve all rights in the provided materials

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swa
Singapore Water Association

Virtual Visit

Experimental Power Grid Centre (EPGC)

Welcome Address

18 September 2020

Dr Adrian Yeo

Singapore Water Association

Council Member

Sembcorp Industries Ltd

Snr VP (Innovations – Water)

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SINGAPORE WATER ASSOCIATION

SWA Initiatives

Since April 2020

SWAtch !

SG United Updates

SWAssist

SWA Marketplace Assist Platform (SWA-MAP)

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Q & A

Upcoming .....

Unlocking the Potential of Wastewater

(Embassy of Denmark Singapore)

22 September 2020, Tuesday
4:00pm – 5:30pm

PUB BIM e-Checker Initiative

6 October 2020, Tuesday
10:00am – 11:00am

Virtual Visit
Experimental Power Grid Centre (EPGC)

Thank You

18 September 2020

1000hrs – 1100hrs

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For further queries on the visit, please contact :

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E: specs@ntu.edu.sg

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

Smart Grid & Power Electronics Consortium Singapore

Experimental Power Grid Centre (EPGC) for Singapore Water Association Members

Dr. KOH Leong Hai, Programme Director

18 September 2020

SPECS@ntu.edu.sg

https://erian.ntu.edu.sg/SPECS

Energy Research Institute @ NTU (ERI@N)
1 CleanTech Loop, #06-04 CleanTech One, Singapore 637141
Phone: (65) 6592 1786 / 2468 Fax: (65) 6694 6217

Overview

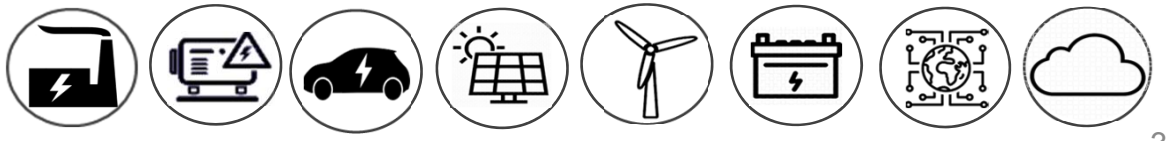
1. Introduction

2. EPGC facilities

3. Capabilities & use cases

4. Q&A

1. Introduction



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Smart grid and Power Electronics Consortium Singapore (SPECS)

AIM

- To catalyse and create a networking platform to connect commercial companies and Institutes of Higher Learning (IHL's)
- To co-develop *commercialisation projects* in smart grid & power electronics

Mission

- Unlock the value of research investment
- Accelerate technologies to market
- Support industrial scale test bedding, validation, standards & certification
- Foster business cooperation, market access
- Build a collaborative innovation ecosystem

Academic Partners:

Supported by:

Nanyang Technological University

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

ERIAN

Systems-level integration & research for tropical megacities.

Living Labs

EcoCampus

REIDS Renewable Energy Integration Demonstrator Singapore

CETRAN

EPGC

Energy Systems (Renewables, Storage)

Grid Systems (Grid 2.0 – Internet of Energy)

Urban Solutions (Smart Energy, Mobility, Energy Efficiency)

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Experimental Power Grid Centre (EPGC)

- Experimental Power Grid Centre (EPGC) is located on Jurong Island and is home to the largest megawatt-scale grid facility in the region

- EPGC's facilities enables **equipment manufacturers** and **system integrators** to test their technologies at actual power before deployment

- The centre strives to be a thought leader for challenges in the domains of **energy grids** and systems. The centre has worked with several industry players to address their challenges over the years

Industry partners:

MEIDEN, SPgroup, Rolls-Royce, HITACHI Inspire the Next, Lloyd's Register, BOSCH, AIRBUS, WEnergy Global, GENNAL, GE, AGC Asia Pacific, SWEE HIN Power Systems Pte Ltd, ST Aerospace A company of ST Engineering, BeeBryte Energy Intelligence, SJ SURBANA JURONG, NATIONAL INSTRUMENTS, PacificLight, Vestas, ABB

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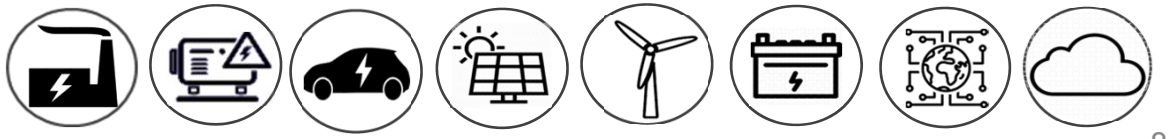
EPGC Virtual Tour (2-minute)

2. EPGC facilities



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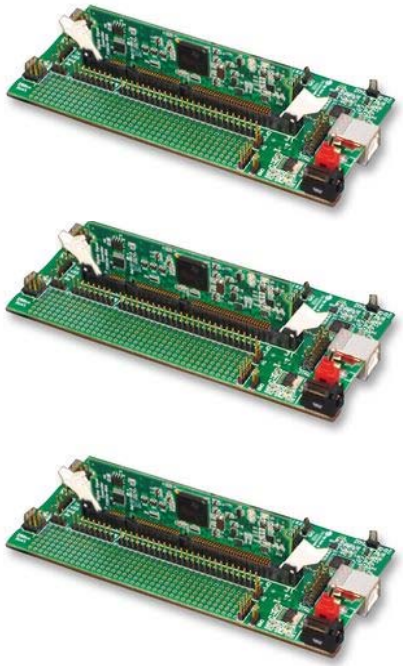
Software/Hardware-in-the-Loop

Hardware-In-the-Loop testing and verification provides a low cost, low risk and rapid evaluation means for developed or deployed controllers. Instabilities and problems can be detected before implementation phase.

