Integrated Modular Solutions

Off-Site Assembly and Integration

SmartMod™ Solutions

EMERSON™
Network Power

What Are Integrated Modular Solutions?

- Customized, pre-fabricated buildings
- Transportable, pre-assembled modules
- Subsystems are fully integrated in a controlled, factory environment with external cabling & piping joined on site
- Scalable to meet future demands
- Supports numerous applications
  - Telecom & Optical networks
  - Oil & gas industrial control stations
  - Mining, military control
  - Data centers

Why choose Emerson Integrated Modular Solutions?

The Fastest and Most Flexible Method of Project Delivery	Global Scope Coupled with a Local Presence	The Highest Quality and Reliability
Critical infrastructure is fabricated, integrated, and tested in parallel with site selection, site preparation, and civil works, **shaving weeks from the project schedule.**	Leveraging our global Solution experience with local expertise **speeds delivery and provides redundancy** to your operation, a true turnkey solution.	Fabrication and integration takes place in a controlled, dedicated manufacturing facility with **proven ISO-9001 quality assurance processes**.

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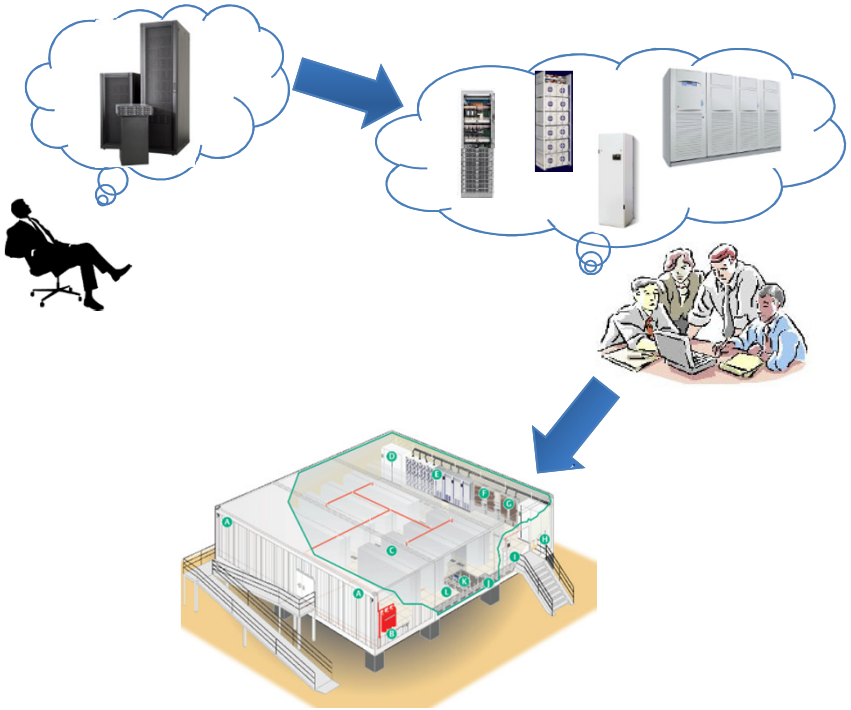
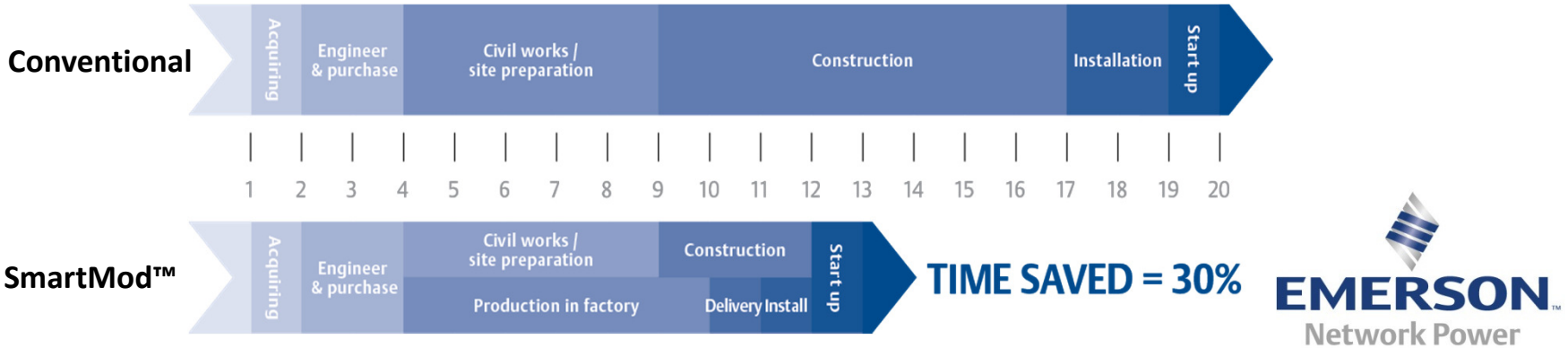
Why choose a SmartMod™ Integrated Modular Solution from Emerson?

- All subsystems come fully integrated with customer customizations and specifications
  - pre-assembled and tested in factory to ensure trouble-free and reliable operation
  - higher operational efficiency with systems engineered to work together
  - fast rollout time and a consistently high level of quality
- Emerson Network Power expertise in all parts of critical infrastructure supports the complete SmartMod™ Solution





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Smart Solutions
Intelligent, Integrated Infrastructure

SmartMod™ Solutions
Customized and Scaled to Customer Needs

SmartMod™ = Modular, Integrated, Proven Solutions

Modular

- designed for modular installation and scalable for future growth
- NetSure™ DC power plants with modular rectifiers
- Liebert modular UPS and precision cooling solutions

Integrated

- Emerson racks, DC power, UPS, precision cooling, ATS, TVSS, load banks and monitoring
- 3rd party fire detection/suppression, generators, cable management
- Full design and integration of all components into one complete system
- Complete project management for each shelter build

Proven

- 30% faster deployment compared to constructing a building
- Worldwide deployments – including transportation and placement
- Experience in data, telecom and energy industries

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= Modular, Integrated, Proven Shelter Solutions

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What is a Modular Constructed Building?

- Conventional "Bricks and mortar"

Design | *Construct* | *Install*

Design = Select & size system components and engineer to work together

Build = Create builing on site

Install = After building is completed, add mechanical/electrical plant and IT equipment

- **Modular Constructed Building**

Design | *Manufacture* | *Deliver* | *Install*

Manufacture = Fabricate and assemble all components of the building in a factory, including the mechanical/electrical plant, while the site is being prepared

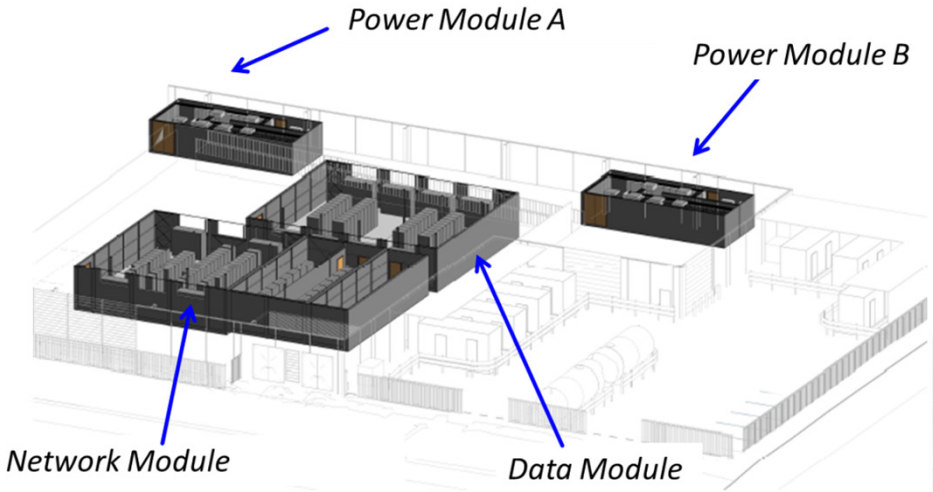
Deliver & Install = Transport module(s) to site and make final connections

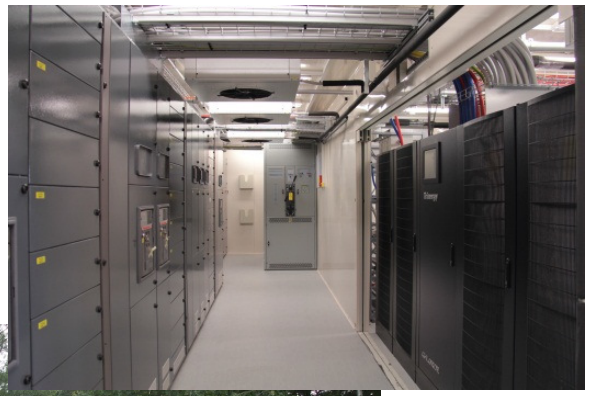
"Manufacture & Deliver" Instead of "Construct & Install" Allows for More Stringent Quality Control, Factory-Environment Integration and Testing, and Faster Speed of Deployment

- **Modular Constructed Data Center (MCDC)**

Design | *Manufacture Off-Site* | *Deliver* | *Assemble On-Site*

Modular, Scalable, Pre-fabricated Concept





- Factory installed equipment
- Easy to transport
- Minimized site installation
- Fast Implementation
- Easy to extend

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Intelligent, Integrated Infrastructure

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From Emerson Network Power

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How will your needs be met?

Around a wide approach to efficient design

Smart solutions for efficient design

Efficient	• Enhance business, space, energy efficiency • Rapid deployment, easy servicing
Economical	• Reduce time and cost of deployment • Standalone construction without burdening existing infrastructure
Simplified	• Simple and flexible design and implementation • Systems that work together
Controllable	• Optimized planning, monitoring & management • Control of your environment

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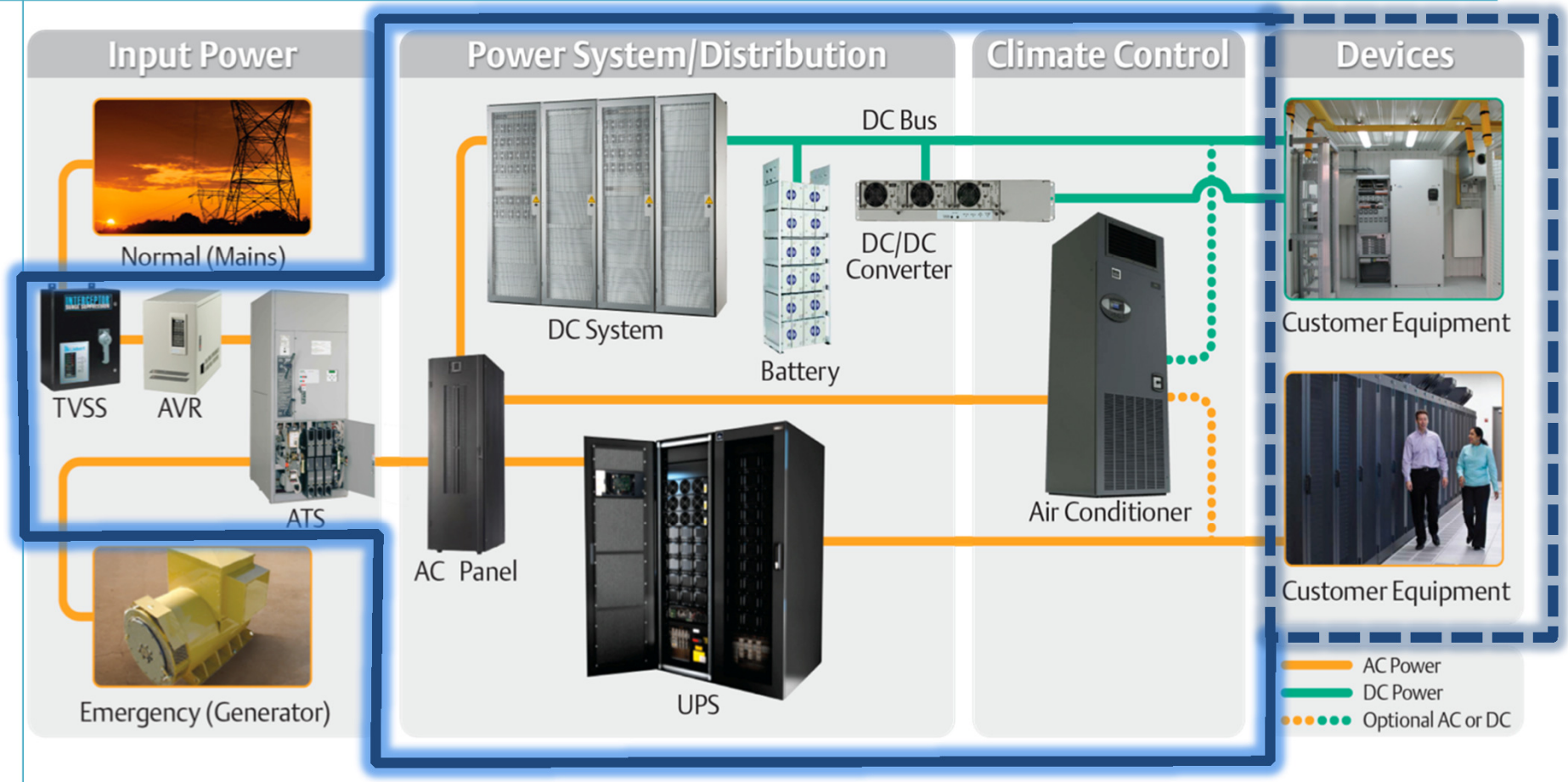
Emerson Equipment Is the Advantage for Simplified Integration



With this critical infrastructure we support the whole Solution. We have expertise in all products within the shelter, both Emerson equipment and 3rd party equipment.

