Company Profile

Enabling your Energy Transition

Improving Power Supply and Control of your Critical Production Processes

Meeting
Date

vonk | Energizing Ambitions

Content

- VONK and Ampulz, legacy and who we are now
- Capabilities & Solutions
- Markets and Customers
- Hydrogen Solutions
- Hybrid Power Systems
- Selection of References and Use Cases
- Life Cycle Services

More than 80 years of experience

Holec N.V. is established

HOLEC

1962

1937

Vonk is establisbed by Mr. Arjen Vonk

1999

Vonk acquires Holec's Power Electronics division

2002

Imtech NV acquires Vonk

2015

Industry International B.V. acquires five Imtech business units and all get their own branding

2020

VONK & Ampulz brands merge into VONK to strengthen position in energy transition

Technical Capabilities

Power distribution and control & automation solutions

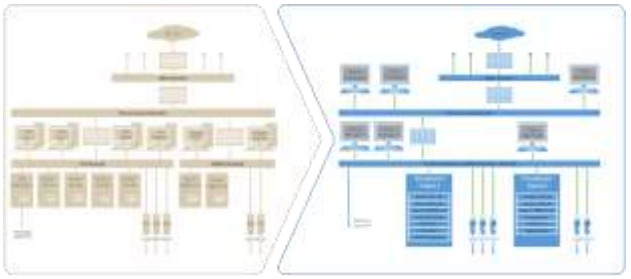
VONK offers power supply and control & automation solutions for complex and remote circumstances

Containerized solutions

- Containerized power distribution and power delivery systems, often with integrated process control systems:
  - Substations
  - Hybrid Power Systems

Key differentiator

- Ability to integrate multiple OEM components and install and commission them in existing complex and live production environments

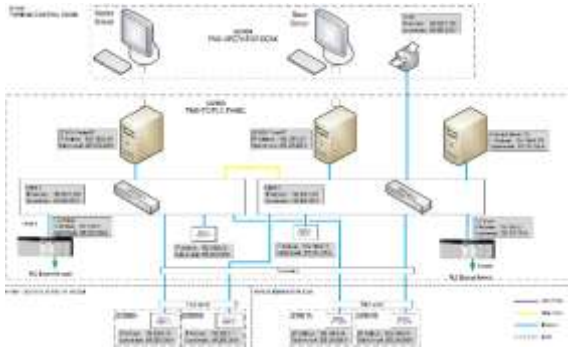


Control & Automation Systems

- Rejuvenation of process control systems for Oil & Gas plants:
  - Networks, virtualization and compliance to latest Cyber Security standards
  - Control Room upgrade, incl. human factors engineering
  - Alarm Management
- Process Safety Systems and F&G systems

Key differentiator

- Deliver an OEM independent system upgrade with minimal (or no) downtime



Power Management Systems

- Assuring power availability for critical consumers whilst minimizing operational costs
  - Load Shedding
  - Automatic start/stop of generator sets

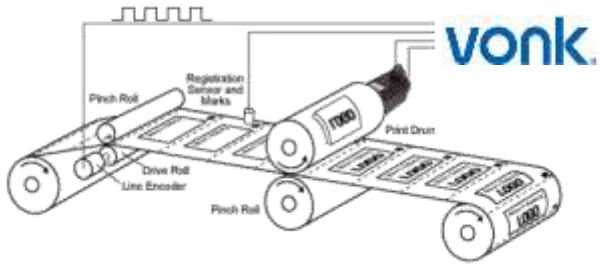
Key differentiator

- PLC based fully customized client specific solutions

Technical Capabilities

Specialized power conversion solutions

VONK offers unique power conversion solutions that require extremely high reliability and accuracy

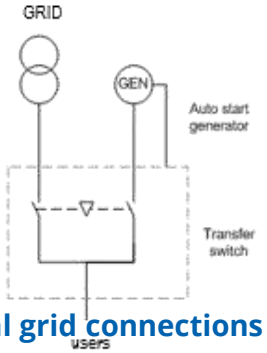


Drive solutions

- Customized drive solutions engineered to meet complex applications
  - Medium frequency drives
  - High voltage / Low voltage drives
  - Direct current (DC) drives

Key differentiator

- Very fast reaction time and outstanding stability of controlling power components, using our proprietary Control Platform

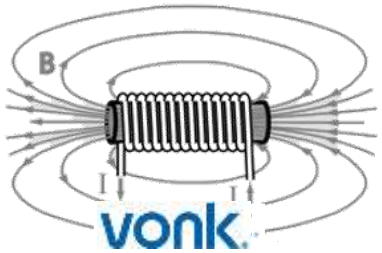


Industrial grid connections

- Active and stable connections for high quality grid connections between different energy sources, users and grids.
  - Power quality improvement
  - Proprietary Active Front End technology
  - High voltage / Low voltage components & distribution

Key differentiator

- Proprietary developed configurable technology, hard- and software engineering capabilities to deliver high quality stable grid connections