Milli-seconds

Micro-seconds

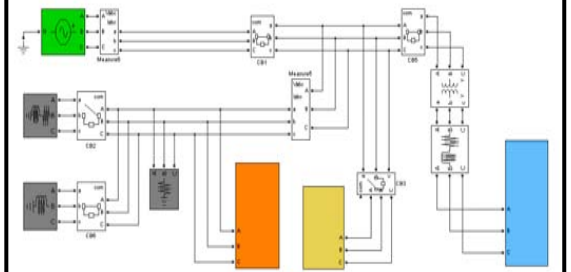
Controller under test is coded and deployed to DSP board

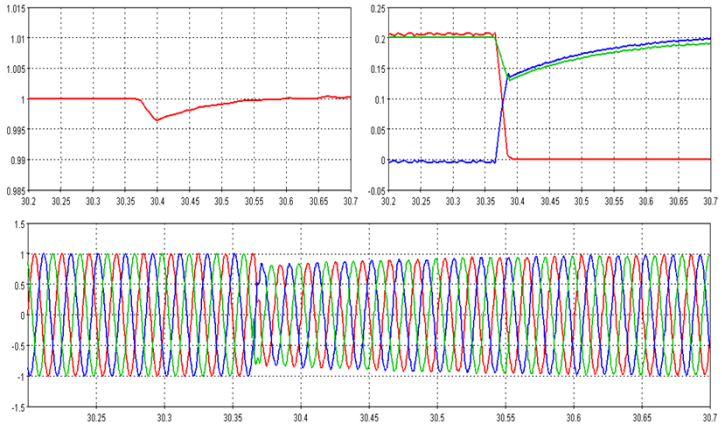


Microgrid High Level Controller

Network Parameters

Microgrid Network Real-time Model





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Megawatt-scale experimental grid

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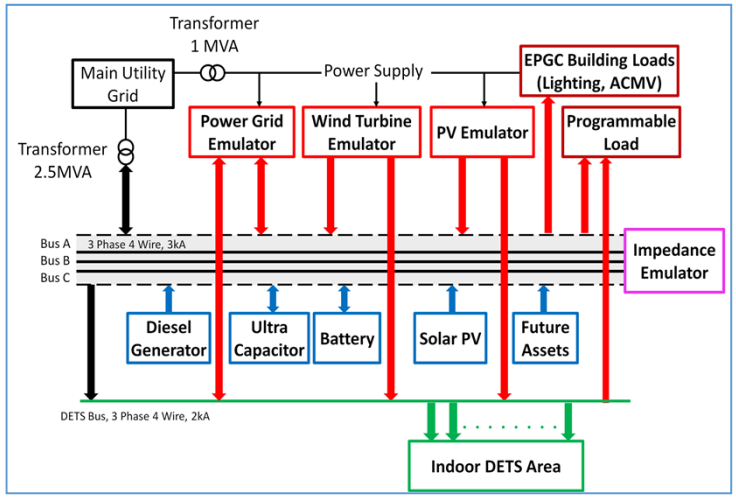
EPGC Testing, Validation platforms

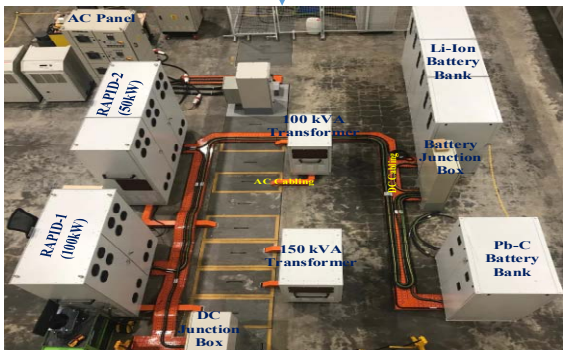
Couple thermal & electrical system

MW Scale Experimental Grid



Real Time Simulator
– Simulation of large electrical networks
- HIL testing for power electronics

iBEEMS Testbed
– Green Building solutions



200kW ESS Testing platforms
– Testing for various ESS technologies, inverters & controllers

500kW Motor Testbed
– Flexible platform for testing of motors, generators and electric drives

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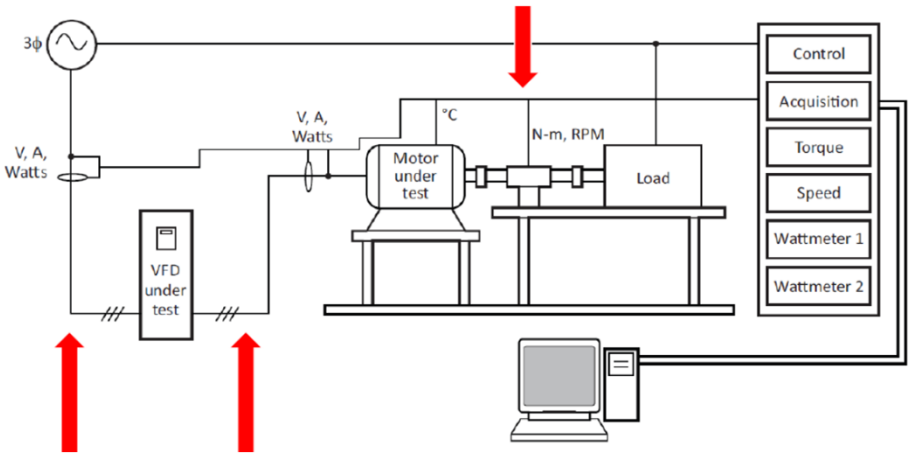
Certification partners pipeline



TÜV SÜD

DNV·GL

DVE

Singapore Test Services

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Living Lab: Renewable Energy Integration Demonstrator – Singapore (REIDS)

Located on Semakau Landfill, REIDS is for test-bedding cutting-edge technologies for smart grids, microgrids and urban electricity systems

Research → Development → Deployment

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Low TRL

Megawatt scale
@ **EPGC**

Mid TRL

Large MW scale projects
Semakau & **Jurong Port**

High TRL

2000 2011 2020 & beyond

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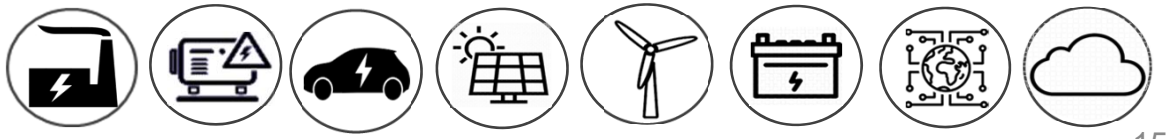
3. Capabilities & use cases



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Portable PV for membrane distillation of seawater desalination

A portable membrane distillation desalination system for remote areas using solar thermal & electric energy – produce sufficient amounts of drinking water for daily consumption

- Fully solar powered desalination system with improved performance of membrane distillation using independent heating cooling loop

