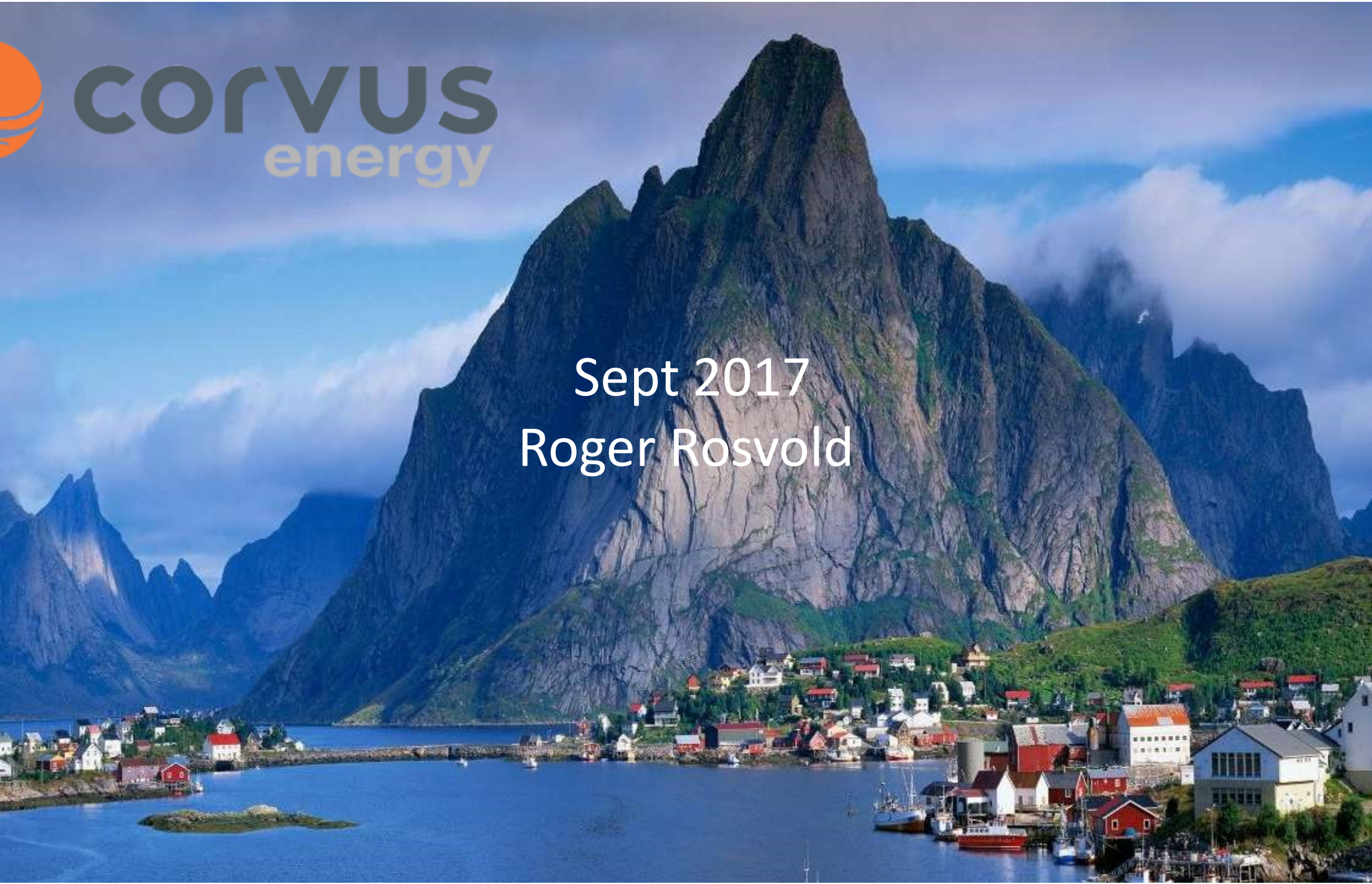




Sept 2017  
Roger Rosvold



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- Factory and R&D Vancouver, Canada
- European Office, Workshop, and Sales Bergen, Norway
- Privately Held Ownership
- 50+ Employees
- Founded in 2009
- Industry Leader in Maritime ESS Solutions





First Maritime ESS



**Prinsesse Benedikte**  
World's Largest Hybrid Ferry  
2.6MWh ESS



**MF Ampere**  
World's First All-Electric Car Ferry



**TESO – Texelstroom**  
World's Greenest Ro-Pax Ferry



**Orca ESS** – First Maritime  
with Cell-level TR Isol



**Viking Lady OSV**  
First OSV to Validate ESS



**Selfa Arctic AS Karoline**  
World's First All-Electric  
Fishing Boat



**Port Equipment**  
RTG Cranes



**Boeing Echo Voyager**  
World's First Long Range  
Underwater Autonomous Vehicle





**CORVUS**  
energy

A photograph of an orca breaching the surface of the ocean. The orca is dark black with a prominent white patch on its chest and a white patch on its face. It is surrounded by a large splash of white water. The background is a clear blue sky and a blue ocean.