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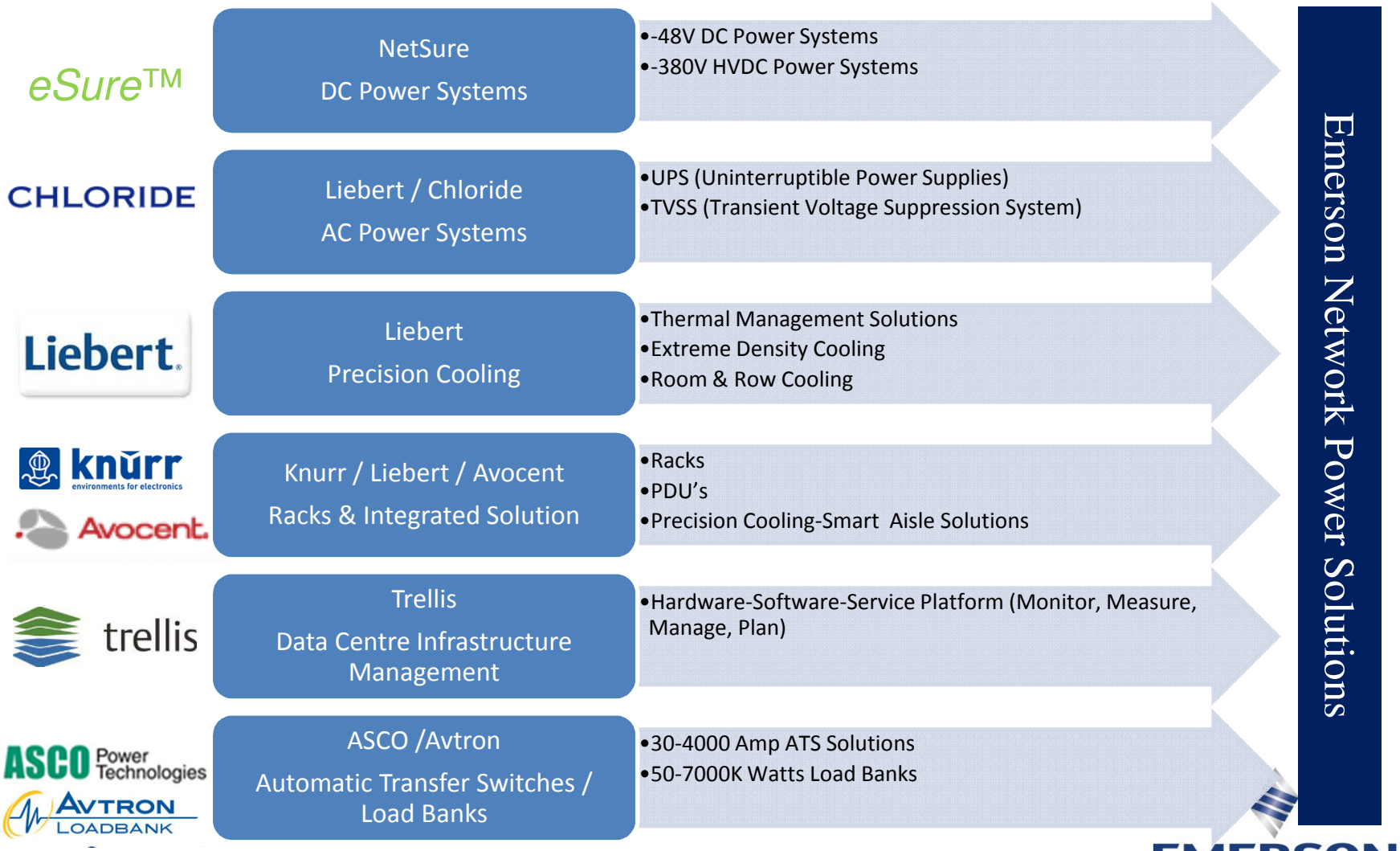
Industry Leading Emerson Products Across Many Categories…



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…Coupled With Industry Best Practices in Design & Operation…

Airflow	– Hot/cold aisle configuration – Aisle containment separates hot and cold air
Power	– Scalable, high efficiency and high availability row based UPS – 94% efficient, fewer battery replacements
Efficient Cooling	– Variable Capacity Cooling: Match cooling system capacity to IT needs – Intelligent controls: Teamwork & Monitoring/Control
Density	– Bring cooling closer to the load – Higher density IT environment reduces footprint
Modularity	– Faster installation and expansion – Easier manageability across IT enterprise
DCIM	– Sensors, Unit Controls & Software – Provides real-time visibility & efficient infrastructure management

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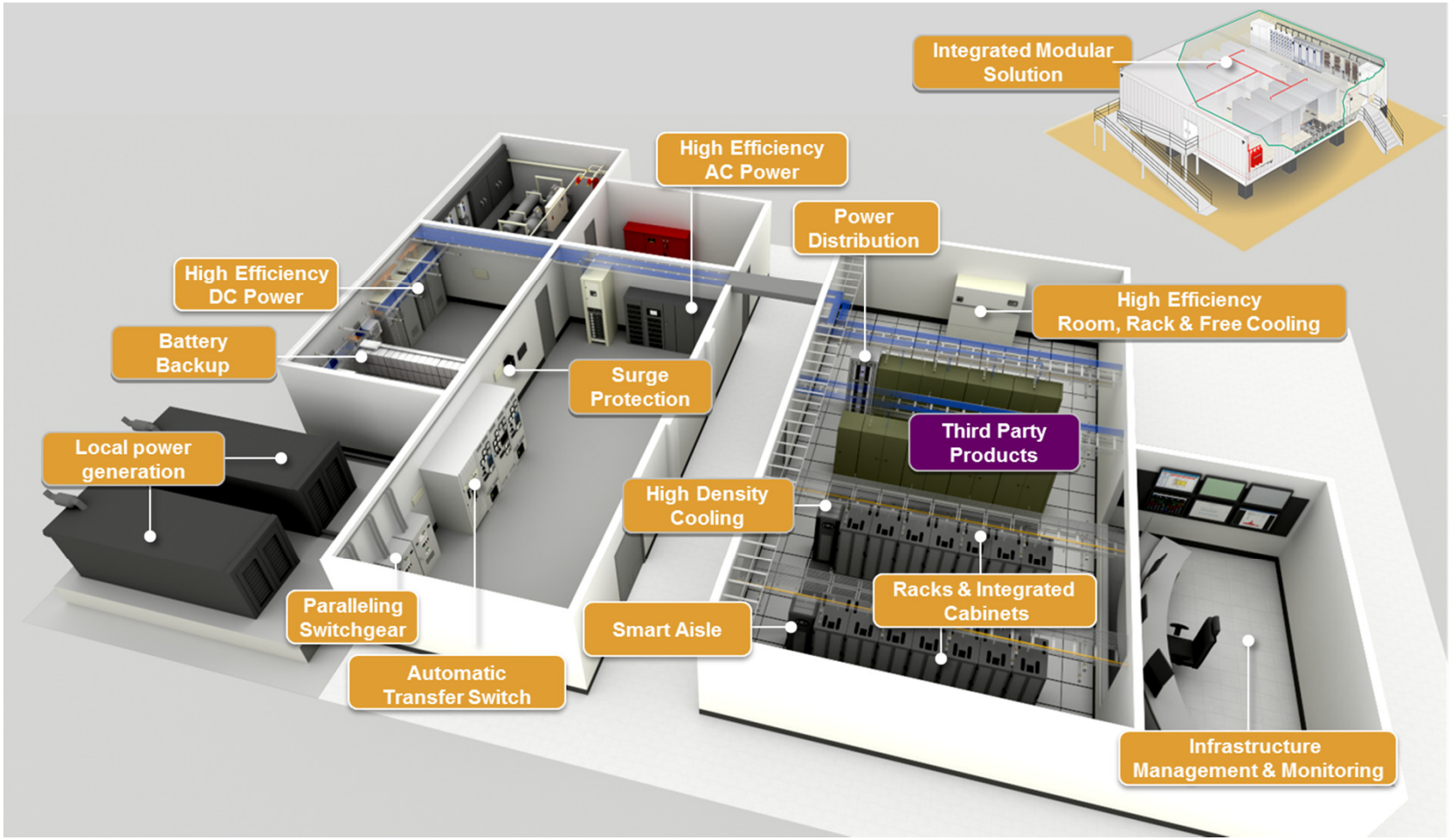
Emerson Capabilities Enable Complete System Integration



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Emerson Capabilities Provide a Turnkey Solution

Project Services

- Design & Project Management and Documentation
- Contract Administration & Quality Management
- Financial Management
- Quantity Surveyors & Schedulers
- Procurement
- Logistics

Engineering Services

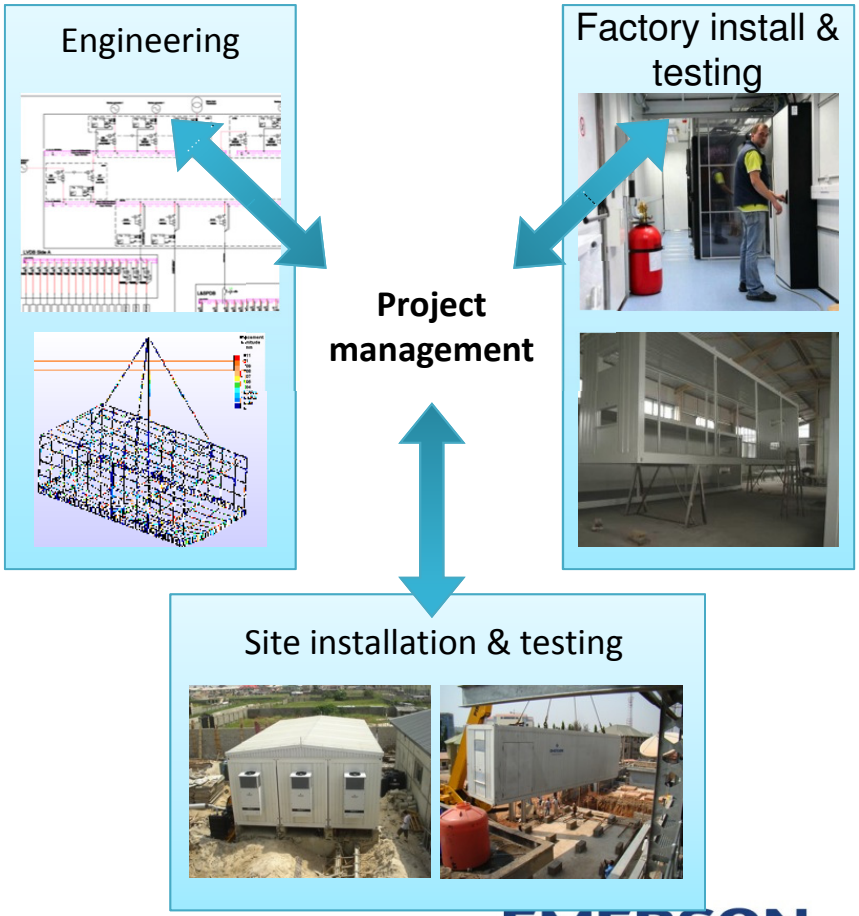
- Electrical Design
- Mechanical/HVAC Design
- Infrastructure Management
- Site Planning
- Modular Containerized Design