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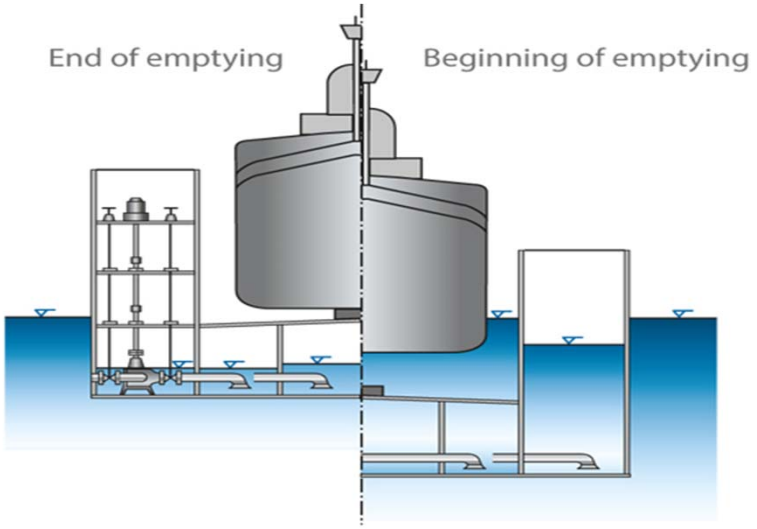
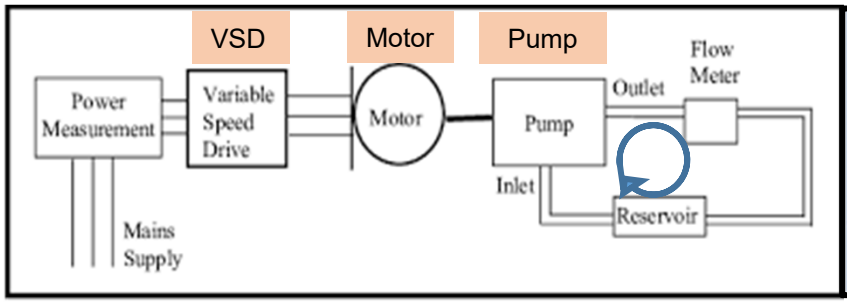
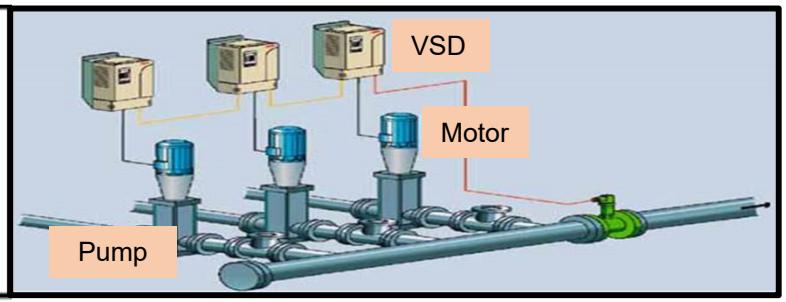
Potential dock pumping use case

- Testing, validation and certification of motor drive for pumping industrial energy efficiency @ EPGC







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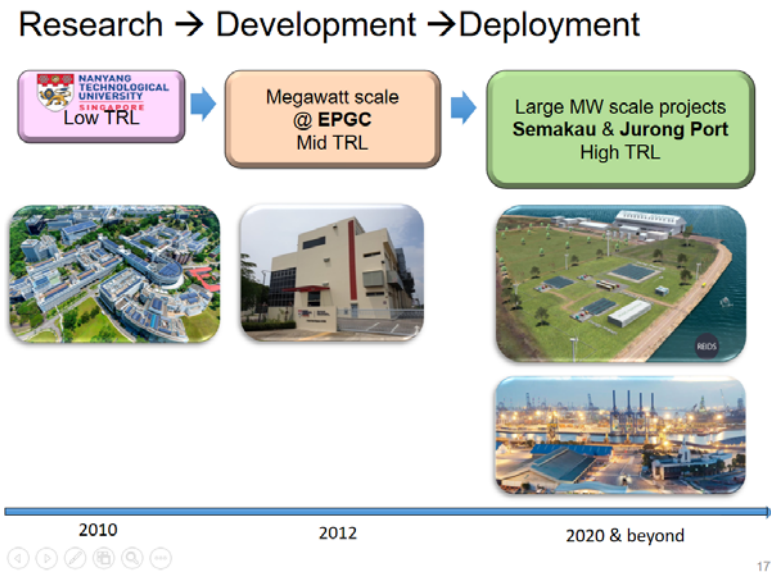

Water-Energy Nexus:

Deployment Opportunity in Singapore

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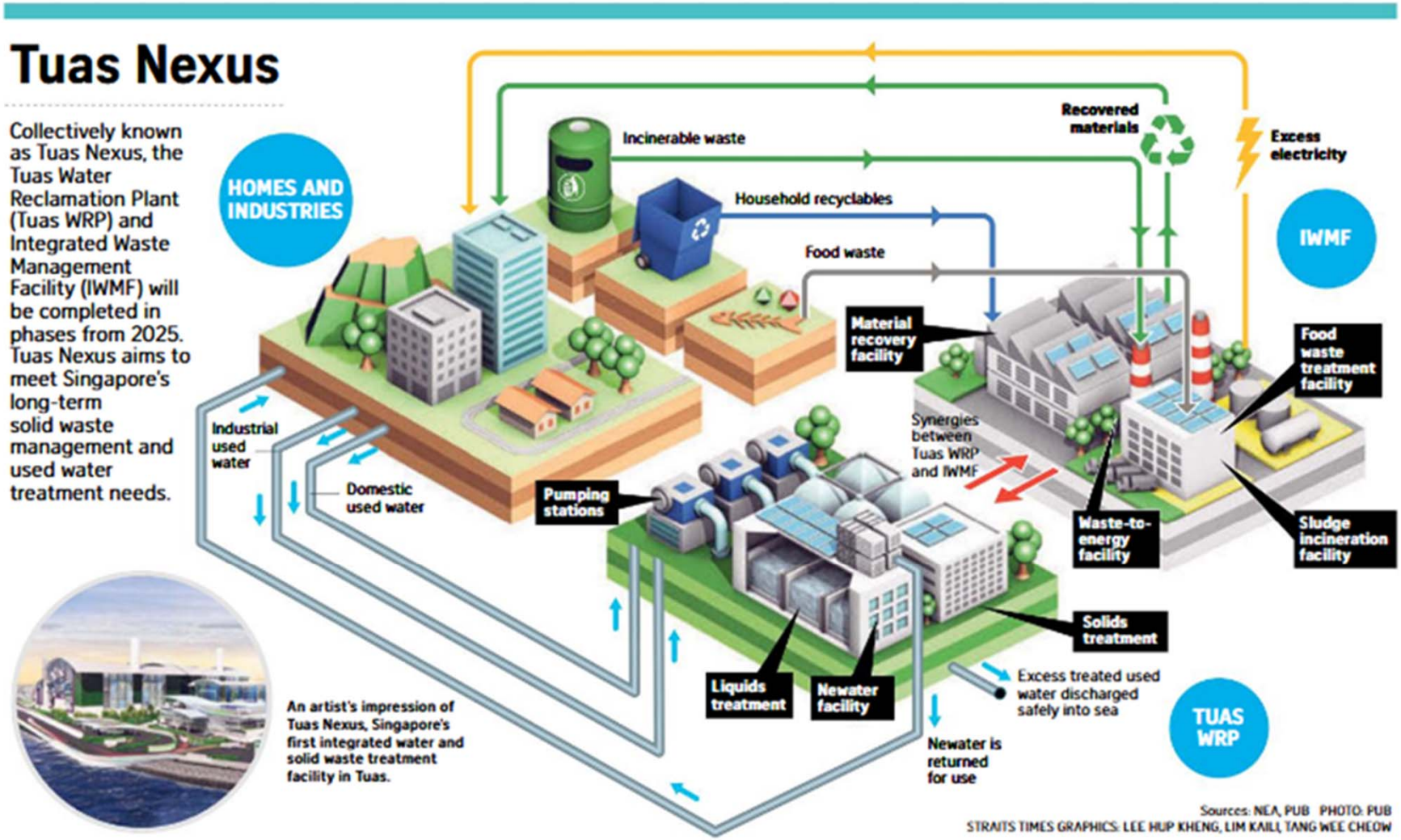
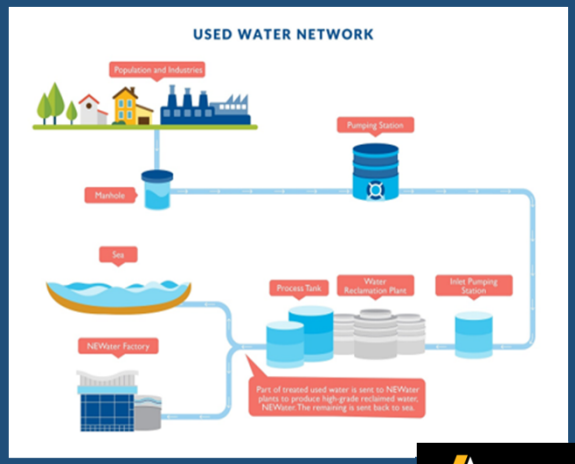
IWMF Water-Energy Nexus Opportunities – Industrial Energy Efficiency