Special power converters

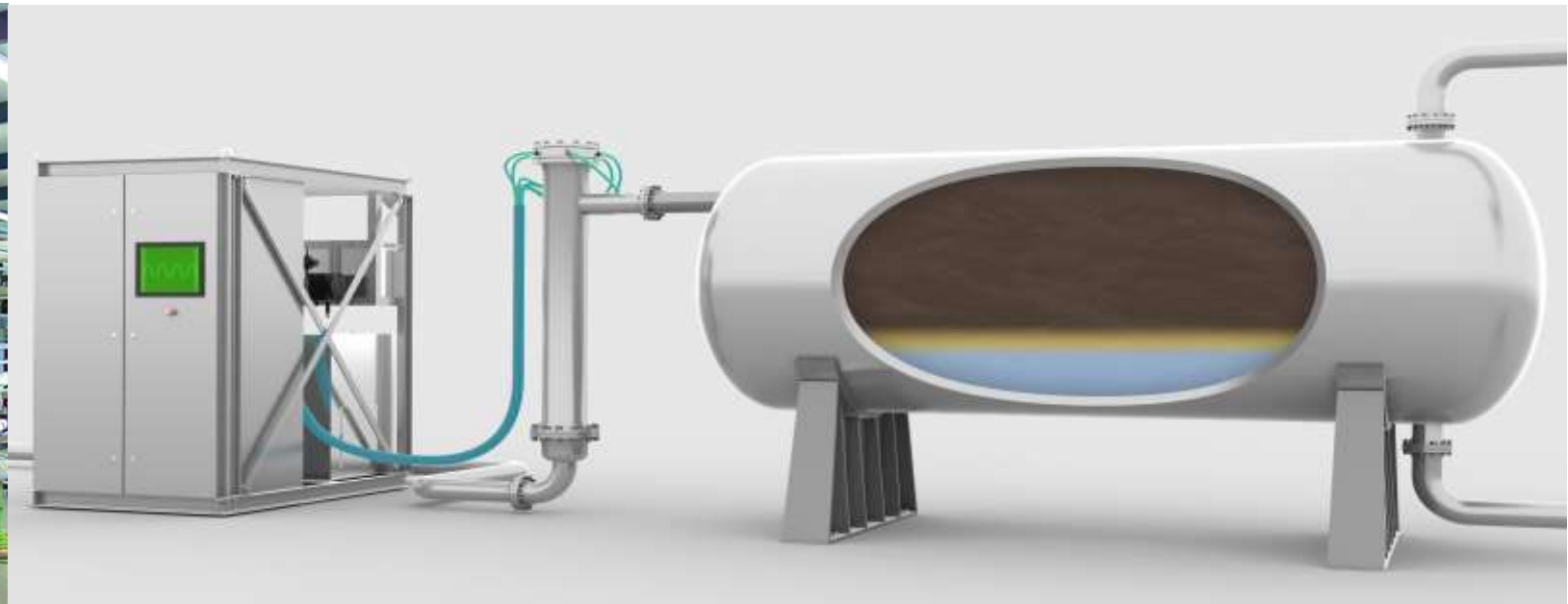
- Solutions enabling complex magnetic and power system management for specialized scientific and industrial applications.
  - Pulse modulators
  - Rectifier systems
  - DC/DC converters

Key differentiator

- Qualified to deliver power converters for nuclear fusion, particle acceleration and high magnetic fields

Special Converters

- Oil & Gas business
- Scientific Institutes
- Infrastructure (DC-Grids)



A selection of our customers

- Conventional Energy (O&G) – offshore and onshore
- Nuclear Energy
- Renewable Energy – offshore and onshore
- Defense
- Manufacturers / Industry
- Scientific Institutes

- OEM's:

We act globally

USA:
MF drive system &
monitoring systems

Netherlands:
AMC powerplant

Germany: High current /
high voltage converters

Iraq:
Substations with PMS

Qatar: Virtualization

China: 2MW PEM
Fuel Cell Grid
Connection

Abu Dhabi:
Offshore ELV

Brunei:
Terminal Rejuvenation

Oman:
Water injection

FMC Brasil:
Resonant power supply

Gabon:
Sealine Project

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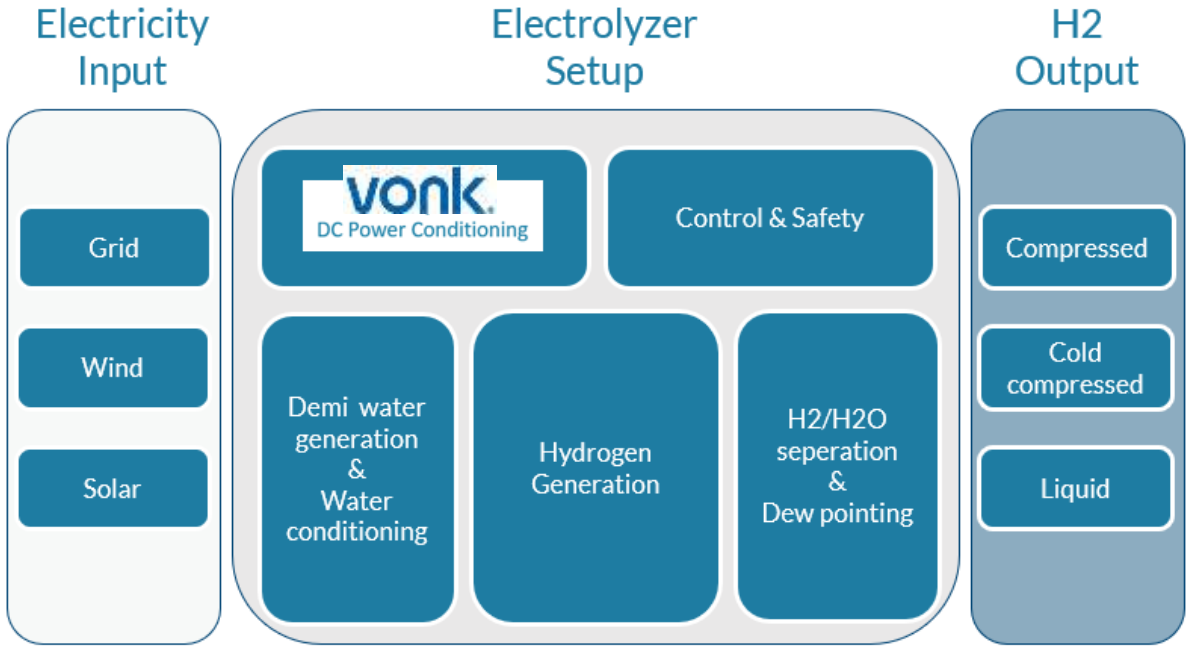
Hydrogen Solutions