Installation & Commissioning Services

- Emerson Product Installation & Commissioning
- Electrical & Mechanical Commissioning
- Factory Acceptance Testing
- Practical Completion Certificates / Site acceptance
- As Built Documentation

Additional Services

- Complete Turnkey Solutions provided through the use of strategic partners



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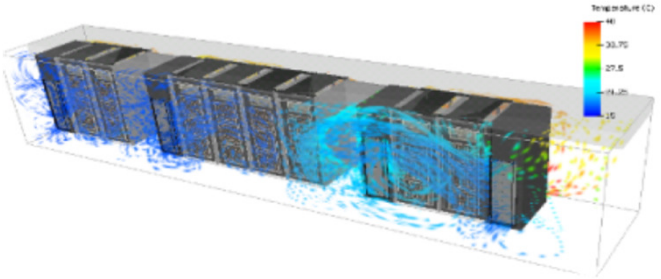
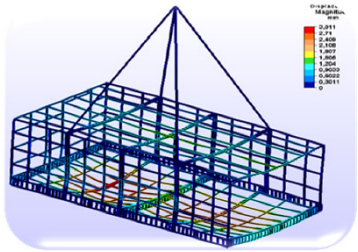
Engineering Design

- **Thermal Analysis: 6 SIGMA DC**
  - CFD software

    (Computational Fluid Dynamics)



- **Mechanical Design: Solid Works**
  - Structural Analysis
  - Simulate Drop Test, Impact, Collapse
  - Simulate Heating or Cooling



- **Drawings: AutoCad**
- **Electrical Engineering: EPLAN & AutoCad**
  - Global standard in electrical design engineering software. Specialize in electrical design, electrical software, electrical engineering design software, cable sizing, cable calculator, voltage drop calculator.
- **Documentation Control & Storage : Sharepoint**

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Integration of 3rd Party Equipment or Services (If Required)

Indoor infrastructure products	Outdoor infrastructure products	Engineering services	Site Construction Services	Site Management Services

•Fire suppresion systems
•Fire detection systems
•F&G detectors
•Gas tightness
•Cable management systems
•Switchboards
•Office fitout
•Raised floor
•Earthing, bonding & lightning protection
	•Sub Stations
	  •Switchboards, Transformers, cables
	•Cable Vaults
	  •Pits, Cables, Conduits
	•Generators
	  •Tanks & Control systems
	•Security
	  •Gates, Bollards, Fencing, CCTS
	•Entrance platforms and stairs
	•Lifting elements, Spreaders, slings and shackles
	•Secondary Roof
	•Fire Protection
	•Surface protection
		•Hydraulic
		•Mechanical
		•Electrical
		•Fire
		•Acoustic
		•Structual
		•Security
		•Access control
		•Alarms and Remote Monitoring
			•Foundations
			•Buildings
			•Ground Works
			•Utility Works
				•Safety
				•Schedule
				•Security
				•Risk
				•Quality
				•Procurement
				•Change management
				•Contract management

We Can Design and Build the Complete Solution. We Can Provide To the Customer One Contact Point for the Whole Project Starting With Only the Customer's Equipment Requirements.

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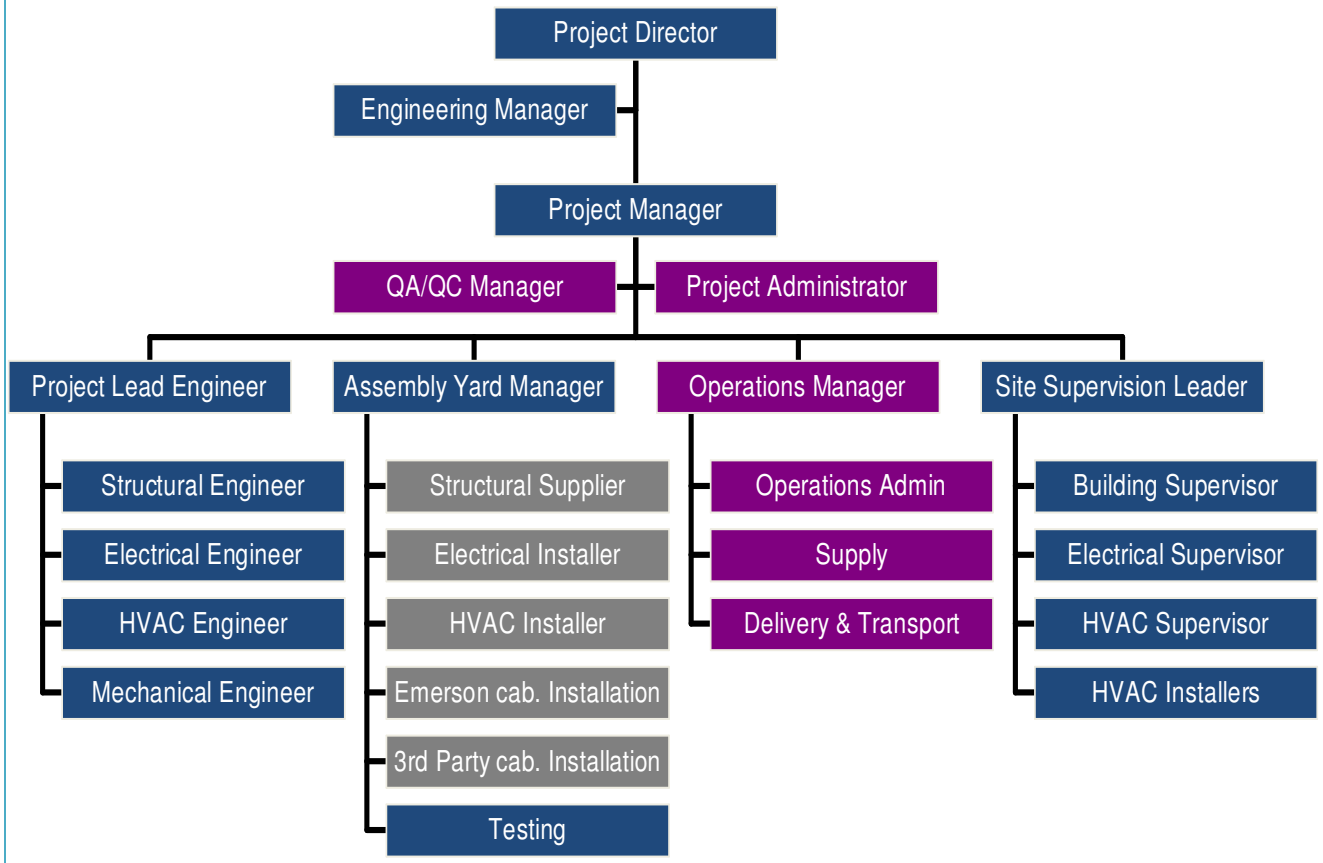
Project Execution Team & Resources



Emerson Resources - Dedicated Project Team

Emerson Resources - Support Team

External Resources

Team Includes:

- Engineering
- Project management
- Factory installation, factory testing
  - Optional 3rd party equipment installation
- On site installation, site testing
- Factory acceptance test
- Site acceptance test

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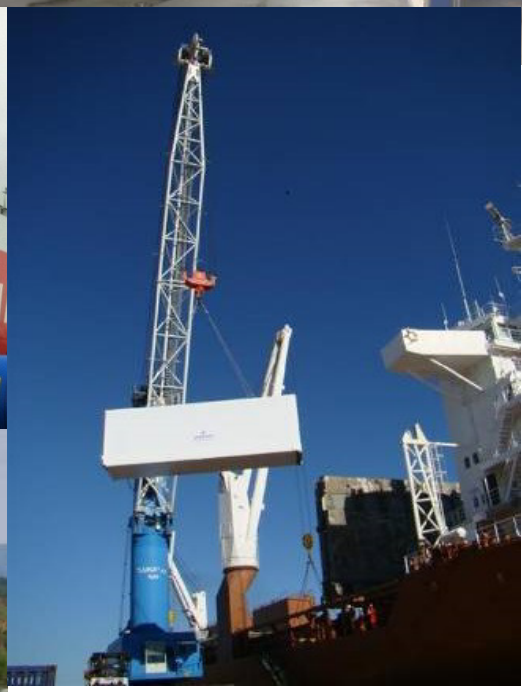
Careful Packaging and Transportation for Delivery to Site by Road or Sea



Emerson services include:

- Preparation for transport
- Sea freight packing
- Loading on ship

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Industries, Applications, and Product Groups Served

Industries & Application

- Telecommunications
  - Optical nodes
  - Switching stations
  - Radio base stations (RBS)
  - Cable landing Stations
- Gas and oil / Mining
  - Control rooms
  - Remote instrument room
  - Local instrument room
  - Switchgear room
- Data communications
  - Data centers
  - Energy centers

Product Group & Application

- Small node
  - Base station
  - Transmission
  - Analyzer
- Remote units
  - BSC
  - Repeater, distribution landing
  - Remote instrumentation
- Switching & Control Centers
  - MSC, Optical main node
  - Control Centre
  - Automatic switchgears
- Energy center
  - Power conversion and backup
- Data center

Each Application Group Can Be Configured Differently According To Project Specifications, But All Share Emerson's Common Engineering Expertise