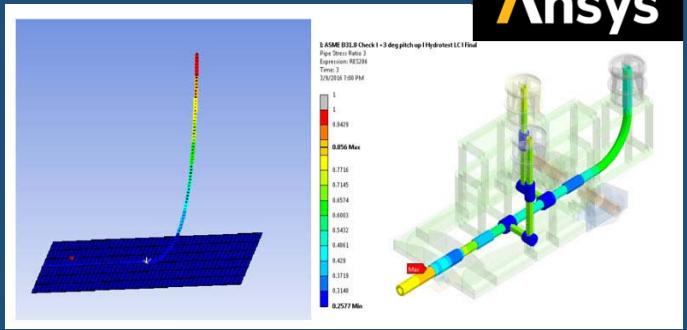
Water-Energy Nexus co-simulation

Planning tool - optimum sizing

Water Grid

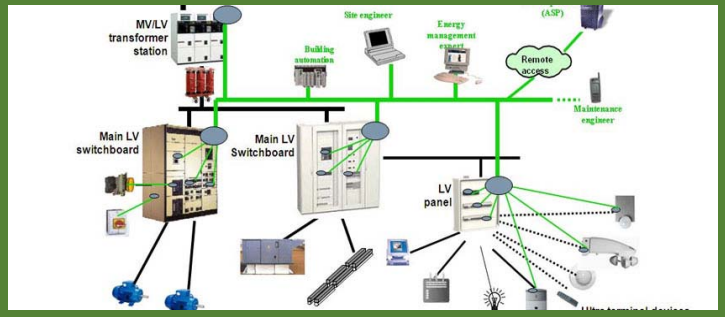


Ansys

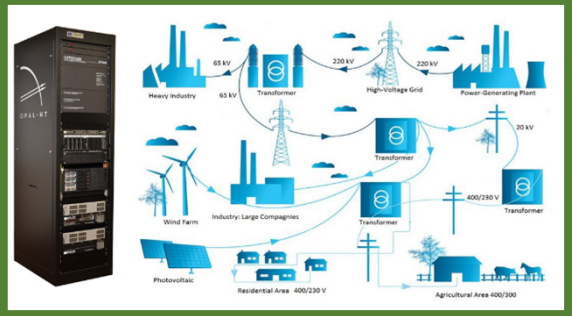


Information Exchange

Electricity Grid



OPAL-RT TECHNOLOGIES



✓ *Water-energy costs savings, water-energy savings, carbon reduction*

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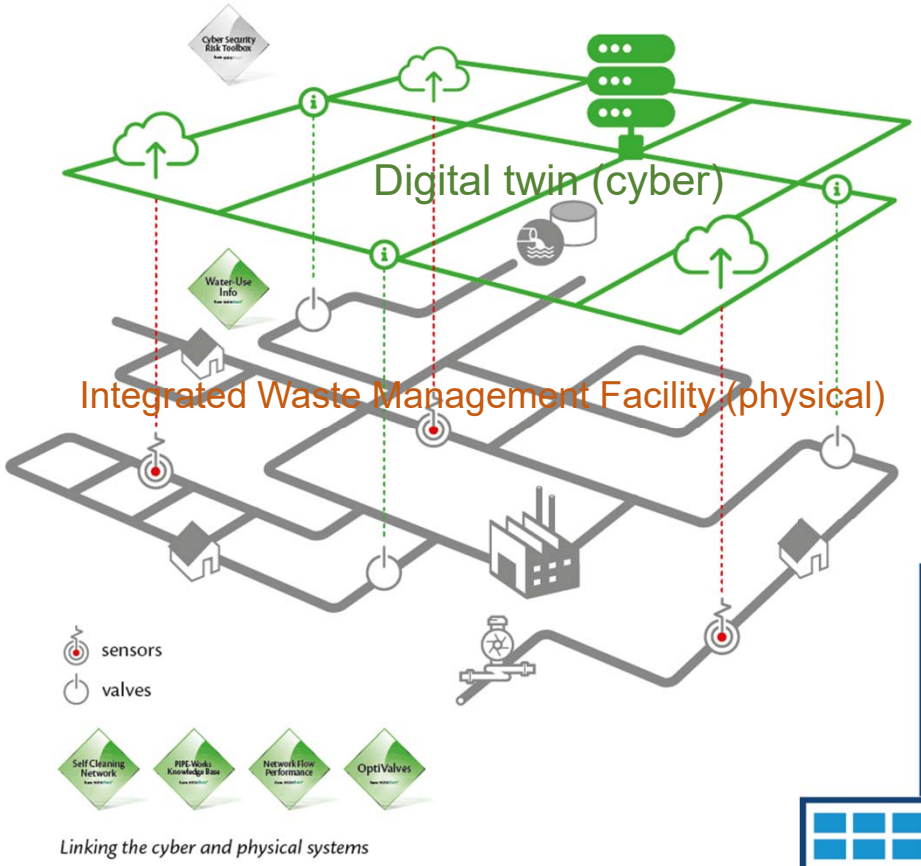
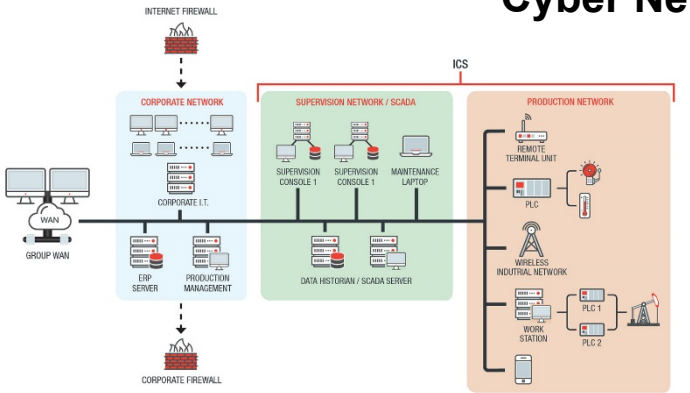
IWMF Cyber-Physical Simulation Platform - Resiliency