- Power Conversion, both for electrolysers and fuel cells
  - More than 10 years of experience
  - Megawatt scale
  - <2MW: integrated in a container
  - >10MW: outdoor transformers, indoor power conditioning, distrib[illegible] control system




- What is critical?
  - Making a 'fit' between the grid and the application
  - Application voltage range depends on membrane stack arrangement



Hydrogen solutions over the years

Netherlands: 2007
Inductive Common Mode suppression to enable PEM fuel cell measurement and Control

Netherlands: 2007
72 kW Grid Converter

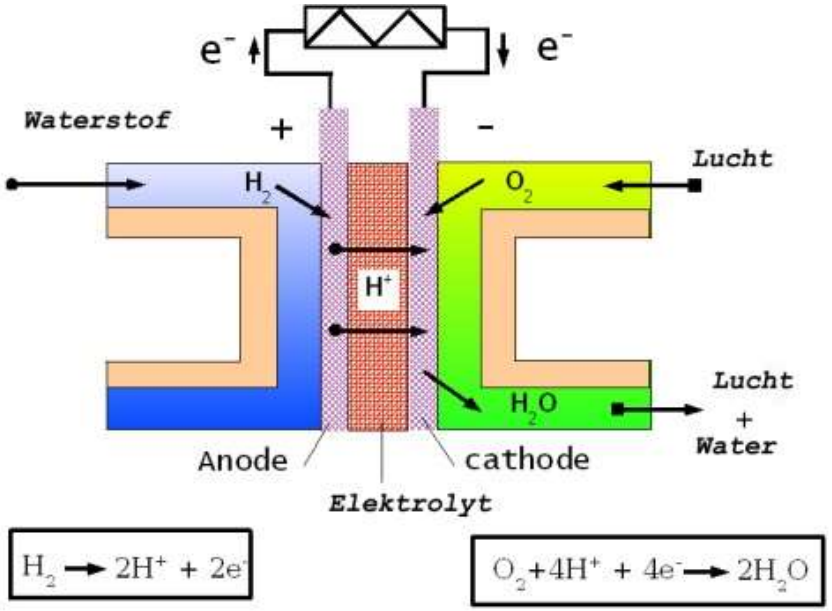
Belgium: 2011
1 MW PEM Fuel Cell Grid Connection

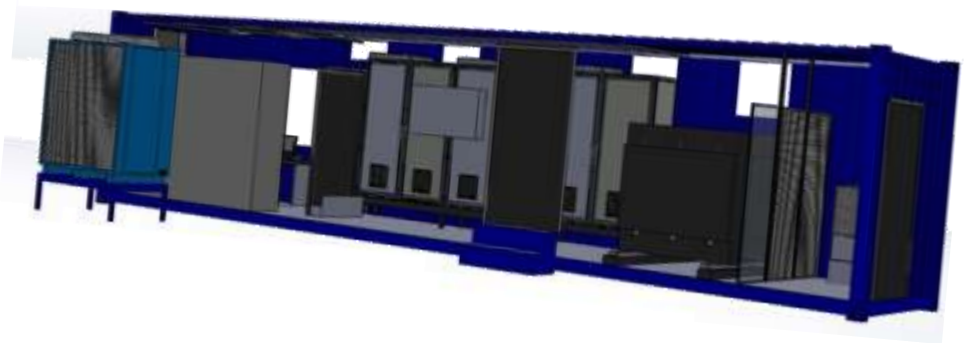
China: 2016
2 MW PEM Fuel Cell Grid Connection

Belgium: 2011
Special Transformers for 6kV grid and isolation balance of plant for Capacitive Common Mode suppression

China: 2016
Own AFE design for performance improvement

H2 projects: 1 MW and 2 MW fuel cells





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2MW Project

VONK Control Platform

- State-of-the-art electronics platform
  - In-house development to support all future projects
  - Any level of power, bi-directional
  - Integrated controls for fast- and slow loops
  - Can handle large number of inputs and outputs, with great accuracy (ppm at system level) and speed (ms for controls)
  - Can be connected to external communication





- Custom solutions based on standard building blocks
  - Variations for systems with different power levels only require changes to the power related components instead of the entire system
  - Strong reduction in engineering time and costs, less risks
  - Already in use for high voltage / high frequency converters, high power converters, low voltage / high current converters, DC-grid converters, hydrogen applications.