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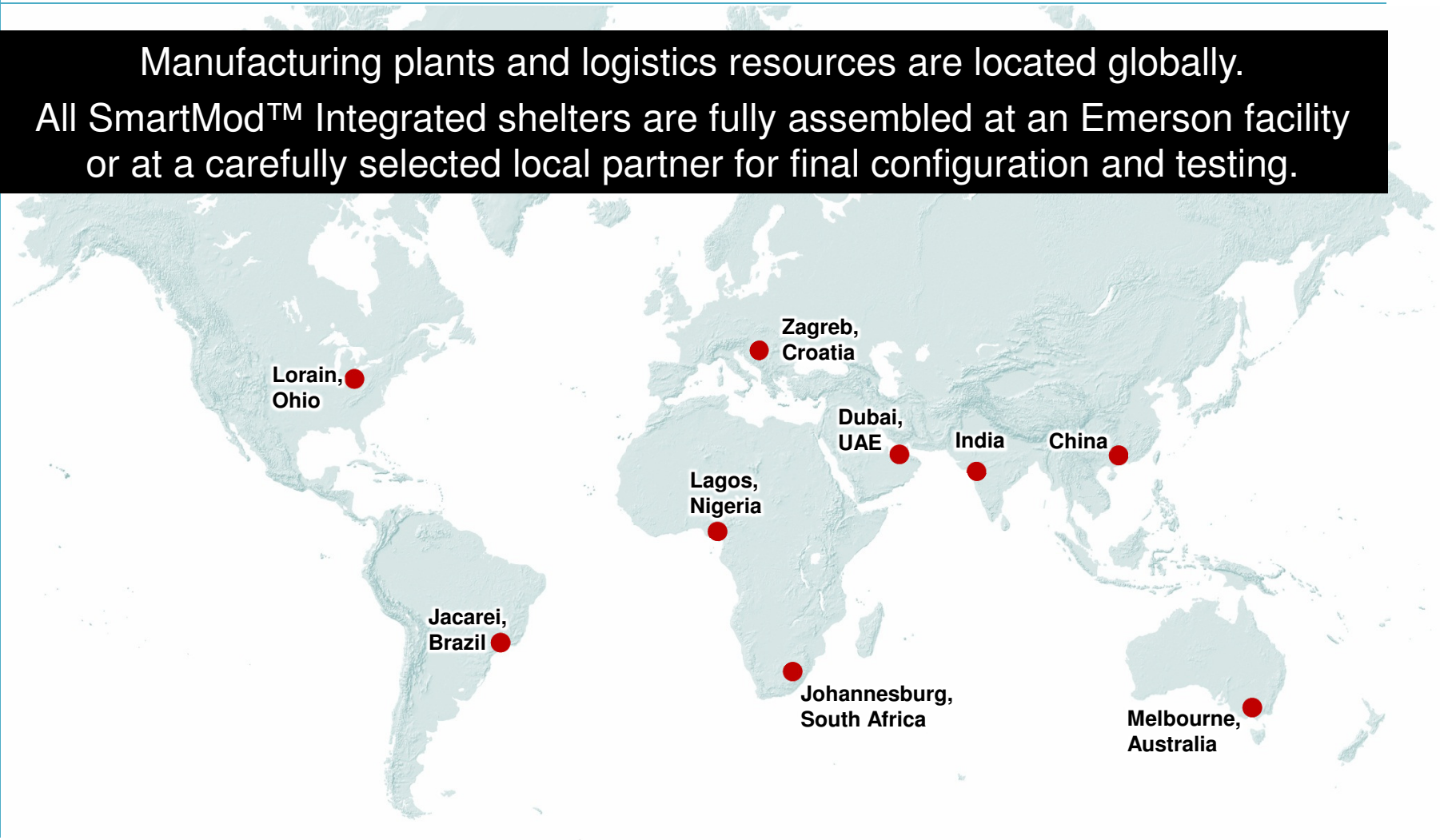
Worldwide Regional Support Centers…

Manufacturing plants and logistics resources are located globally.

All SmartMod™ Integrated shelters are fully assembled at an Emerson facility or at a carefully selected local partner for final configuration and testing.



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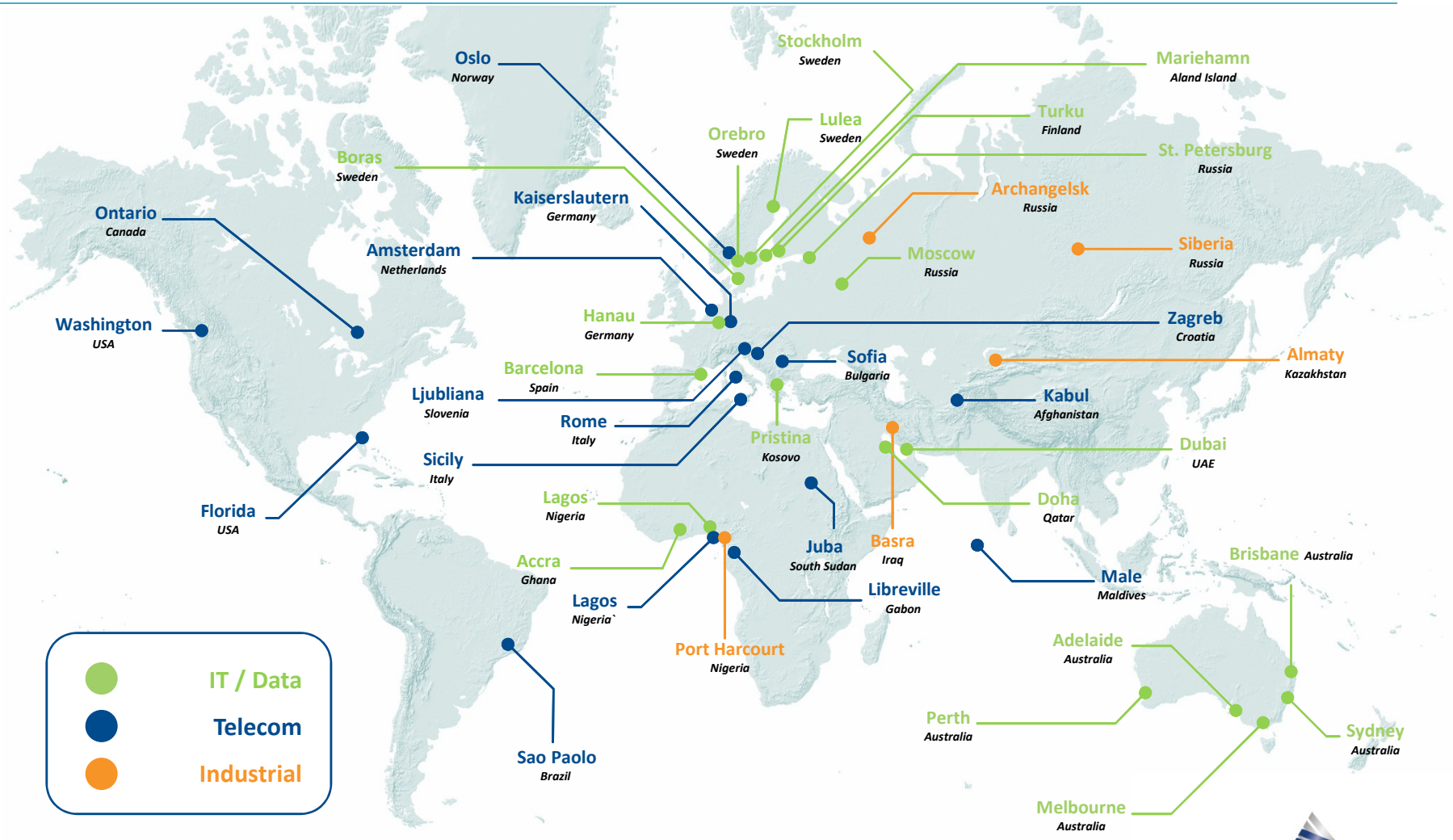
…Global SmartMod™ Deployments



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Integrated Modular Solutions Wins & Reference Cases

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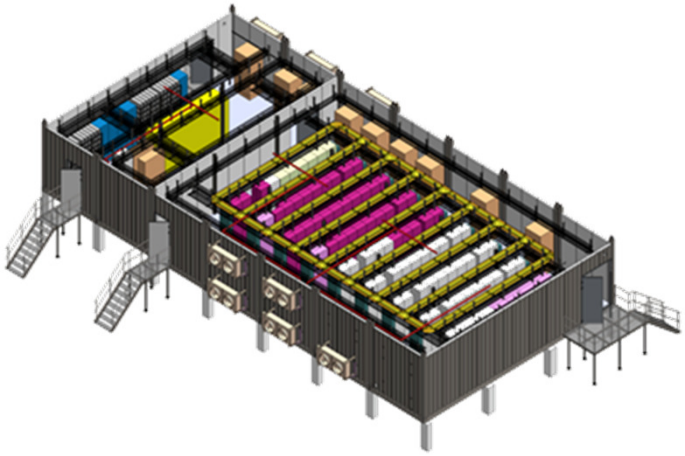
Integrated Modular Solutions

Case Studies: Telecommunications

Cable landing station – Nigeria and Ghana



Background:

- Emerson was one of the vendors for submarine cable landing stations for the WACS project (West Africa Cable System) which now enables high-speed internet access throughout Africa and is a milestone project for the continent's internet connectivity
- Solution required two energy centres and five equipment room modules

Emerson Value Proposition

- Emerson Network Power delivered an integrated modular solution with
  - Emerson NetSure® DC Power systems
  - Emerson Liebert climate system
  - 4 hour battery backup, fire suppression system, and remote supervision system
  - AC-System with AMF panel
  - Customized equipment room with factory mounted subracks for seamless on-site installation of equipment racks

Result:

- 6 months delivery time
- Unmatched flexibility to meet difficult site conditions during installation (site is 20 meters from sea)
- Satisfied customer with a reliable critical infrastructure facility

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Cable landing station – Nigeria and Ghana

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Power Module – Australia

Background:

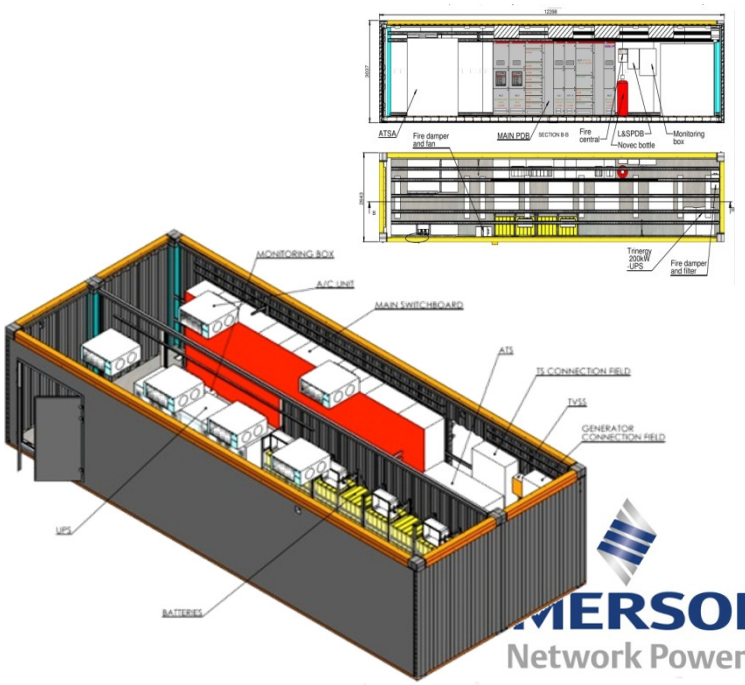
- Client required a fully-redundant (2N) modular electrical power infrastructure for 10 core /aggregation node sites to support a large broadband infrastructure buildout
- Solution needed to fulfill high-end technical characteristics as well as safety and security demands (bullet proof walls, 2h fire resistance)

Emerson Value Proposition

- Emerson Network Power delivered modular solution with:
  - ASCO ATS closed transition switch with maintenance bypass
  - Power distribution board
  - Chloride 200kW UPS with future upgrade provision to 400kW (including battery backup)
  - Liebert HPAC free-cooling solution (N+1) configuration
  - Novec fire suppression system

Result:

- 6 months delivery time
- Full conformance with Australian standards
- Flexibility to adapt to specific site conditions (placement of prefab modules inside a warehouse)
- Reliable critical infrastructure with 2N architecture



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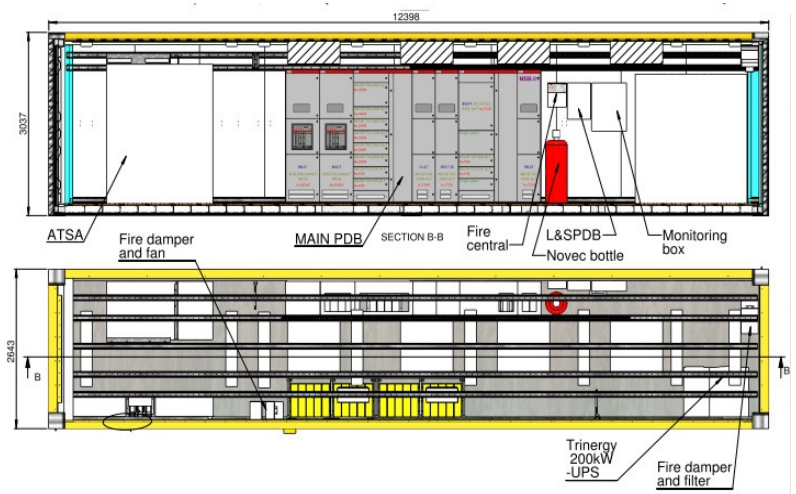
Power Module – Australia