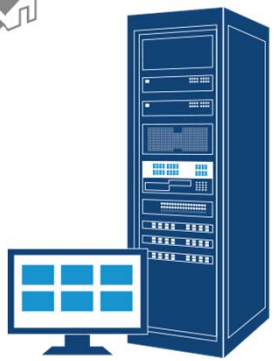


Cyber Network



Communication

Communication



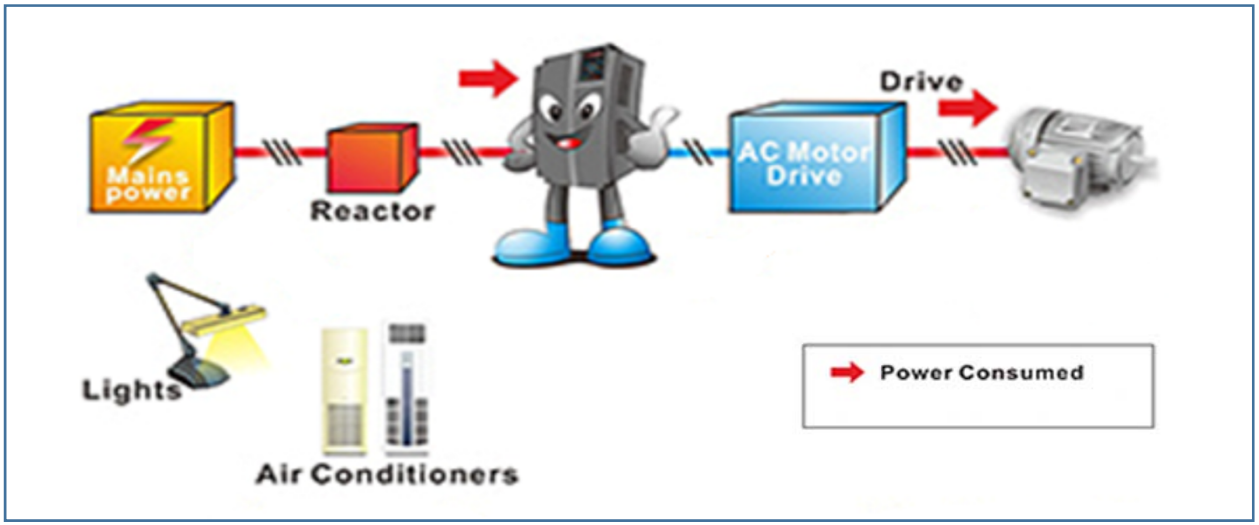
Real-time Simulation Platform

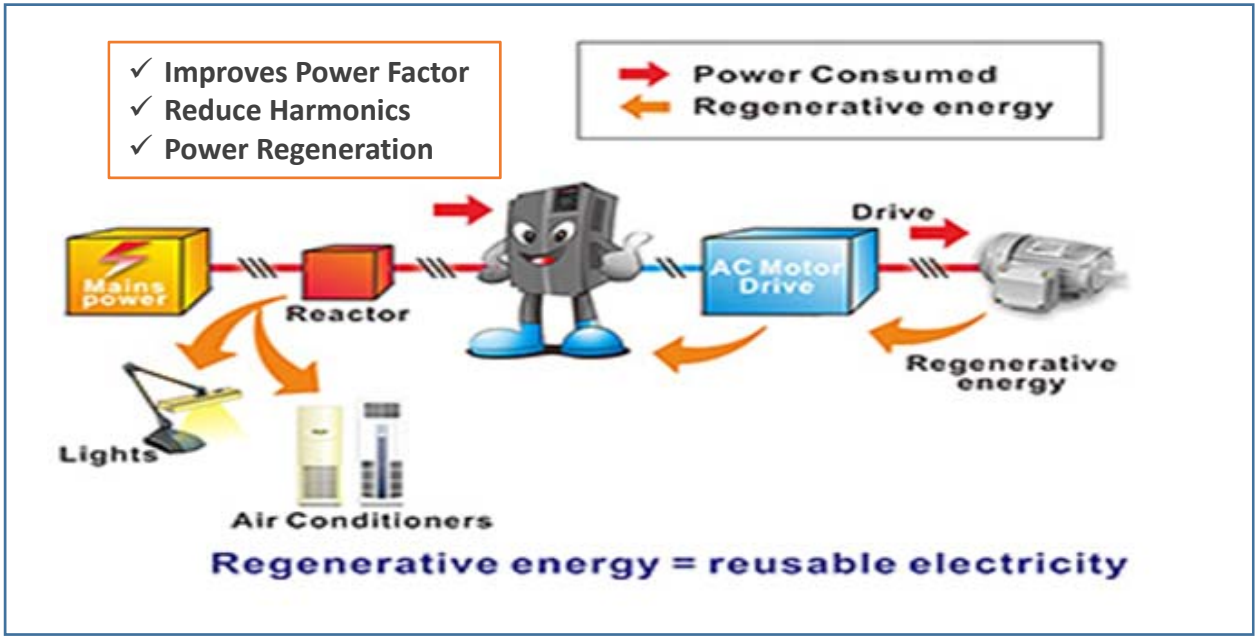
Digital I/O
Analog I/O
Amplified I/O
IRIG-B/GPS Synchronisation
IEC 61850 (SV, GOOSE)
C37.118
DNP3, OPC-UA, etc.