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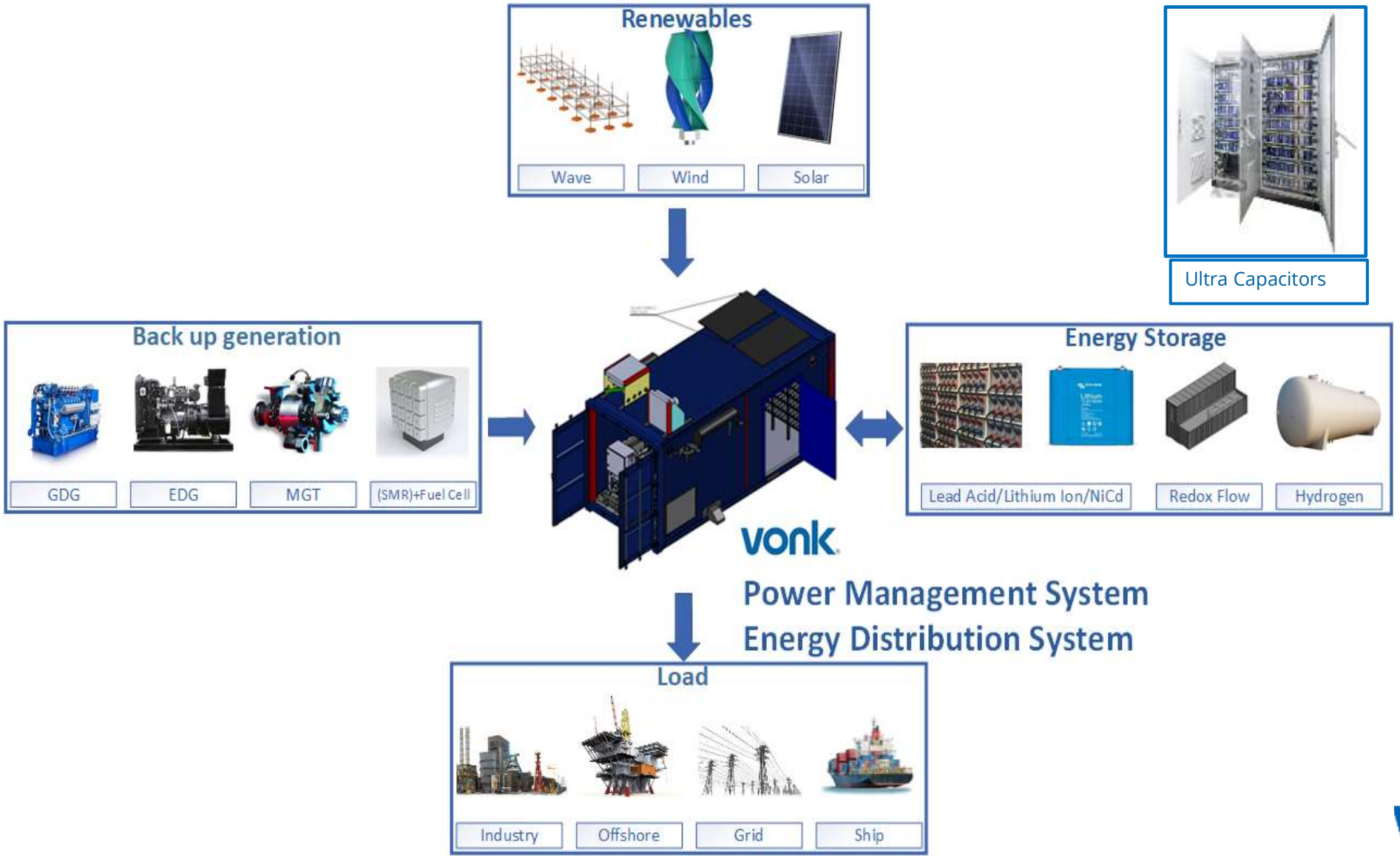
VONK Hybrid Power System



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Shell NAM's K83 Platform

Powered by solar and wind

- Ready by Q4 2020
- Continuous load: 7.5 kW
- 152 solar panels – 50 kWp
- 1 Helix Type Wind Turbine 3 kW
- Feasibility Study to add Wave Energy Converter

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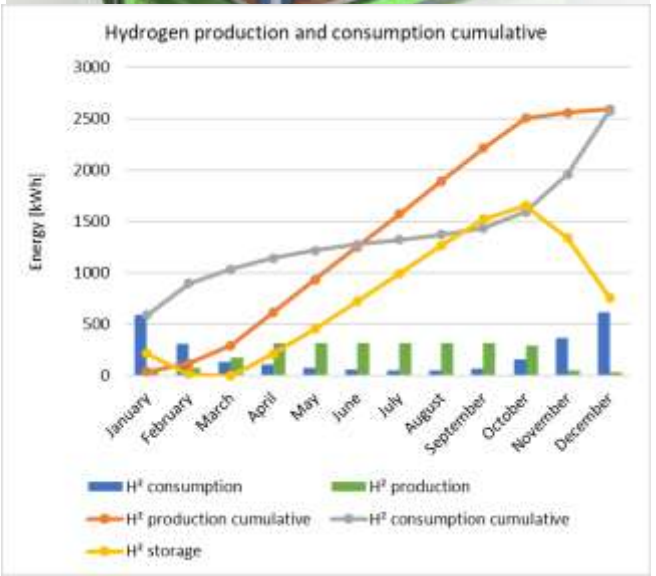
New innovation added to VONK's Green Product Portfolio