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On-site deployment

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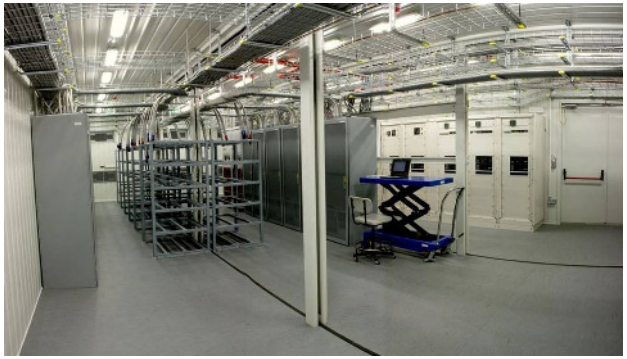
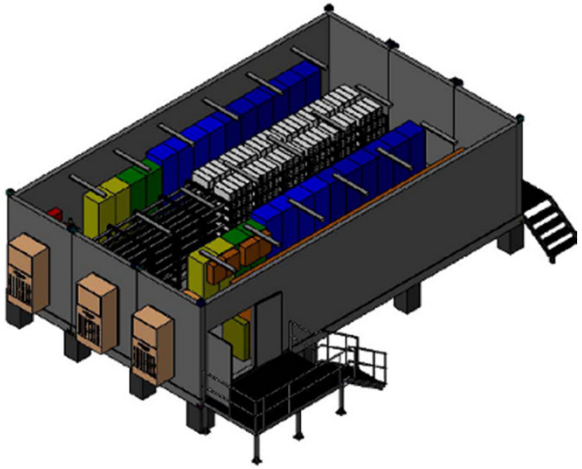
Energy Centre - Nigeria





Background:

- Client needed energy centres for supply of mobile telephone exchanges (MTXs) to support national wireless deployment
- Solution required two energy centres for Lagos and Abuja

Emerson Value Proposition

- The integrated solution designed and delivered by Emerson Network Power included:
  - NetSure® DC Power systems, 600kW + 600kW
  - Inverter system, 300kW + 300kW
  - 6x 14kW Liebert HPAC
  - 10x 1600Ah battery backup
  - 3200A electrical distribution with a changeover system for 3 generators and a transformer

Result:

- 6 months delivery time
- Installation flexibility to adapt to difficult site conditions in Nigeria

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TETRA Emergency Prototype – Norway

Background:

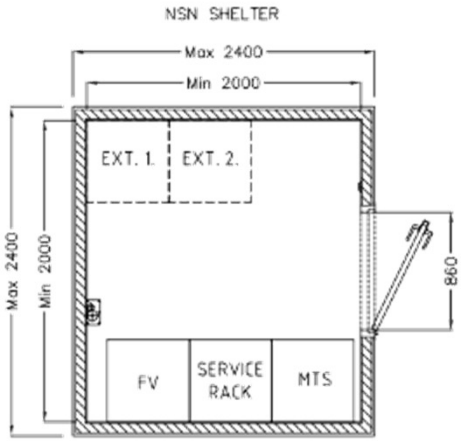
- Deployment of Tetra base station shelters across Norway
- Public service network (Police, Ambulance, Fire fighting, etc.)
- Requirement for extra light shelters due to helicopter transport on remote locations

Emerson Value Proposition

- Design of extra light shelters with welded construction due to high mechanical and security requirements
- Combining different materials and use of special panels to achieve required mechanical strength while keeping low weight
- Implementation of a special freecooling unit (Emerson's custom design and construction)

Result:

- Emerson awarded contract for supply of 150 shelters
- Successful implementation of changes and new features during production
- Delivery in batches of 6-15 shelters
- Ongoing project (96 shelters delivered up to date)



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Scalable Mobile Switching Center Extensions – MTN Nigeria

Background:

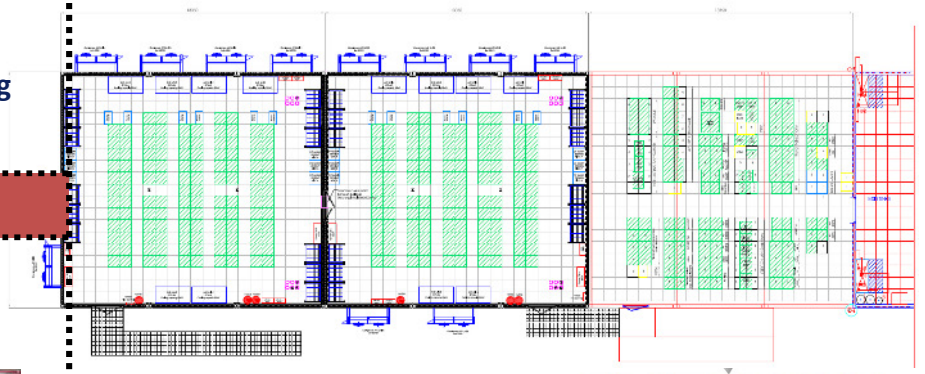
- MTN needed a scalable alternative for quick rollout of Mobile Switching Centers in 5 locations to support network upgrades
- Solution calls for prefabricated MSCs at each site, with expansion capability, tested and turn-up at site and delivered in 6 months
- Existing site constraints meant that a compatible and compact facility was required

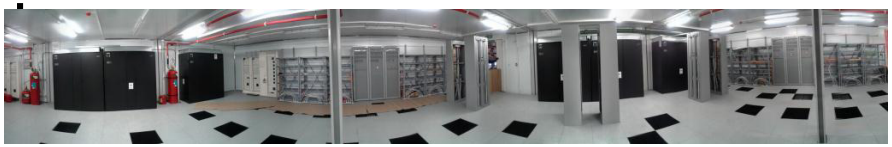
Emerson Value Proposition

- Emerson Network Power crafted an integrated solution with Emerson NetSure® 701 DC Power systems (expandable to accommodate growth), Emerson Liebert HPM Digital 66kW precision cooling, AC Distribution, UPS, 2 hour battery backup at 120kW load, and access control
- Project management monitoring schedule at every gate to meet aggressive lead time
- Understanding of exacting specifications dictated by existing site and meeting those challenges

Result:

- MTN successfully deployed the solution to
  - Improve wireless network performance
  - Expand their infrastructure at an existing site





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Scalable Mobile Switching Center Extensions – MTN Nigeria

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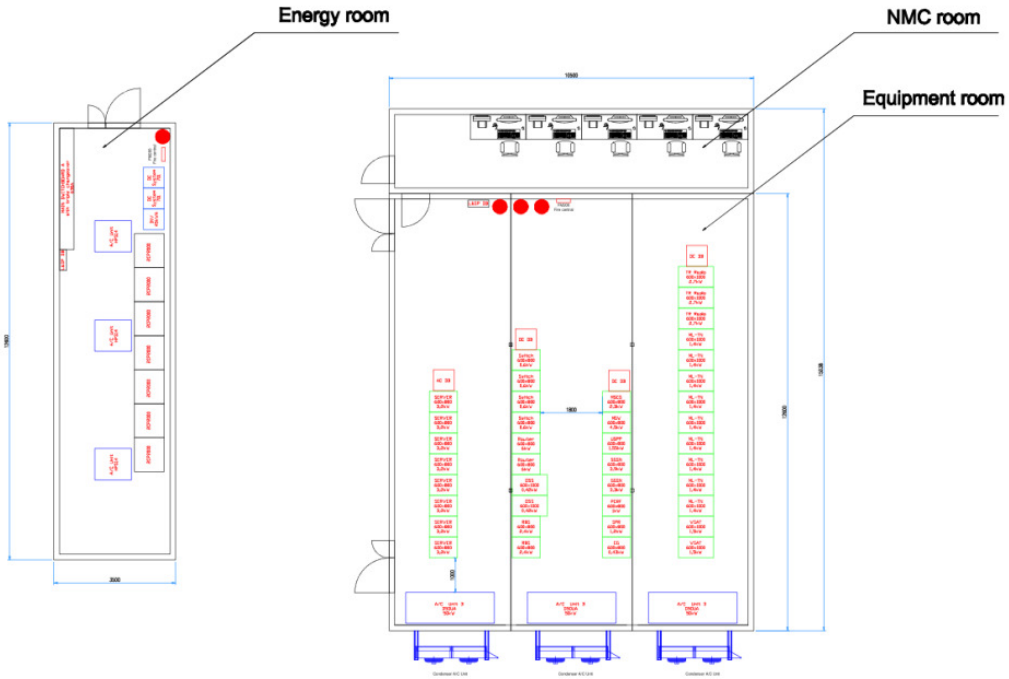
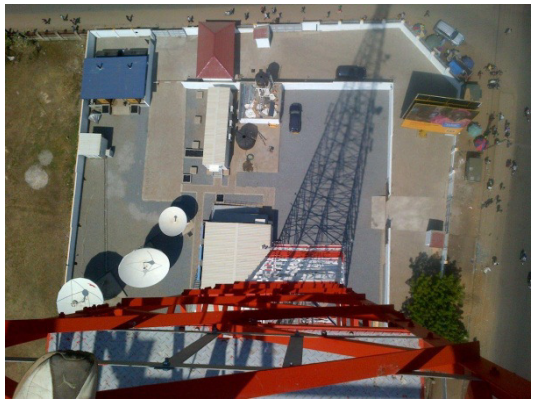
South Sudan – Switch site

- building consists of following main parts:
  - Shelter housing, 5 modules 12,6x3,5mx3,6m
  - Access ramp & roof
  - AC-system
  - DC-system NetSure 701 Multi system
  - Inverter system
  - Automatic fire extinguishing system FM200
  - Grounding and bonding system





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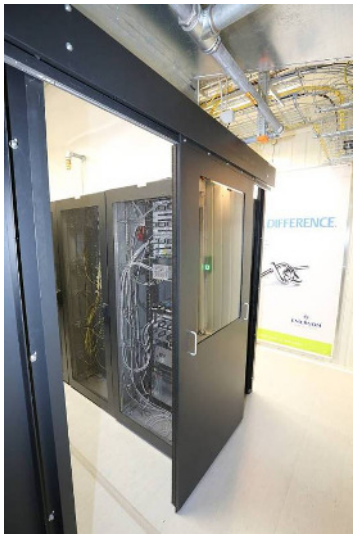
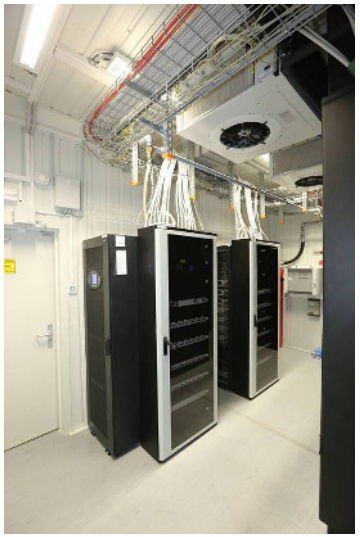
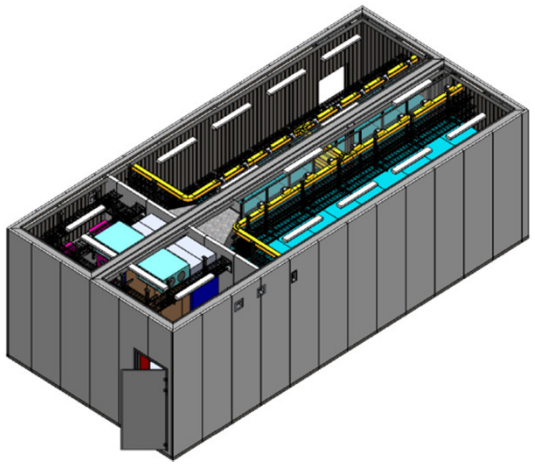
Integrated Modular Solutions

Case Studies: IT Industry

Data Center – Germany







Background:

- City of Hanau required a fast deployment of a datacenter with state of the art technology
- Preference for a turnkey solution

Emerson Value Proposition

- The integrated data center solution delivered by Emerson Network Power contained:
  - Liebert HPM systems and HPSE units
  - Liebert APM UPS system (30kVA + redundant module)
  - Knürr racks and PDUs
  - Electrical distribution cabinets
  - Fire alarm and Novec + Vesda suppression system
- Modular solution is capable of future expansion