I/O Interface

Controller Hardware

IWMF Water-Energy Nexus Industrial Energy Efficiency Opportunities – Motor Drive





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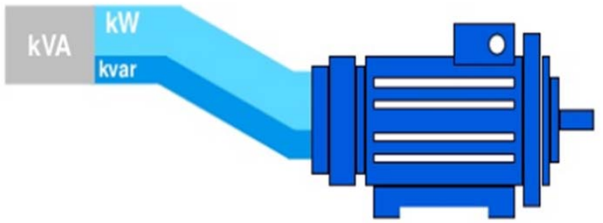
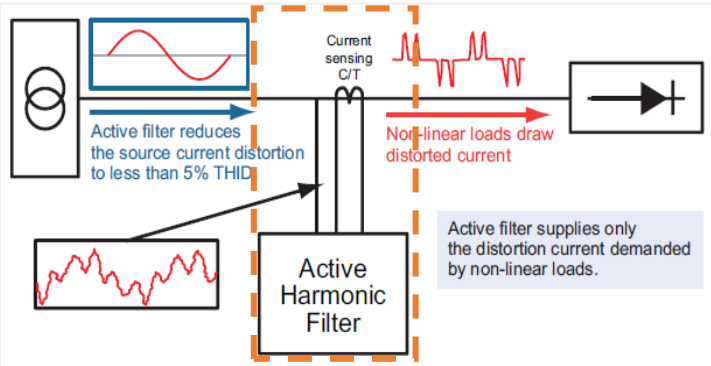
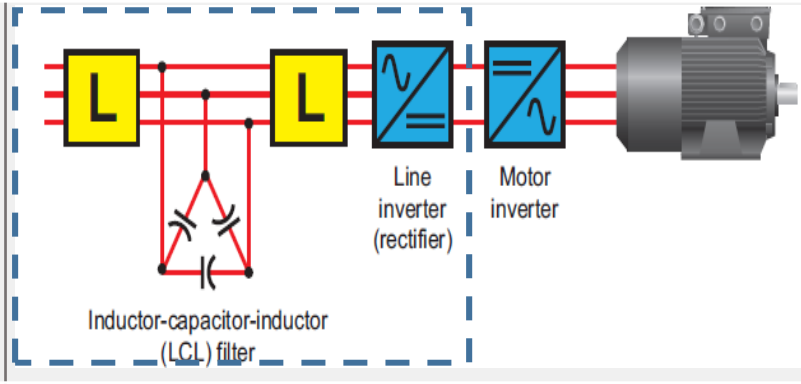
Source: ABB

Active Filter vs. Active Front End consideration

- ✓ **Improves Power Factor**
- ✓ Reduce Harmonics
- ✓ Power Regeneration

Power Factor Improvement



	Advanced Active Filter (AAF)	Active Front End (AFE)
Rating	4,480kW + 310A	4,480kW
		

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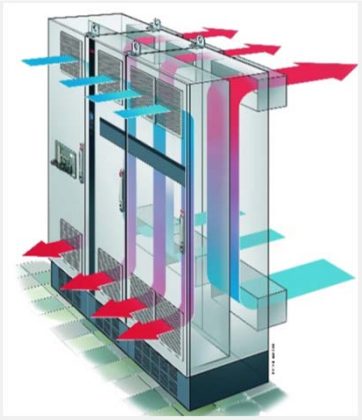
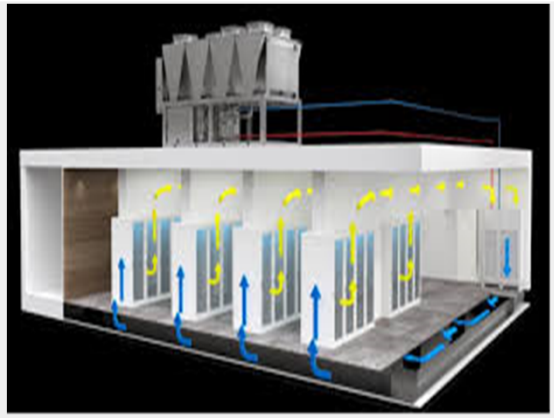
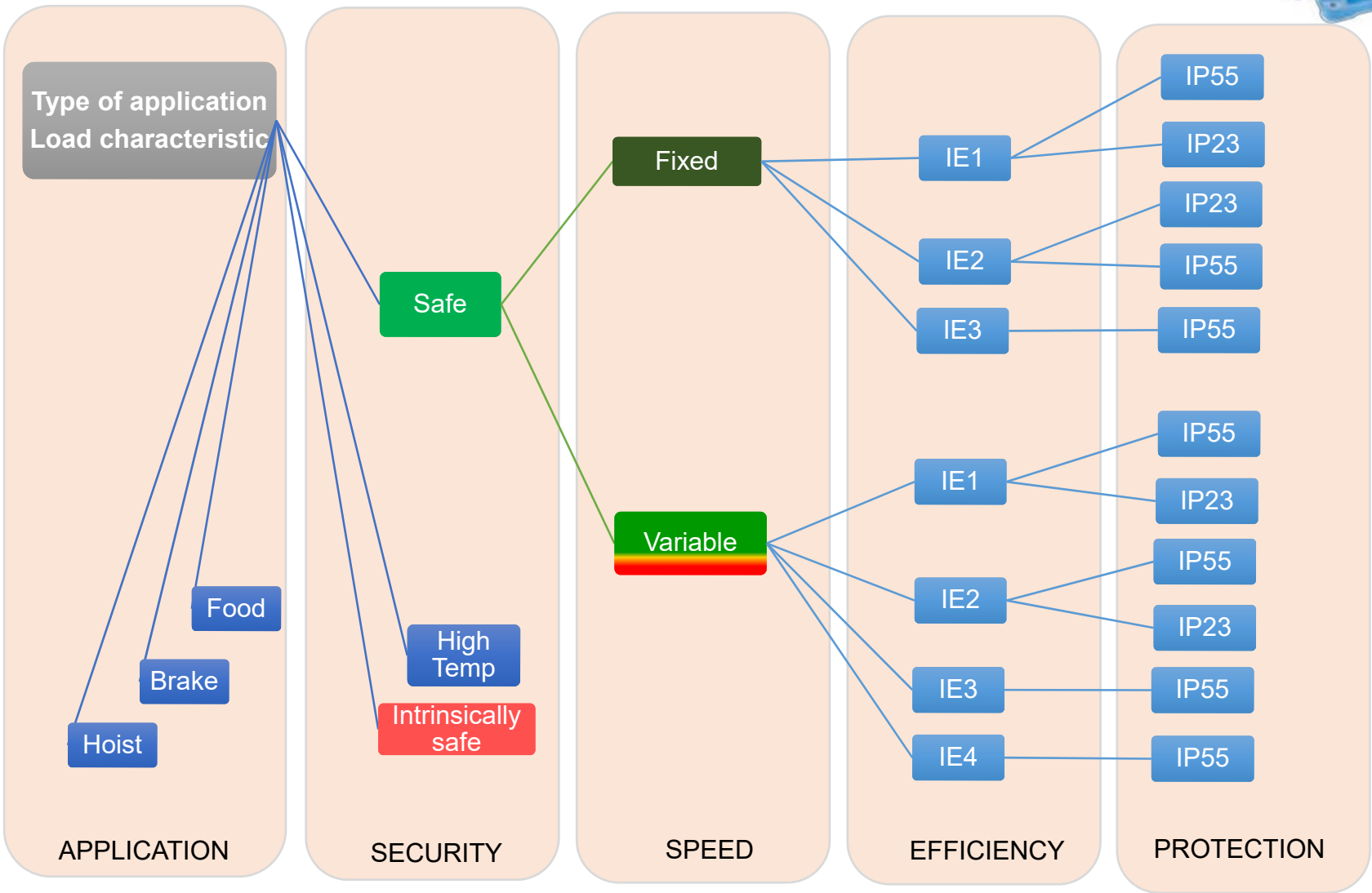
Electrical Drive Energy Efficiency Cost savings - Cooling consideration