# ORCA ESS

*Designed for Life at Sea™*

# Next Generation Product Planning

studied your needs & feedback

- Performance
  - C-Rates
  - Cycles
- Safety
- Dimensions
- Price

alyzed Corvus ESS fleet data

- 8+ years
- 40+ vessels
- >40 MWh
- >2 Million operating hours

sting engineering expertise

- 200 years of combined ESS experience & knowledge of maritime
- Global service and support organization



"Fanneljord" – Powered by Corvus



"Edda Ferd" – Powered by Corvus



- High quality/low cost lithium-ion cell
- ESS Packaging and System Design
- Blind-mate rack & backplane



# The Industry's Most Compelling ROI



**Hybrid Ferries**



**All-Electric  
Ferries**



**Supply Vessels**



**Platform**

ROI (Annual)	26% - 45%
Payback (Years)	2.2 - 3.9

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- Product platform
- Range of active cooling options
- Dynamic cell balancing
- Appropriate shock/vibe performance
- Appropriate IP rating



# Orca Energy orders from June 2016



Ferry

17



Offshore Research

10



Tank

2+2



Cargo

1+1



Exploration

2+2



Pass

1



Fish Farm

2



Fishing

3



Yacht

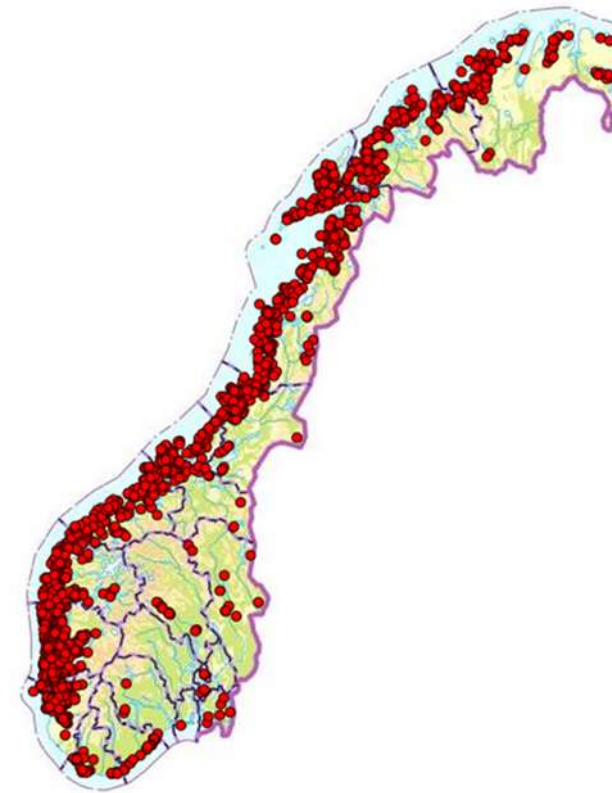
1

40 + ships

50 + MW



- Fish Farm Barge
  - 1000 in Norway
  - 600 with gensets



- Increased focus on safety in the marine cluster
- Corvus - to make the safest ESS for marine application
- Orca launch Electric & Hybrid Marine Amsterdam 2016



## Circular - Series V

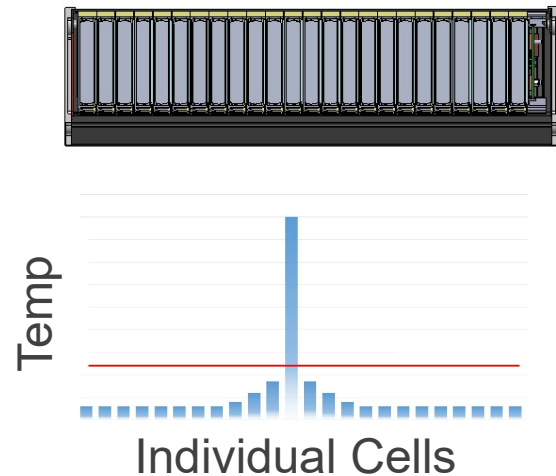
**Circular recipients:** (check box)

- Sdir : Norwegian Maritime Authority
- A: 16 specially authorized employment offices
- U: Selected Foreign Service stations
- P: Equipment manufacturers, any subgroups
- OFF: Offshore companies / OIM / operators
- Hov: Main organizations
- Others:

**No.:** RSV 12-2016  
**Date:** 18/07/2016  
**Journal No.:** 2016/8065  
**Applicable until:** Maximum 31 Dec + 5 years  
**Supersedes:** Previous circular series V  
**Reference to:** Excerpts from ....., year and page No.