Result:

- Exceptional performance, fast delivery and adaptation to new challenges during project execution (such as new site conditions, etc.)
- Site is now operational and Emerson is able to showcase to potential customers

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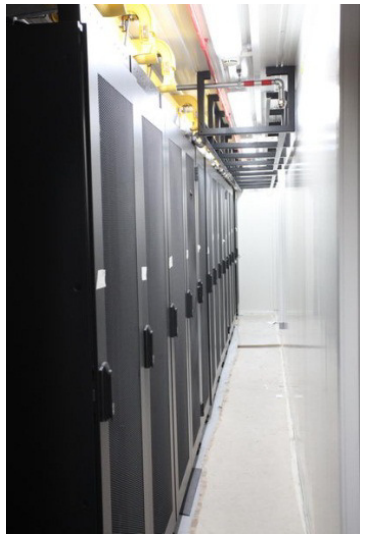
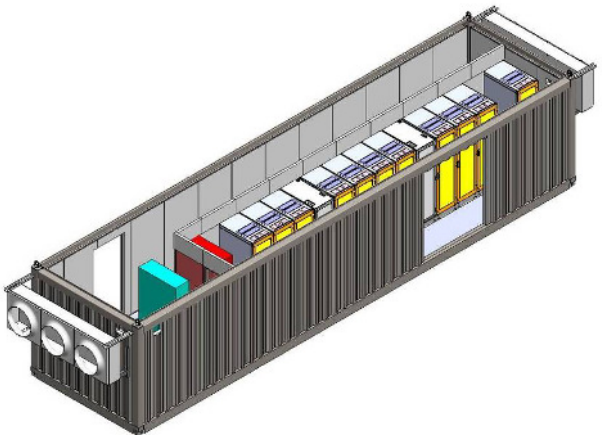
Data Center

Data Center – Dubai





Background:

- Customer required rapid deployment and mobility for the new datacenter facility
- Possible relocation in a few years was one of key drivers for selecting a prefabricated modular solution

Emerson Value Proposition

- The integrated data center solution delivered by Emerson Network Power contained:
  - Liebert CRVs
  - Liebert APM UPS system (30kVA + redundant module)
  - Knürr racks and PDUs
  - Electrical distribution cabinets
  - Fire alarm and Novec + Vesda suppression system
  - Vibration dampers below equipment for earthquake resistance
- Modular solution is capable of future expansion

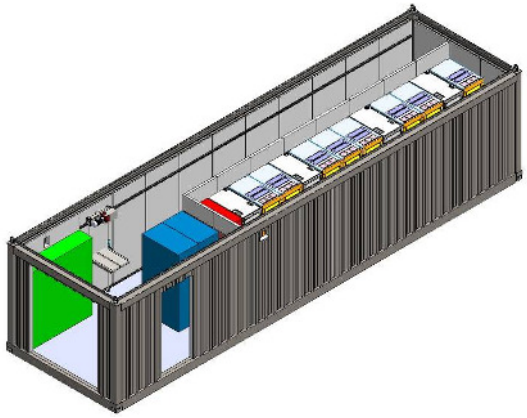
Result:

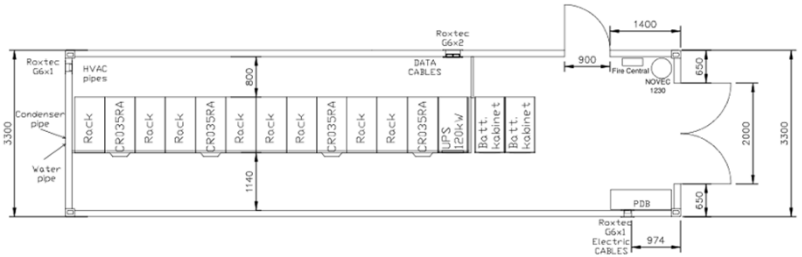
- 5 month delivery time
- Design resulted in fast and efficient site installation (plug and play model) and quick start-up of datacenter
- Satisfied customer

EMERSON Network Power

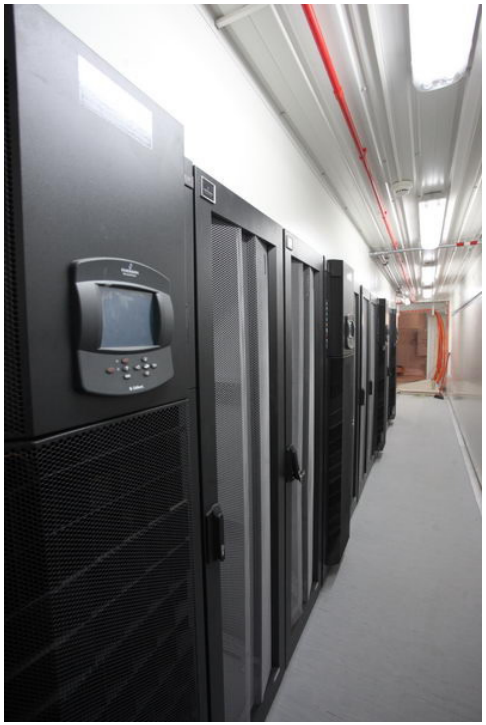
Data Center

Data Center





- HVAC system
  - 4 Liebert CRV's
- UPS system
  - Liebert APM 120kVA+30kVA
- Racks for customer equipment
  - Knuerr Miracle Racks, 8 units
- Electrical distribution
- Fire alarm and extinguishing system
  - NOVEC + VESDA



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Data Center – Russia

Background:

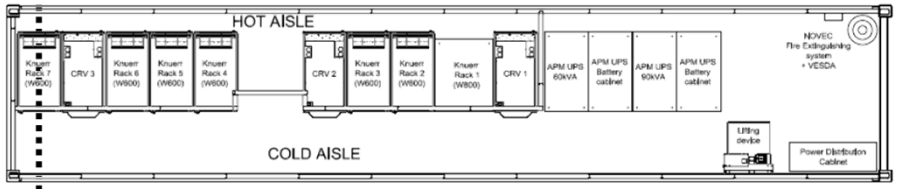
- Customer required rapid deployment and mobility for the new datacenter facility
- Possible relocation in a few years was one of key drivers for selecting prefabricated modular solution
- Road transport restrictions required datacenter to be deployed in ISO standard 40’ HC container

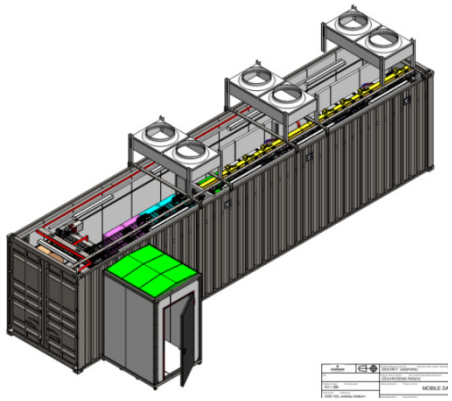
Emerson Value Proposition

- The integrated data center solution delivered by Emerson Network Power contained:
  - Liebert CRVs (N+1 redundancy)
  - Liebert APM UPS system (30kVA and 60kVA + redundant modules)
  - Knürr racks and PDUs
  - Electrical distribution cabinets with ASCO ATS
  - Fire alarm and Novec + Vesda suppression system
- Lifting assist platform for server, battery, or power module installation
- Sliding racks for rear access (sliding rails in floor)
- Airlock for personnel entrance
- Access control system

Result:

- 5 months delivery time
- On-site installation with support of local Emerson office





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Data Center

40’ HQ data centre

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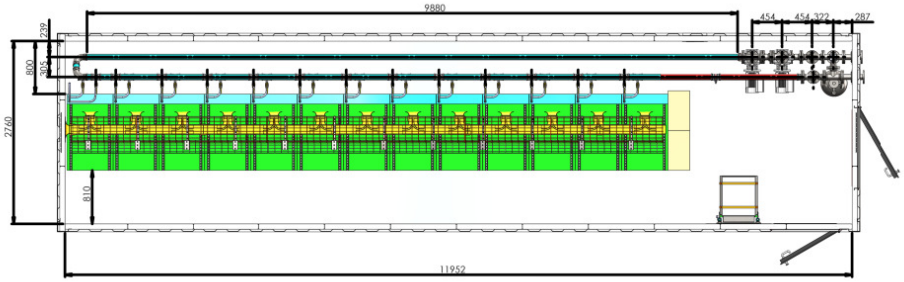
Data Center for Advanced Particle Research – Moscow University, Moscow

Background:

- The GSI research center required a highly efficient self-contained solution for advanced particle research and simulation
- The solution would utilize a novel free cooling approach to minimize energy consumption

Emerson Value Proposition

- Emerson Network Power created an total solution with fully contained power, racks, and rack-level heat exchangers for free cooling
- Emerson Knuerr CoolDoor racks, up to 30kW each, as well as Power Distribution Racks, were provided integral to the system, including access control, heat exchanger pumps (2n), and an automated lifting platform for server swap-out



Result:

- GSI deployed the data center module into a high performance computing research environment, achieving an energy-efficient solution

"I want to thank everybody for the very professional work... all details have been done with care and thought."
–Head of High Performance Computing Department

Disaster Recovery Data Center – Doha, Qatar

Background:

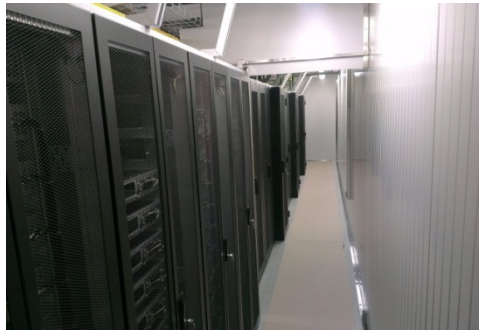
- The International Bank of Qatar required a data storage solution to enable a disaster recovery plan.
- Solution called for a prefabricated modular data center at 60kW – 7.5kW/Rack.
- The facility required an all-in-one container with power, cooling and switchboard controls.

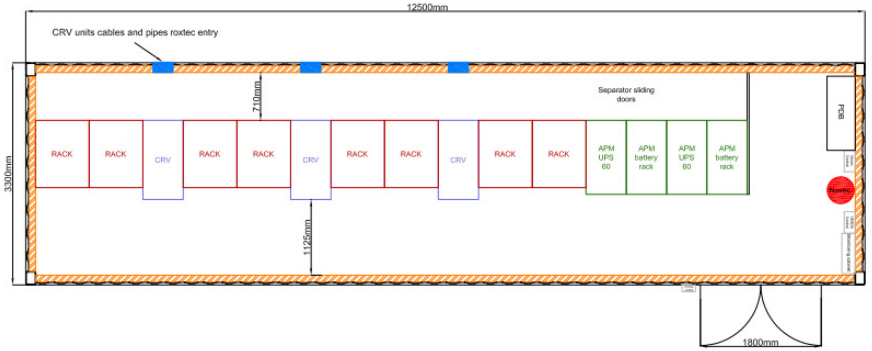
Emerson Value Proposition

- Emerson Network Power crafted an integrated solution with Emerson ASCO transfer switches, Emerson Liebert CRV cooling (n+1) in a hot-cold aisle configuration, fire detection & supression, access control, Emerson Knuerr server racks, and Emerson Liebert APM UPS (2n) for 28 minutes of backup

Result:

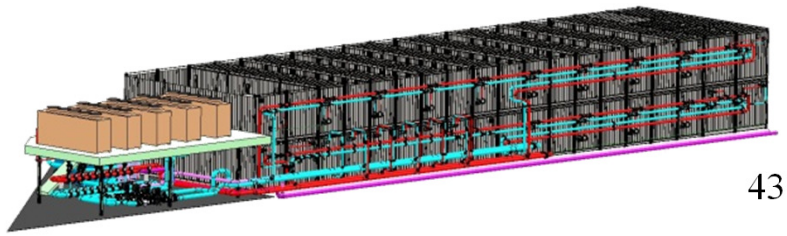
- IBQ successfully deployed the data center container and achieved a quick and cost-effective solution for a low load environment