	Dual-Side Cooling *Advanced Active Filter (AAF)*	**Traditional Cooling** *Active Front End (AFE)*
Efficiency Loss (%)	3.12%	6.7%
kWHr Loss	89kWHr	190kWHr
*potential savings **up to 53%** using dual-side cooling per year*		





Selection of Energy Efficient Prime Movers



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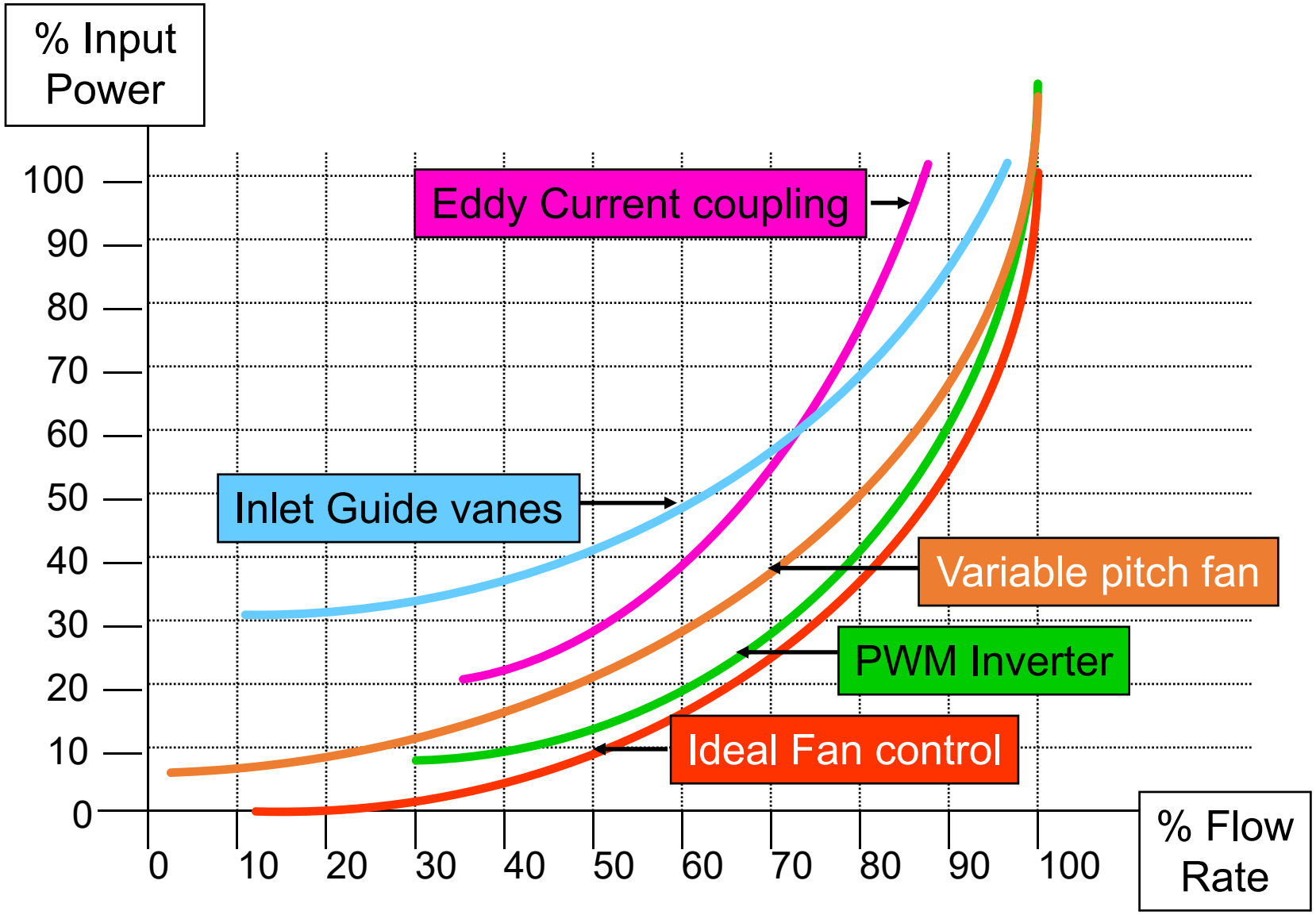
Source: Emerson