- Bi-directional Hydrogen unit
  - Solar2hydrogen when sufficient Solar Power available
  - Hydrogen to Electricity in winter
- Latest Technology
  - Completely green
  - No Diesel required
  - Less Solar panels required, smaller platform utilization
  - Less Batteries required, improving lifetime
- Limited maintenance (Once every 2 years or less)
  - No rotating parts
  - A 1000 liter clean water tank can last for multiple years
- Proven technology?
  - 4 pilots running without problems



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VONK Bi-directional Hydrogen Unit

- Off Grid storage, 2 options :
- Option 1
  - 20 bar (natural pressure from electrolyser without compression)
    - ❖ Option 2800 l storage at 20 Bar
    - ❖ 48 kWh: 26 kWh electrical, 22 kWh thermal (Usable?)

  - 300 bar (with compression)
    - ❖ 800 l storage at 300 bar
    - ❖ 533 kWh: 293 kWh electrical
- Current Shell ONEgas Leman concept has 120 kWh usable battery storage
- Hydrogen fuel cell specifications:
  - 8 kW electrical power, >8 kW thermal power

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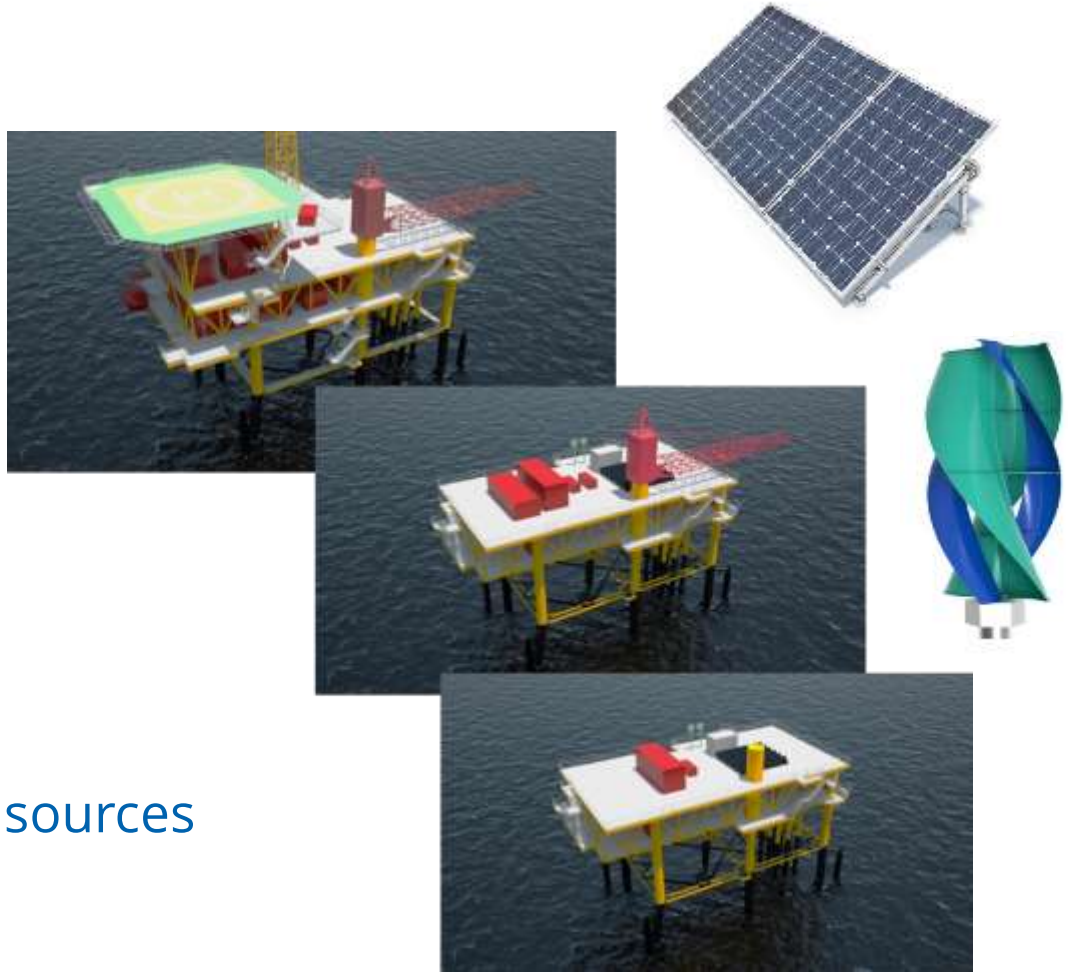
Platform Simplification / De-complexing

Process of Simplification:

1. Relocating processing facilities to central platform
2. Removing superfluous installations (processing installations, helideck ,..)
3. From manned to unmanned (NUI)
4. Decreased maintenance frequency
5. Energy optimization, followed by installation of an HPS, using predominantly renewable power sources



Platform Simplification and Electrification

Project – Leman Echo (Shell ONEgas) in the southern North Sea

- Heli-access
- Powered by fossil fuel generators
- Low utilization (e.g. Dehydration)
- Manned
- Maintenance interval : 30 days

- Marine-access (‘Walk to Work’ ship)
- Powered by maintenance free HPS
- Simplification – Process relocation
- Un-manned
- Maintenance interval : 2 years

90% OPEX Reduction, 98% CO_2 reduction

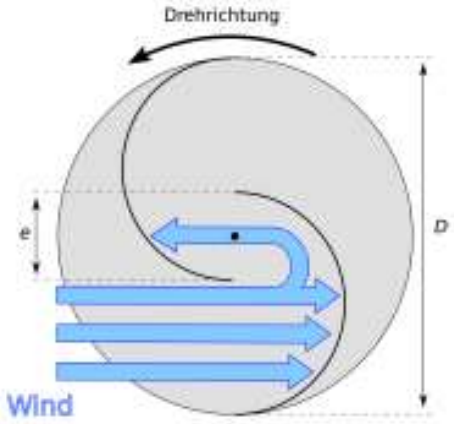
HPS on Simplified Shell ONEgas Leman Platforms (Echo, Bravo, Delta)

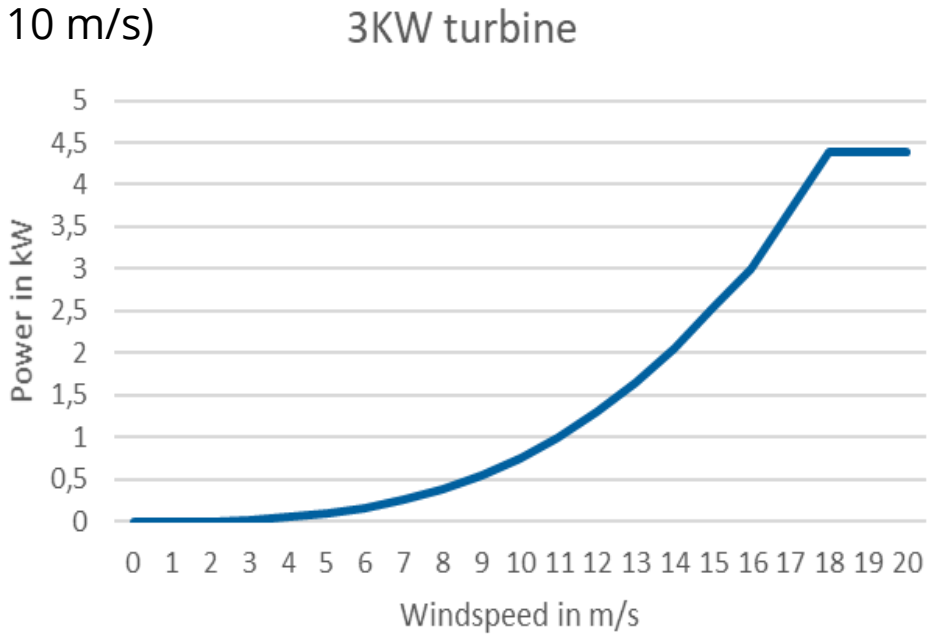
- Continuous load: 7.5 kW
- 150 solar panels – 40 kWp
- 2 backup gensets 32kVA
  - Control system
  - Fuel, Exhaust and Cooling
- Battery storage
  - 4x12cells - 24Vdc 10,000Ah
- VONK Power Management System
- Interfaces to a control system (DCS) and remote monitoring & control
- Navigational aids system
  - Control panel
  - Navigation lights
  - Fog horn
- Plug & Play Containerized units

State-of-the-Art Wind Energy Solution

next to Solar

- High Efficiency Double Helix Savonius Rotor
- Early start already at wind speed of 2 m/s (is ca. 2 Bft or 5 knots)
- Robust, withstands winds of 50 m/s
- 360 ° windside without tracking
- Low noise operation (35 dB at 10 m/s)
- No conflicts with birds
- Low maintenance





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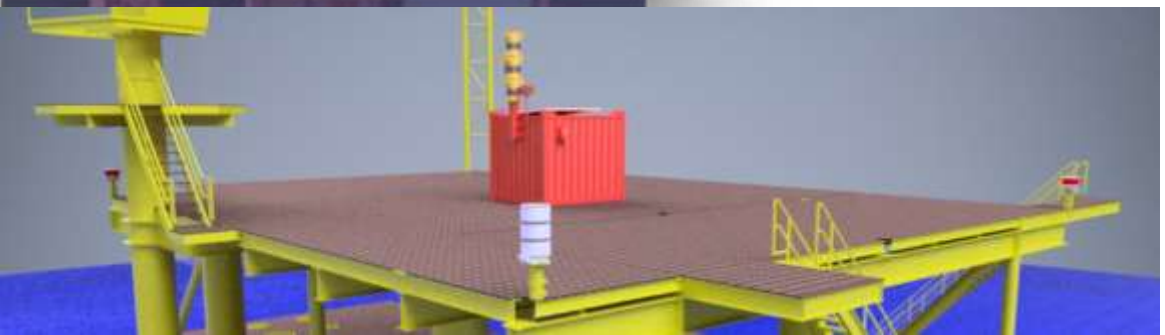
Decom HPS for Platforms

after Operation, prior to Decommissioning (warm & cold stack lighthouse mode)