"I just wanted to thank you and your team for my new [disaster recovery] centre. It's an absolute work of art and I am extremely happy with everything that I have seen..."
–IBQ Head of IT

T-Systems Data Center – Spain



Background:

- T-Systems needed to build a 1.1MW data center deployment
- Rapid schedule drove a containerized solution for ease of shipping and site construction
- Tier III certification was a mandatory requirement, as well as high energy efficiency targets

Emerson Value Proposition

- The integrated data center solution delivered by Emerson Network Power contained:
  - Modular, hot/cold aisle configuration
  - Power, IT, and air-handling modules
  - Low density (2.5kW/rack) and high density (10kW/rack) compute load
  - High energy efficiency
  - Tier III compliant power and cooling architecture

Result:

- Facility has achieved Tier III Uptime Institute Design Certification
- Contractual agreement that Emerson can use the live datacenter as a showcase project

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T-Systems Data Center – Spain

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Data Center

T-Systems Data Center – Spain

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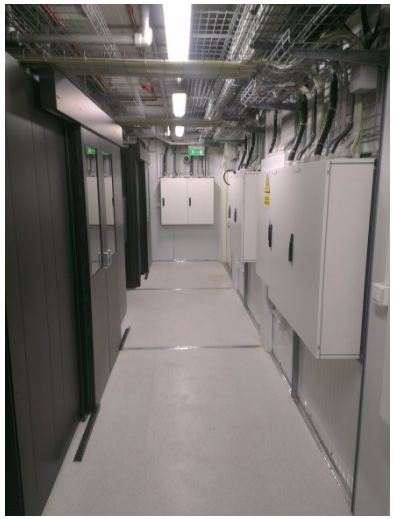
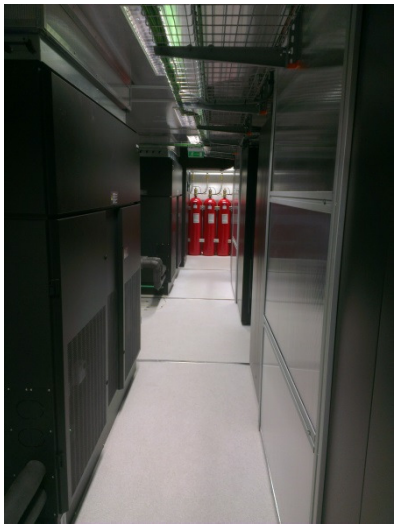
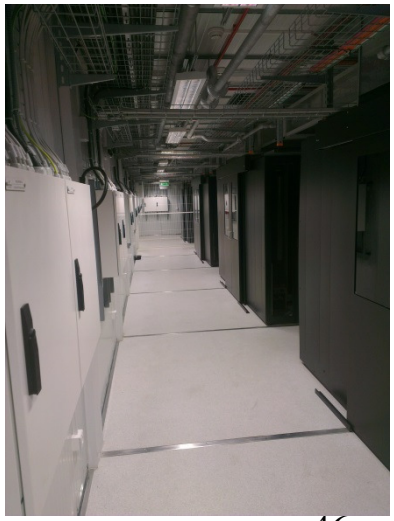
Data Center

T-Systems Data Center – Spain


Data Center

Integrated Modular Solutions

Case Studies: Oil & Gas / Mining

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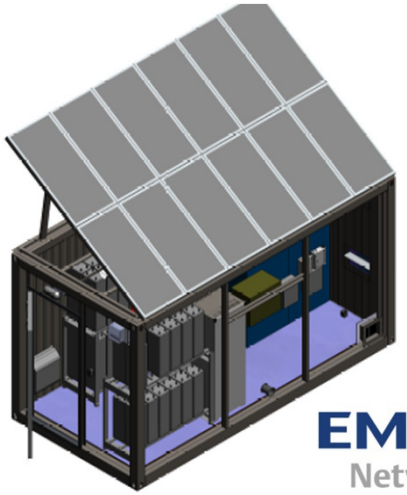
Block valve station – Kazakhstan

Background:

- Deployment of 7 remote sites on the Kazakhstan – China Gas pipeline (Block Valve Stations)
- No electrical source of power on site
- Required a customized energy solution

Emerson Value Proposition

- The modular solution delivered by Emerson Network Power included:
  - 24V DC & 48V DC Power Systems
  - 230V AC with battery backup
  - Power Control and Alarms
  - Air conditioning and heating
  - Automatic fire extinguishing system
  - Integration of solar power system
  - Integration of Thermo Electric Generators (TEG)



Result:

- Successful adaptation to Kazakhstan standards
- Emerson met the challenge of implementing new technologies and providing a hybrid solution (TEG-Solar)
- No issues reported during 5 years of continuous site site operation

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Network Power

Industrial

Control Building and Wellpads – Iraq

Background:

- A mineral resources company required a control building for their central oil facility as well as wellpads for remote oil wells

Emerson Value Proposition

- The solution delivered by Emerson Network Power for the control building contained:
  - 29kW cooling utilizing Liebert HPM (N+1 redundancy)
  - Gas detectors
  - Raised floor system
  - Vesda fire suppression system
  - Gastight and blast resistance
- Each wellpad included:
  - 29kW cooling utilizing Liebert HPM (2N redundancy)
  - Chloride UPS system (14kVA/12kW) with Ni-Cd batteries and UPS bypass
  - Gas detectors
  - Gastight and blast resistance

Result:

- 9 months delivery time with implementation of customer changes during factory production
- On-site installation by Emerson installers to ensure best quality of product and service

EMERSON
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Industrial

UPS Substations – Iraq

Background:

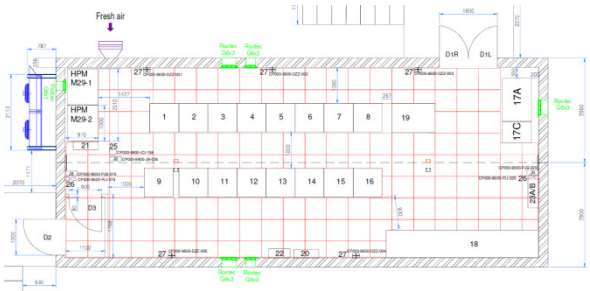
- A mineral resources company required UPS Substations buildings for supplying their central oil facility and process equipment facilities

Emerson Value Proposition

- The integrated solution delivered by Emerson Network Power included:
  - Liebert HPM HVAC system and control panel
  - Chloride industrial UPS and VRLA batteries
  - AC distribution
  - Fire and gas detectors and control system
  - Roxtec Inlets

Result:

- 9 months delivery time with implementation of customer changes during factory production
- On-site installation by Emerson installers to ensure best quality of product and service



Network Power

Industrial

UPS Substations – Iraq

Background:

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Emerson Value Proposition

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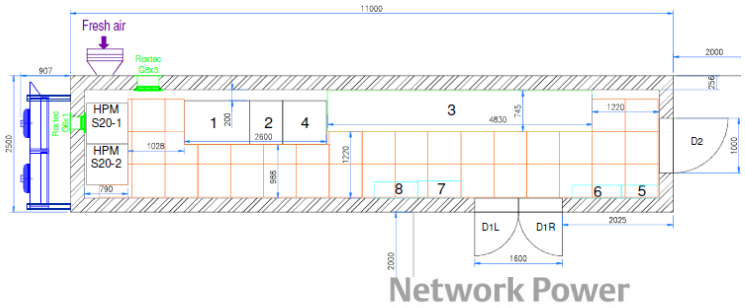
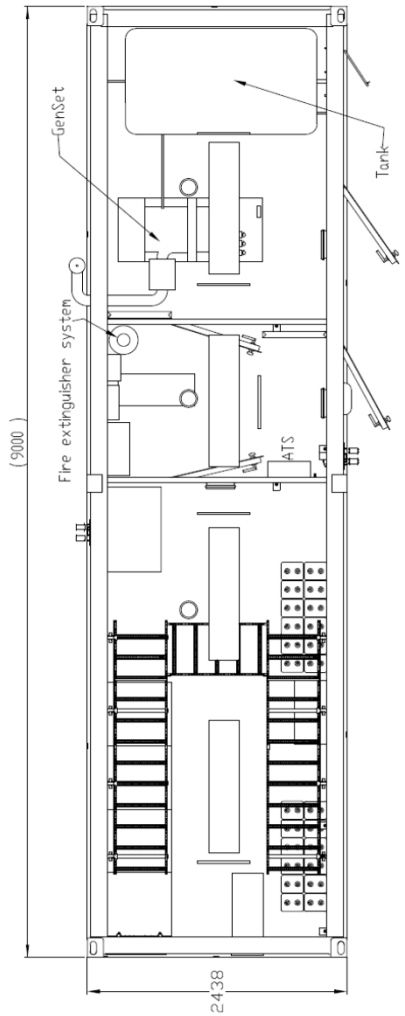


Network Power

Industrial

BVS – Russia



Background:

- Block valve station shelters with integrated generator, three-source changeover and fire system
- Placed along various gas pipelines across Russia

Emerson Value Proposition

- The solution delivered by Emerson Network Power contained:
  - ASCO ATS
  - Liebert PSS
  - Diesel Gen-Set and tank
  - AC Distribution and overvoltage protection
  - Roxtec inlets
  - Control equipment
  - Fire extinguisher system

Result:

- Single module production in 4 months
- Ongoing orders since 2004
- 50+ units delivered (between 4-7 on annual basis)

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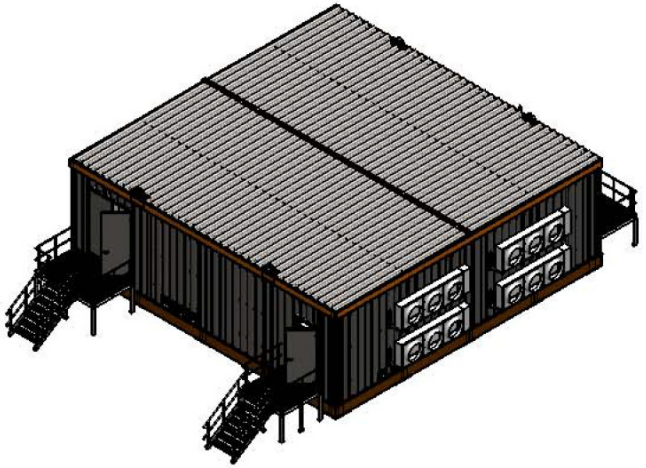
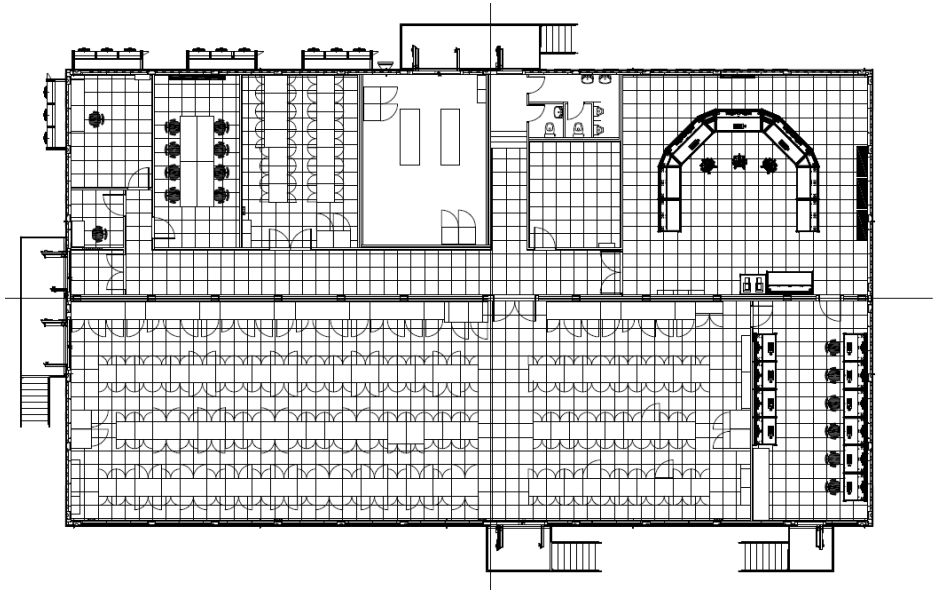
Industrial