- True cell-level thermal runaway isolation
- NOT dependant on any cooling
- Exceeds Class and Flag standards



## Orca

- Thermal runaway isolated to a single cell
- Adjacent cells stay cool

## Norwegian Maritime Authority test Protocol#1

All cells 100% SOC

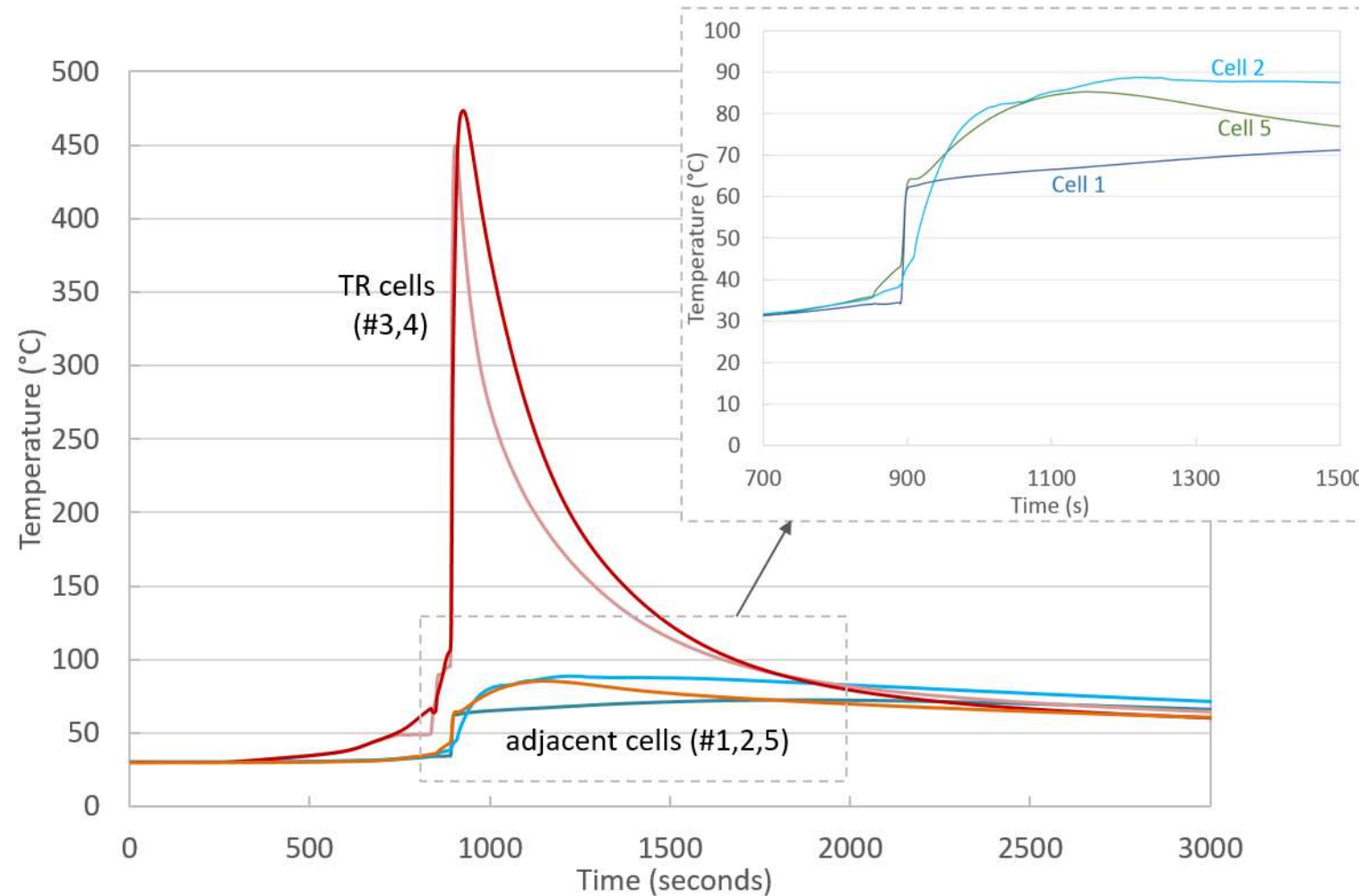
Safety disabled

OC overcharge

Cooling method: none

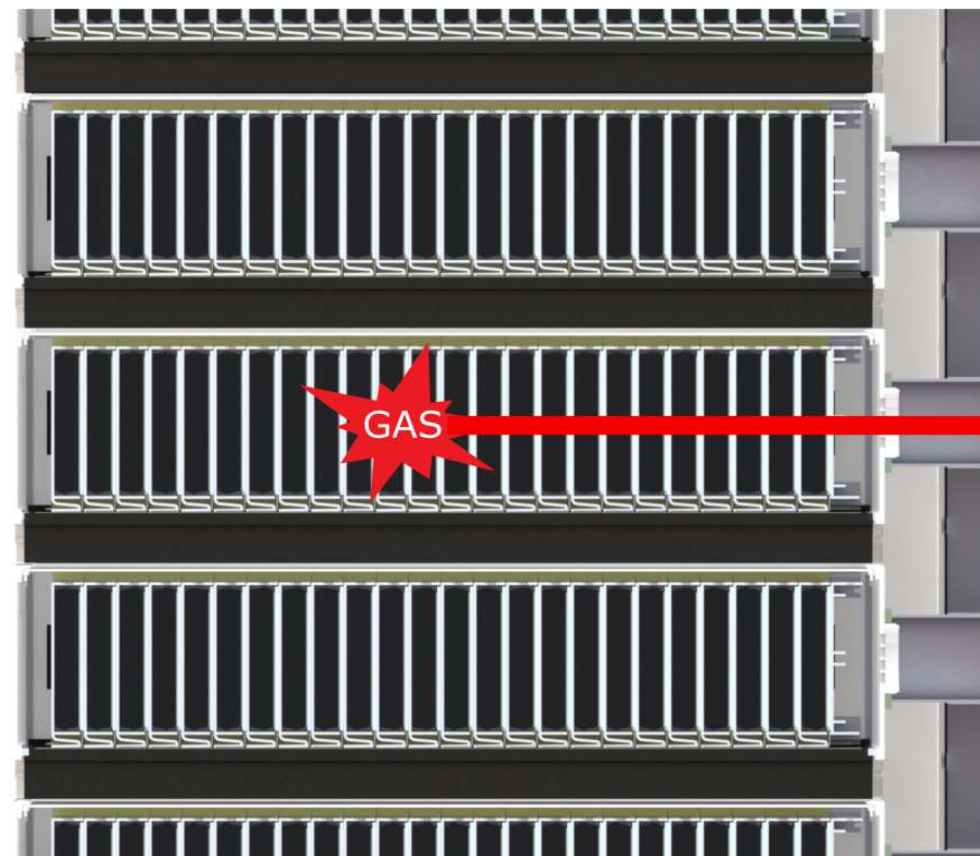
Fire suppression:

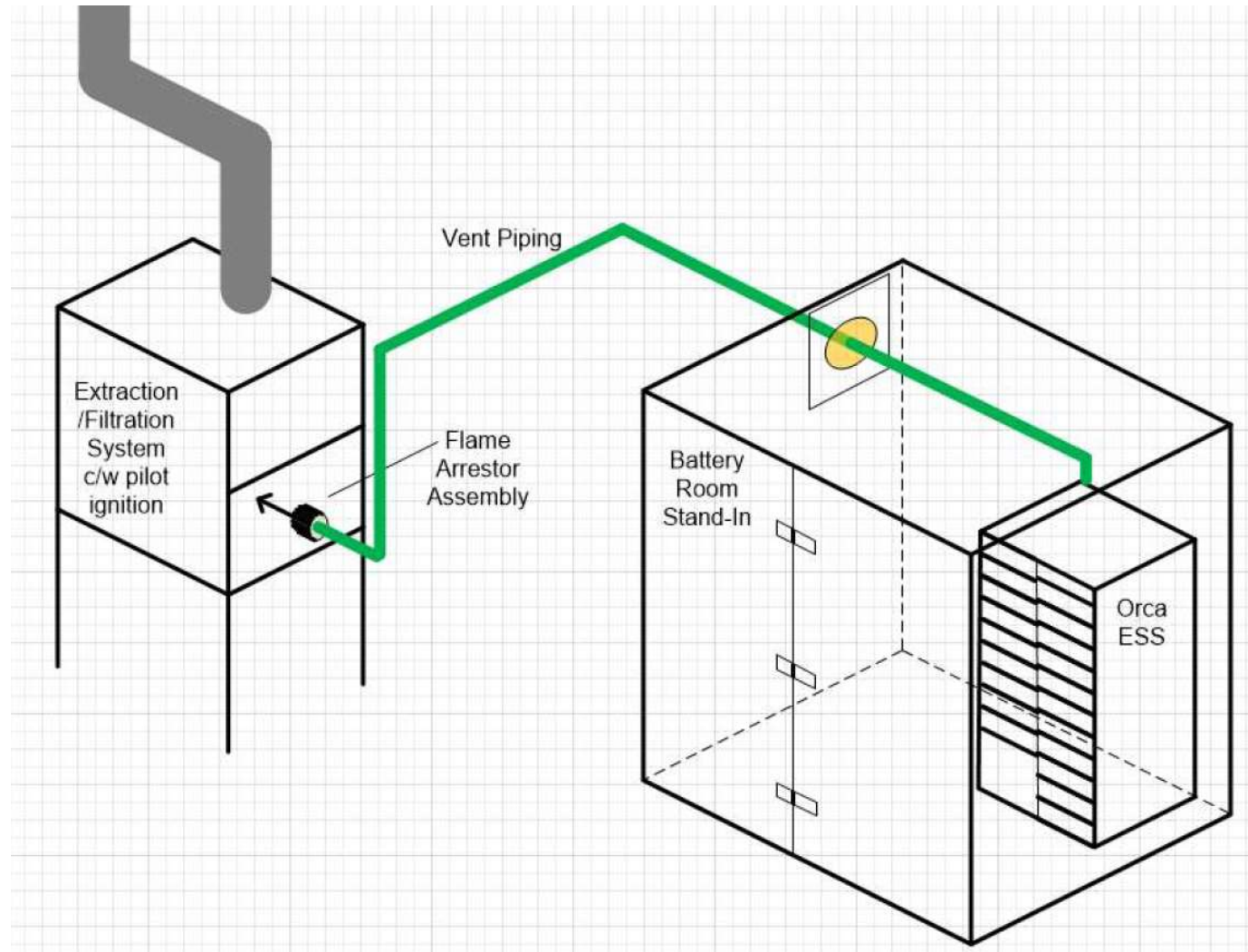
none





- Designed for safety
- Integrated thermal runaway gas exhaust system
- Easily vented to external atmosphere
- Fire suppression not required







**Our date**  
03.02.2017

**Your reference**  
Halvard Hauso

**Our reference**  
2016/78646-3

**File no**  
550

**Inquiries to**  
Jarle Jacobsen

**Direct phone**  
+47 52 74 52 54

Having observed the tests and evaluated the report DOC #: 1008271 received 28.09.2016, it is the view of the NMA that

- the tests were carried out in accordance with the test procedure of 8. september 2016 “1007767” and
- there were no signs of propagation between the overcharged cell-pair and the remaining cells during the tests, and consequently no propagation between modules.