- Based on proven HPS concept for green energy supply
- Very low OPEX, zero CO_2 emissions
- Very limited maintenance requirement
- Easy to erect and remove for relocation/re-use
- Option for mandatory well integrity monitoring (warm stack)
- Option for low power Navigational Aids system
- Compact solution, small footprint (10ft container)



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System Monitoring

Mobile phone

- Station monitoring
- Well integrity monitoring
- Nav-aids health
- Fuel status
- System health

Natural Gas

to Hydrogen to Power, using SOFC fuel cell

- Produced natural gas is treated and then directly fed to a SOFC fuel cell, producing electricity, without prior reforming from CH4 to H2

Gas treatment

- Cleaning & drying of well production gas

Converting gas into electricity

- High temp SOFC fuel cell: gas + oxygen -> electricity + pure water + heat
- Heat could be recovered to use elsewhere on platform, turning this in a CHP unit

VONK Hybrid Power Management System

- Power distribution management
- Power storage in batteries
- Electricity input from fuel cell as well as solar / wind / wave
- Potential EDG as back-up

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Selection of References and Use Cases

Seria Crude Oil Terminal Infrastructure rejuvenation

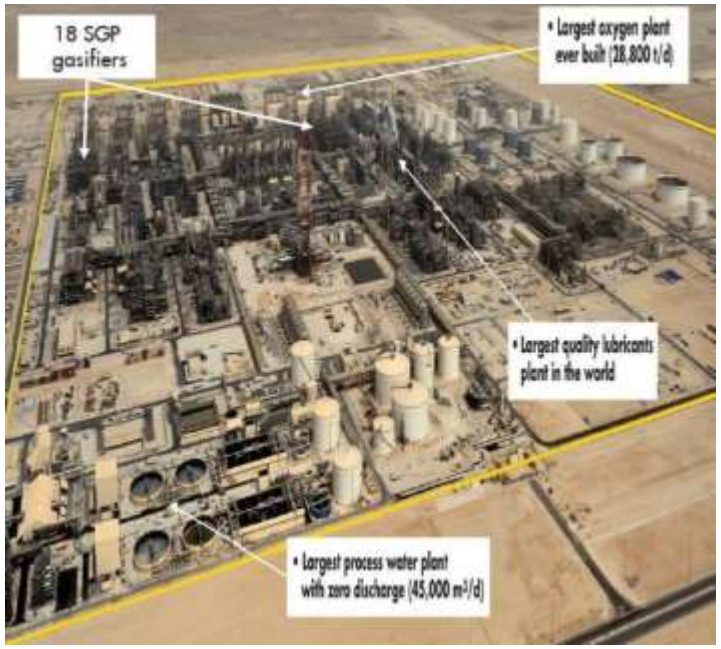
- General:
  - Brunei Shell Petroleum
  - Oil Terminal Rejuvenation
- Scope:
  - Infrastructure upgrade
  - Reverse engineering
  - New Control Room
  - New Electrical Building
  - Change out all instruments and Systems
  - New network topology
  - Online transfer control from existing to new CCR
  - Installation
  - Commissioning and Start-up

Independent Integrator

Qatar Shell GTL (Pearl)

- General:
  - Pearl Plant Wide Virtualization project
  - 120.000 + Hardwired I/O
  - Renewal of IT infrastructure for
    - Process Automation System
    - Electrical Network & Monitoring System

- Scope:
  - Main C&A contractor
  - Feed, Concept and Detailed Design and execution
  - Honeywell Experion DCS upgrade
  - ABB 800x ENMC upgrade
  - Managing the upgrade in running production plant
  - No Plant Shut down



قطر للبترول
Qatar Petroleum

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Example of Special Power Converter: ESRF

ESRF

European Synchotron Radiation Facility

- Produces X-rays 100 billion times brighter than the X-rays used in hospitals.
- These X-rays are produced at the ESRF by the high energy electrons that race around the storage ring, a circular tunnel measuring 844 meters in circumference.

Ampulz Scope

- 6 PWM voltage source converters as Ramping Injector Power Supplies for the Booster Synchrotron
- DC / DC converters

Key Data

- 2.2MW Dipole converter: 1500 V, 1600 A;
- 0.5 MW Quadrupole: 1000 V, 500 A
- Synchronised switching of converters
- Extreme ripple characteristics
- 90 million current cycles in 15 year

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SMDS Bintulu: ICSS and Central Control Room

- General:
  - Upgrade of complete DCS (Yokogawa) and IPS (Honeywell) systems
  - Control room Rejuvenation
  - Under Governance and assurance of Shell P&T
- Services:
  - Basic design, Reverse engineering
  - 50.000 I/O
  - 3 days Shutdown
  - System Integrated Test
  - Site Installation Supervision eg workpack
  - Commissioning & Start-up
- Design Criteria:
  - Study performed by VONK