SSAGS - Shell Nigeria

- 4 buildings
  - 3 Field Auxilliary Rooms (FAR)
  - 1 Central Control Building (CCB)
- In total 1400m2, 500t of steel
- Blast and fire resistant buildings
- Designed according to Shell standards (DEP)
- EPM + IMS + Liebert + Knurr + Copeland





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SSAGS - Shell Nigeria

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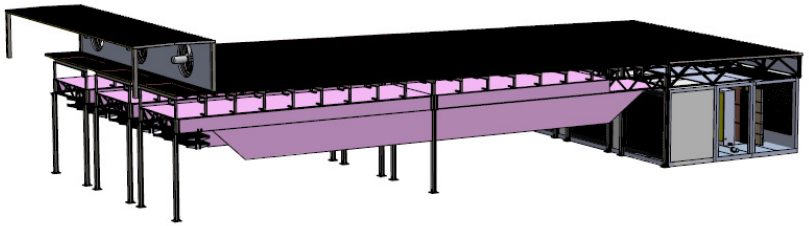
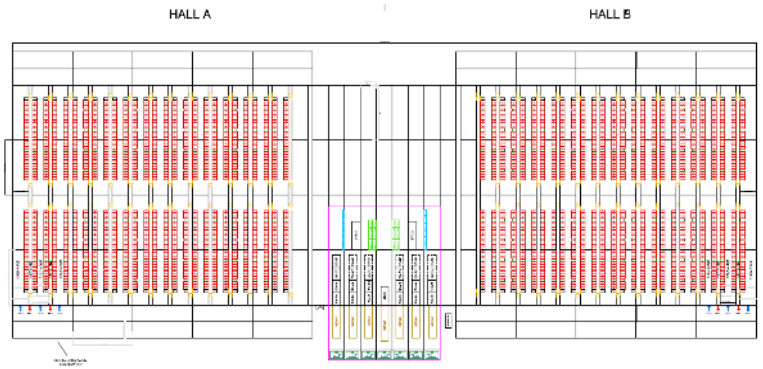
Industrial

Emerson modular data center concept with freecooling





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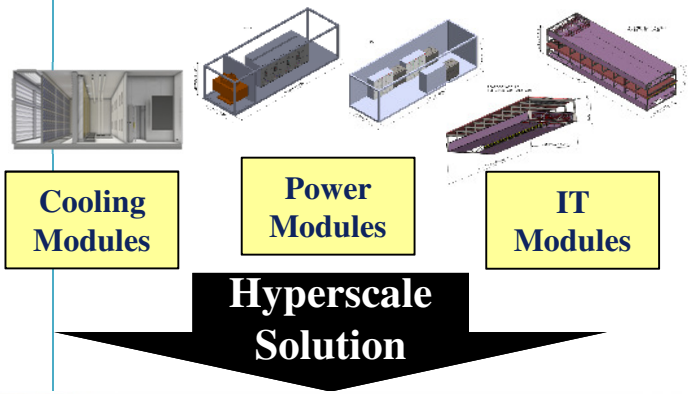
Designing and Deploying Innovative Solution for Facebook's Rapid Deployment Data Center

A rendering of Facebook's Luleå 2 Rapid Deployment Data Center (RDDC)



- Unique technology incorporated in power skids, evaporative air handlers, water treatment plant, building superstructure
- Emerson is also providing turnkey design, project management, and deployment services
- Over 250 shippable data center modules will be provided to Facebook

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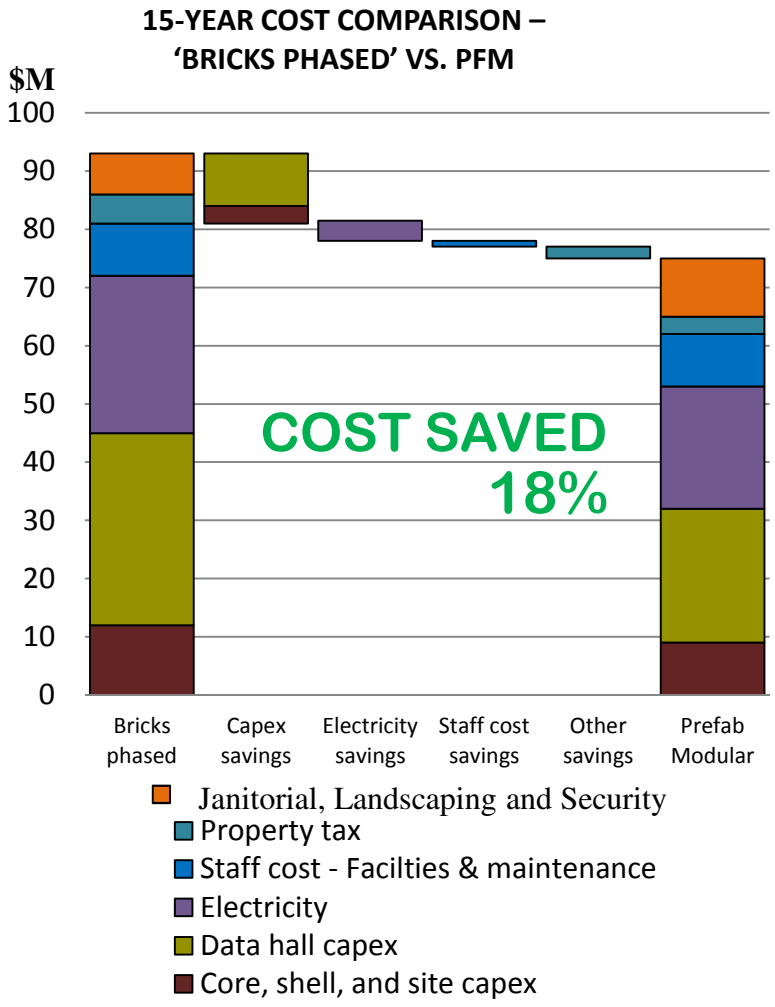
Pre-Fabricated Data Center Value Prop: Lower TCO

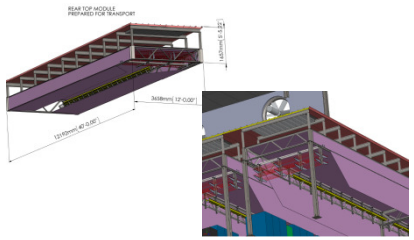
- **Customer Need**
  - Efficient Capital Deployment
  - Delivering Competitively Valued Computing Service to their (Internal/External) Customers
- **Our Differentiation**
  - **Our Vertical Integration Drives Design for Manufacture (↓ Capex) and Construction Efficiencies (↓ Capex)**
  - **Our Innovative Designs Drive Smaller Modular Builds (↓ Capex) and Higher Facility Utilization (lower PUE) (↓ OpEx)**



EMERSON Network Power

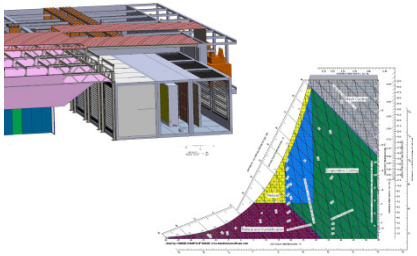
Modular Constructed Data Center

Integrated Superstructure Solution



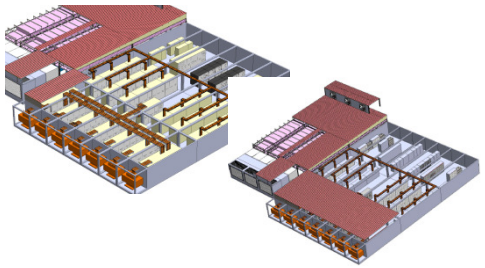
- Modular, flexible, pre-populated and prepared for shipment
- Integrated, structural, optimized solution

Cooling Solutions



- High Efficiency Economization
  - Evaporative Cooling
  - DX Pumped Refrigerant
  - Chiller Plants
- Complete Control System

Power Distribution Solutions



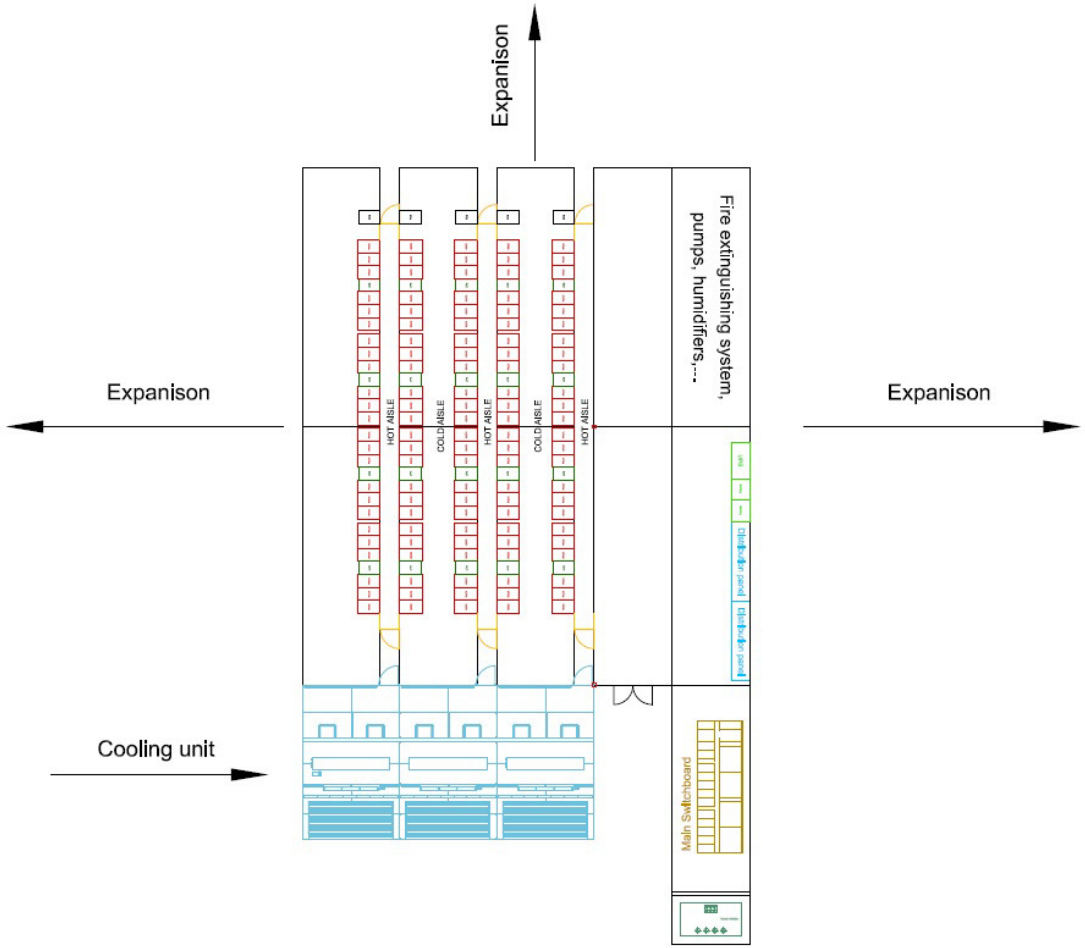
- Switch Gear
- Power Distribution Unit
- UPS

Delivery and Construction

- Production & Delivery: As low as 9 month timelines *
- On-Site Delivery: International, local codes managed by Global Program Management Office
- Contractor cost minimized by Emerson procurement

* Not including site prep / permitting

Modular data center concept



- Expandable modular building
- Fresh air freecooling unit
- In row UPS
- Centralized UPS
- Integrated MV/LV transformer
- LV switchgear
- Monitoring system
- Fire extinguishing and detection

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Power modules, Water Treatment, Sprinkler Station

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Unit IT & PH

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