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# TYPE APPROVAL CERTIFICATE

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**DNV·GL**

Certificate No:  
**TAE000026N**

**This is to certify:**

**That the Battery (Accumulator)**

with type designation(s)  
**ORCA Energy**

Issued to

**Corvus Energy Inc.**  
**Richmond BC, Canada**



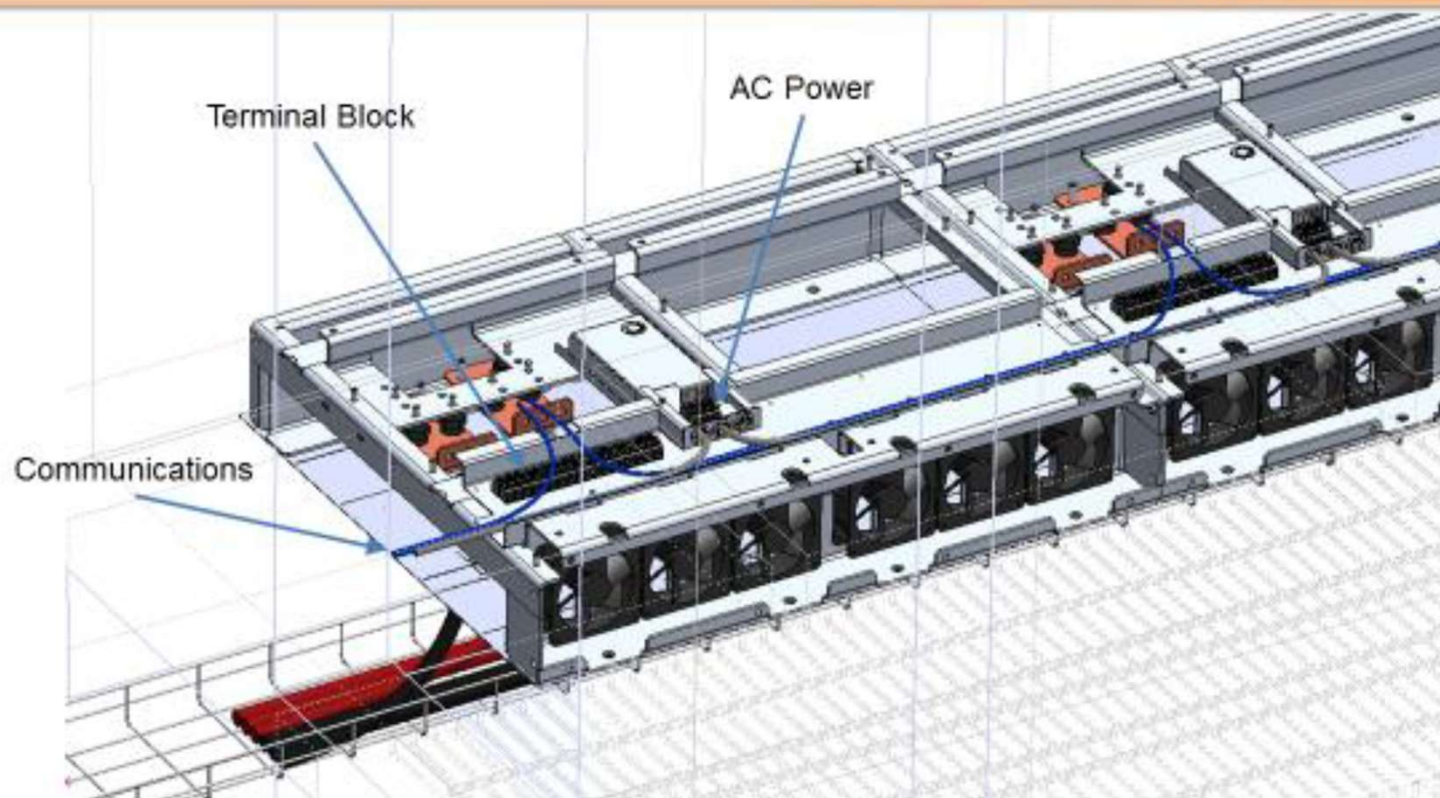


THANK YOU



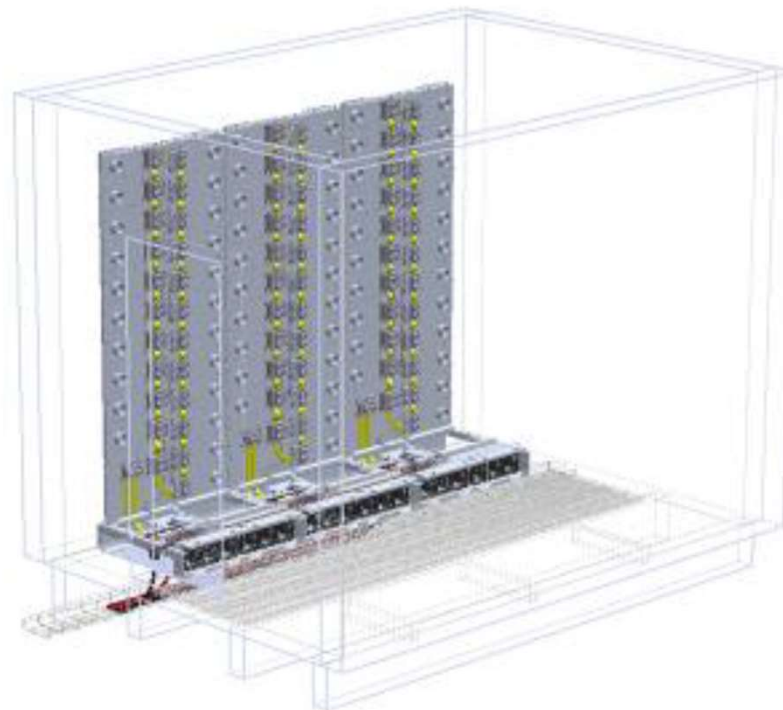


## STEP 3: Run Customer Cables





## STEP 4: Attach Back Planes

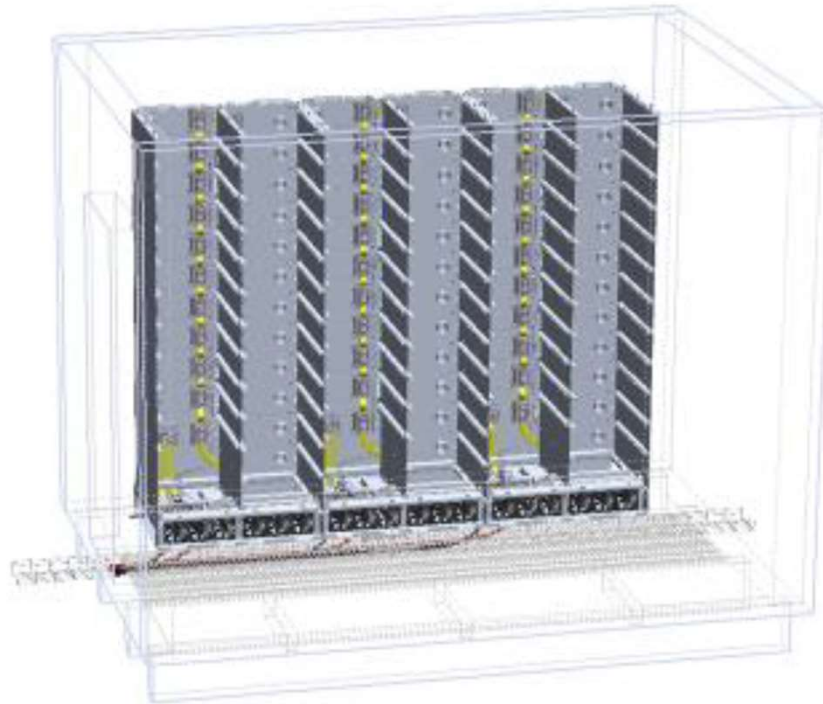


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## STEP 5: Attach Rack Columns