Many more experiences in the region

- E-houses and FAR's in Bintulu
- E-houses in Bukom
- BSP offshore FAR's and E-houses on various platforms in ao Champion and Ampa
- Life Cycle Management with BSP (Project in execution)
- Emergency Diesel power houses for NLNG (Project in execution)

Drive solution: Active Front End Drive for Thales

Thales Smart-L EWC

- 4 Marine & 2 Land based Radar systems
- Target: Ballistic Missile detection (Implement NL obligation under NATO)

THALES

Scope

- Development of Drive Control (DCC3)
- Development of Environmental Control systems
- 17 years Maintenance support

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Converter technology examples

- CERN fundamental research particle accelerator
- IPP 140MW power supply for Plasma research
- Hamburg particle accelerator power supply Magnet collision effect
- Citytec power converter DC grid
- Uranium enrichment Medium Frequency drives (Urenco/Orano multiple sites)
- KUN Power supply for Fundamental Research with 30T magnet (HFML) Radboud University

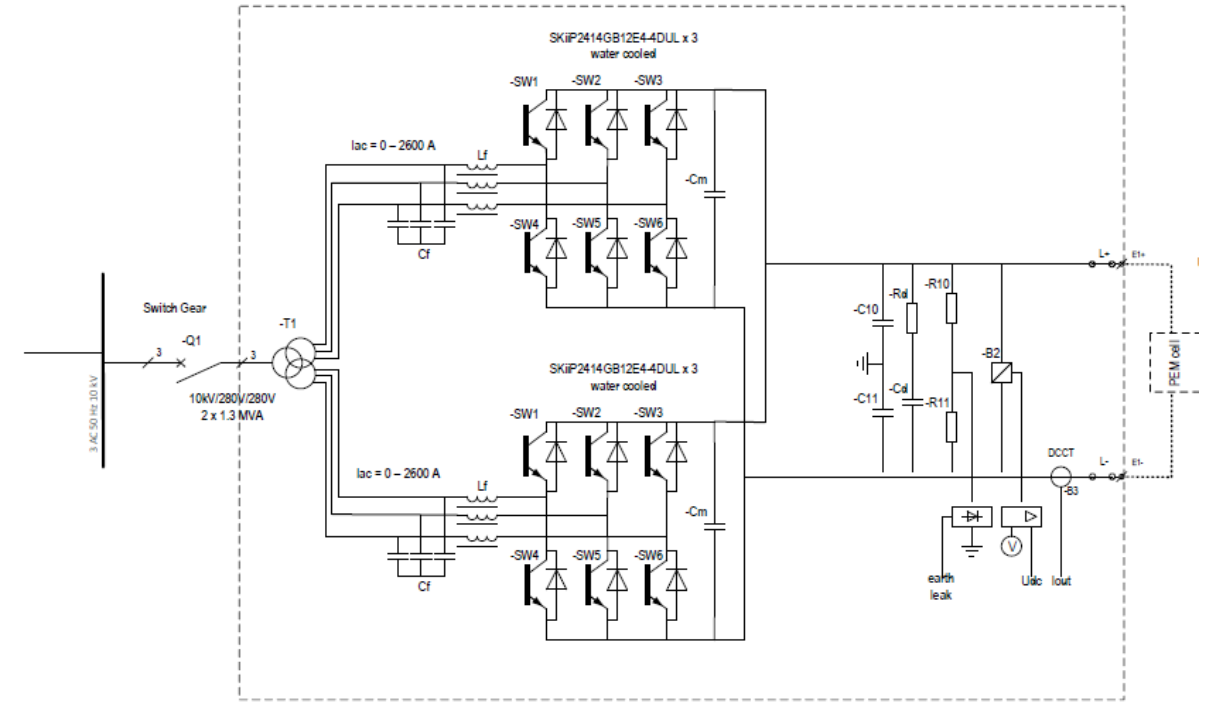
The Standardization of Power Supplies (2)

Making the ‘fit’ between the grid and the voltage range of the stacks is the main challenge when it comes to standardizing power supplies for electrolysers.
How to deal with this?

Topology based on Ampulz’ own Active Frond End technology.

Standard building blocks to suit highly flexible development for megawatt scale power supplies

Near perfect sinal wave output to meet power quality requirements with only minor filtering



Client feedback

"APCM contract Qatar: VONK is the only System integrator I trust"

Mark Pattenden, MD QSGTL

"SCOT Project ran like clockwork"

Gerry Campbell, BSP Project BOM

"The VONK system helps to produce more gas against lower cost"

Arthur Hartong
Maintenance Manager Onegas

Life Cycle Services

- (Offshore) Commissioning Services
- End-to-end Solution
- Spare Parts

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Business continuity plan

during Covid-19 pandemic time

- Engineering department fully working from home
  - Proven efficiency, continued operation
- Continued operation in our manufacturing area
  - Separated teams to mitigate risk of complete team infection
  - Rules for e.g. distance and facial mask applied
- Supply Chain managed on distance
  - Production not interrupted
  - Remote witness tests
- Testing and FAT
  - Remote witness tests
  - Awarded by Shell for high quality remote quality control

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Questions?

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Energizing Ambitions