Motor Drive Energy Efficiency – Fan Load



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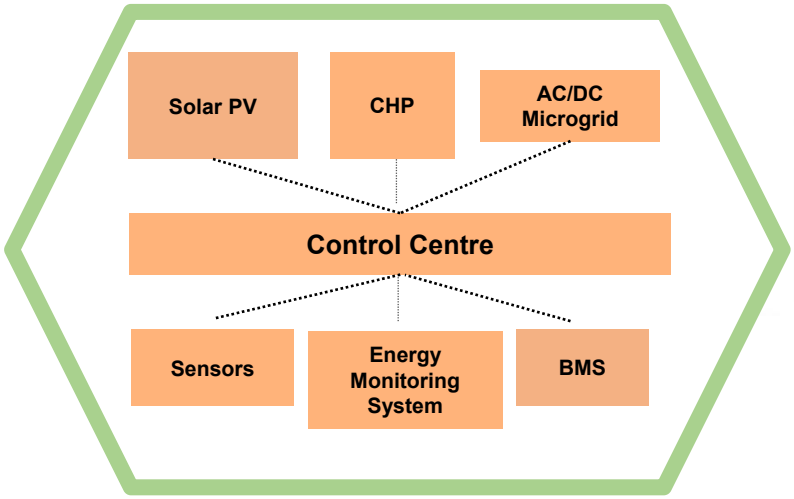
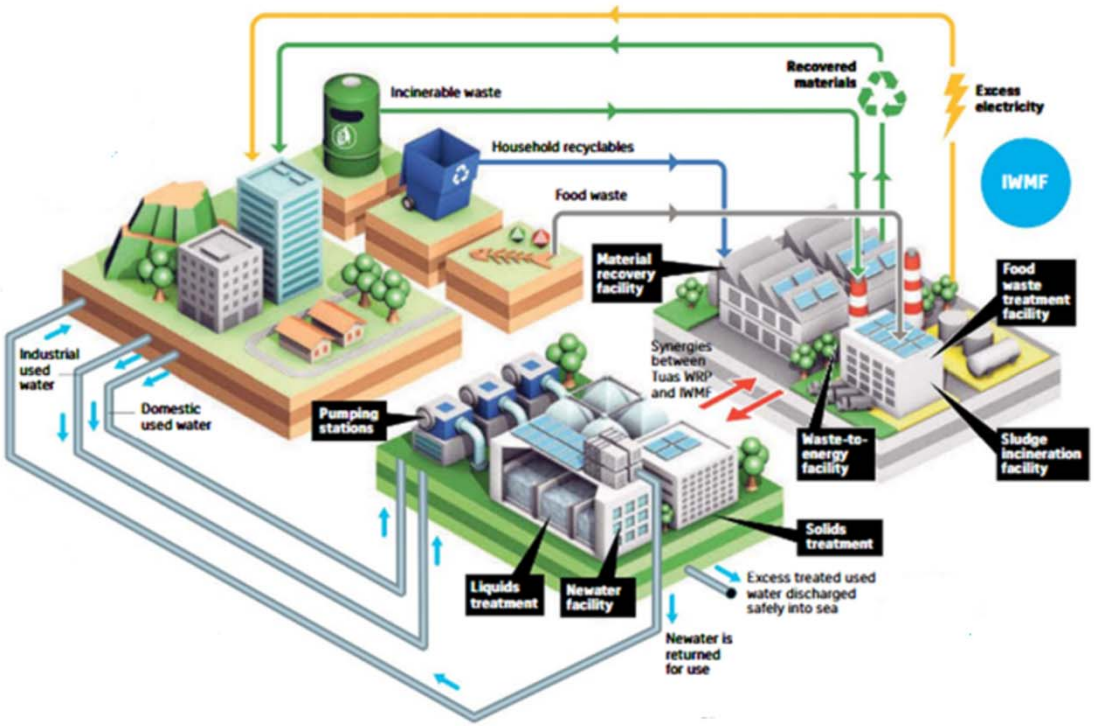
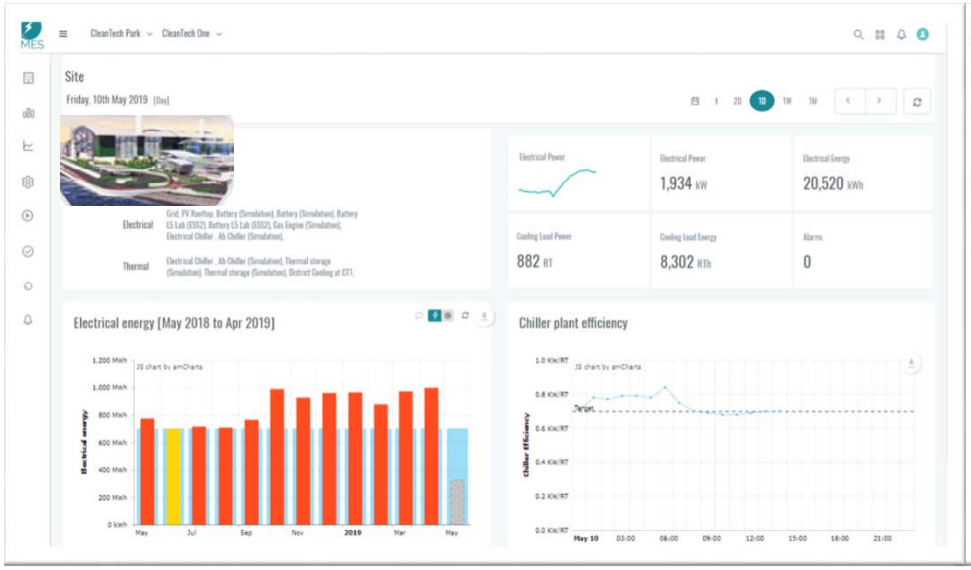
Source: Emerson

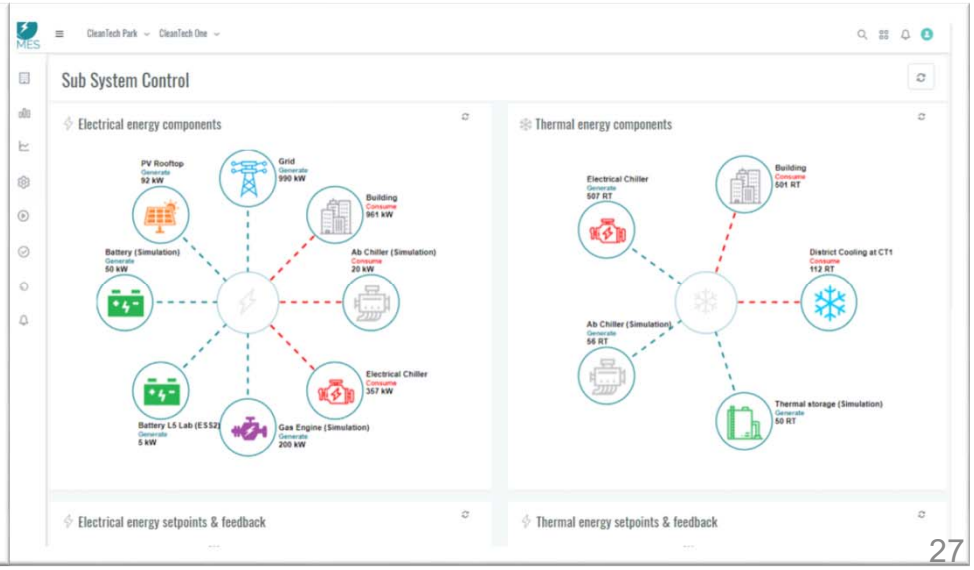
IWMF Smart Water-Energy Nexus deployment Opportunities

Smart Multi-Energy System (SMES)









4. QnA

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