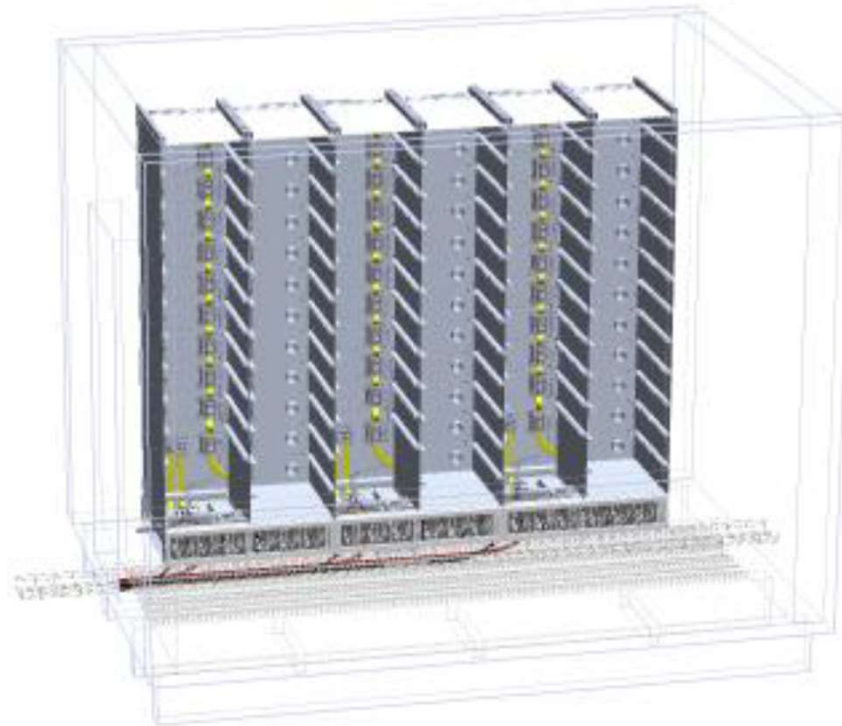


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## STEP 6: Add Tops and Panels



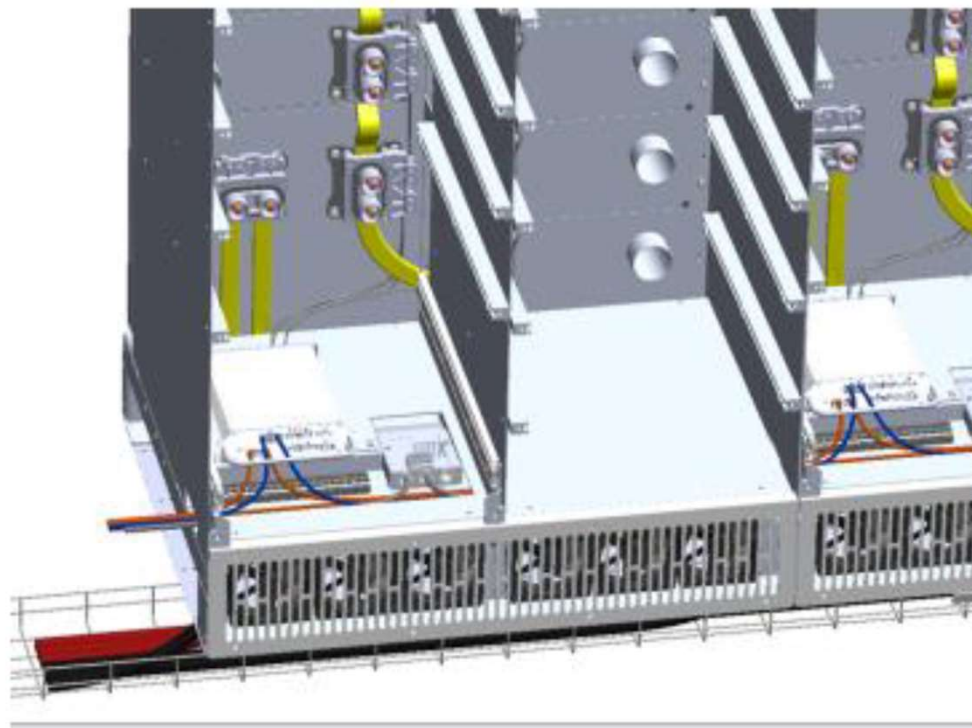
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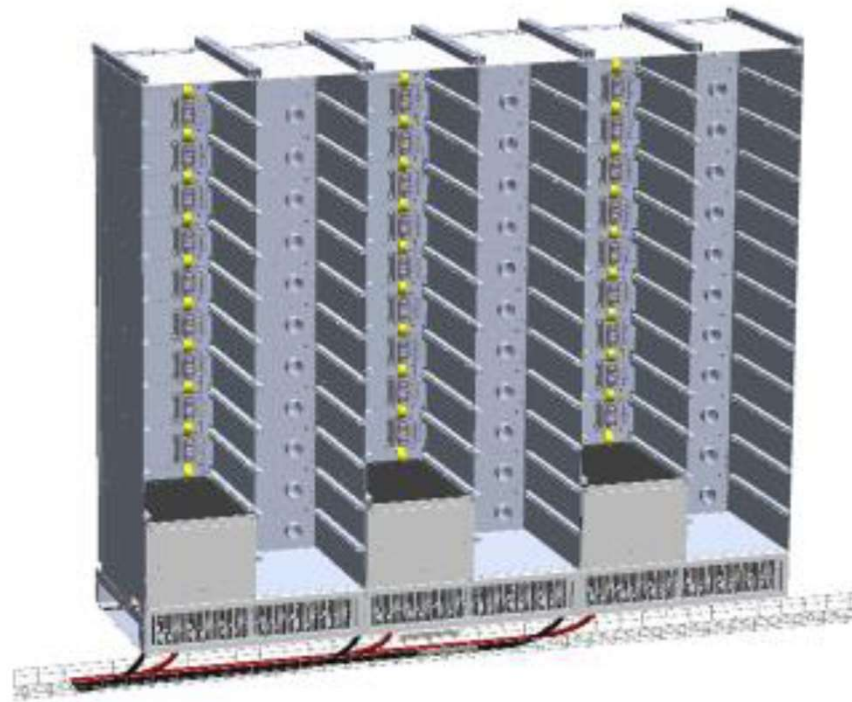


## STEP 7: Connect Pack Controller



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## STEP 8: Slide in Switch Gear

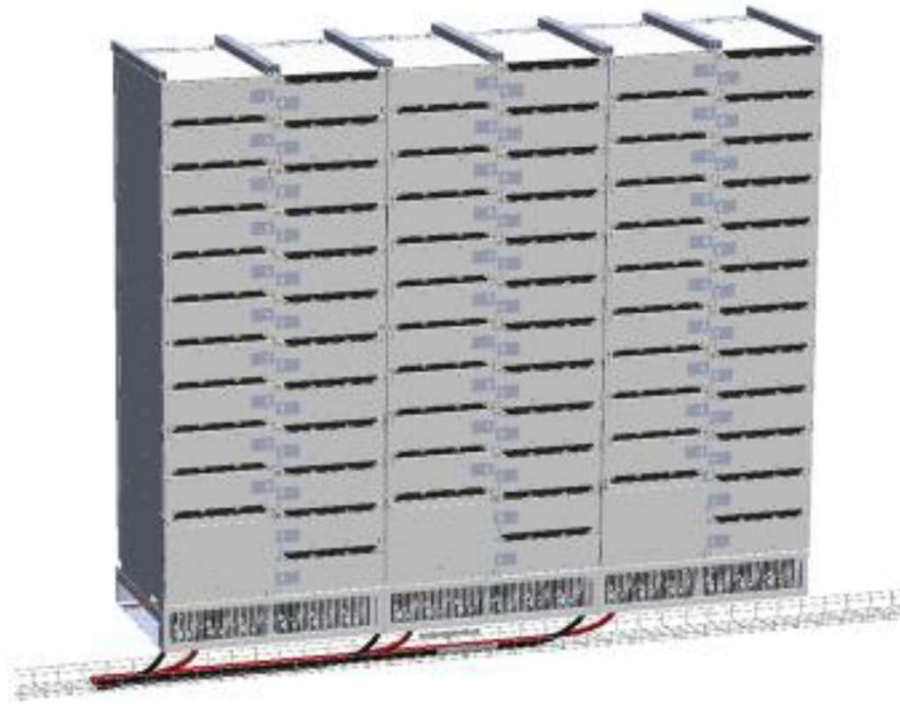


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## STEP 9: Load Modules



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### **Designed for Maritime Operation**

- Volume & weight reductions
- Improved thermal management
- Thermal runaway prevention, isolation & containment
- Maintenance and serviceability
- Industry-proven BMS
- ESS Management Portal
- Enhanced EMI immunity design
- Rapid & simple commissioning