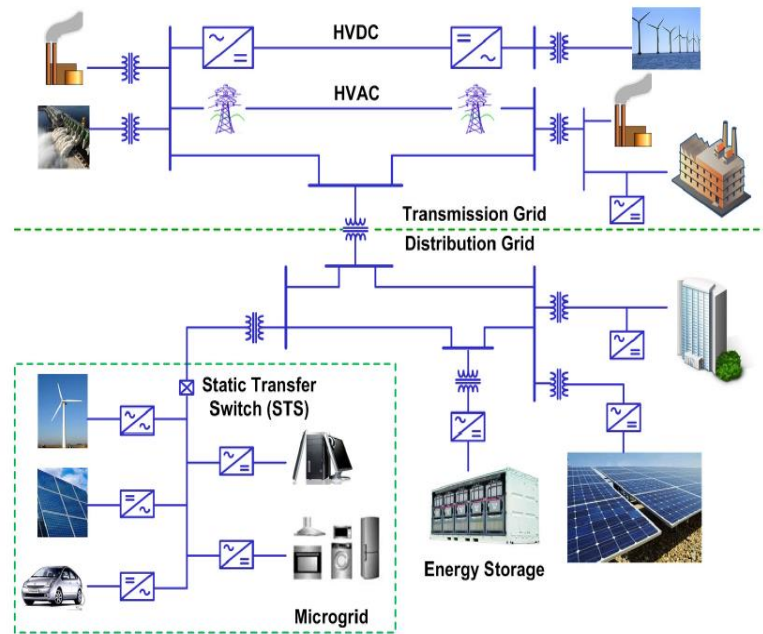




## Renewable Energy Research Group-Power Electronic Systems

### Core Research Areas

- Offshore Wind Power Converter
- Energy Router
- Microgrid Converter
- Stability Analysis of Power Electronic System
- Nonlinear Analysis and Design
- Grid Integration and Control
- Electro-thermal Analysis
- Advanced Power Converter Topology
- Modular Multi-level Converter



**Contact Person: Prof. Zhe Chen**

Phone: (+45) 9940 9255      Email: [zch@et.aau.dk](mailto:zch@et.aau.dk)

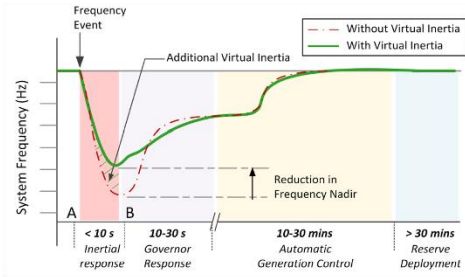
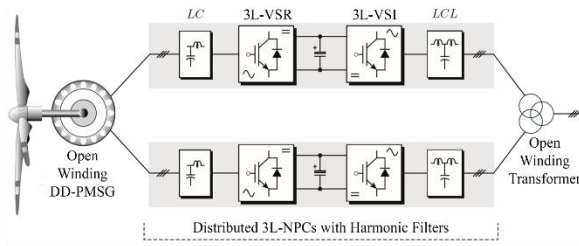
Website: <http://homes.et.aau.dk/zch>

Group website: <http://homes.et.aau.dk/zch/group.htm>

Publications: <http://homes.et.aau.dk/zch/publications.htm>

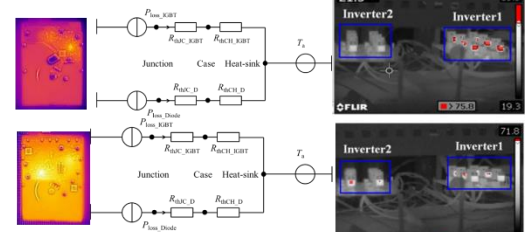
# Power Electronic System Research

## Offshore Wind Power Converter



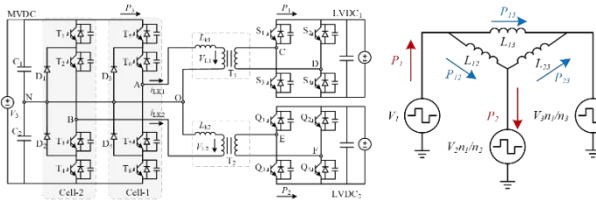
Industrial Project – offshore high-power wind converter

## Virtual Inertia

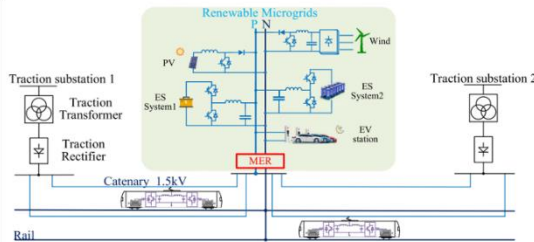


Active thermal balance control

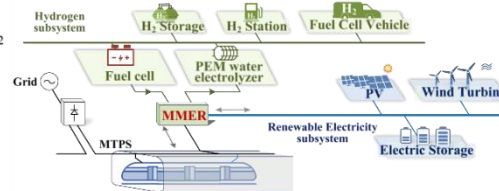
## Energy Router Technology



Multi-port Energy Router

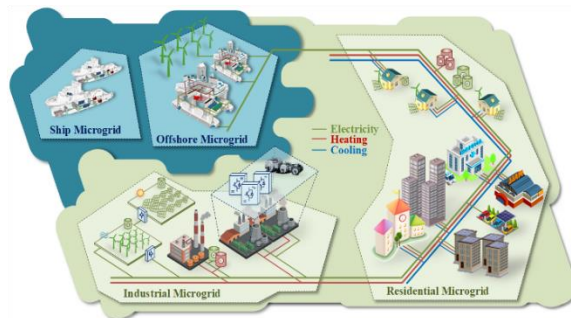


Metro Energy Router



Multi-port Energy Router for Renewable Metro System

## Microgrid Converter



Efficiency optimization

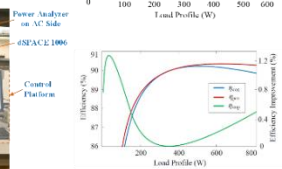
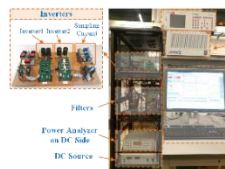
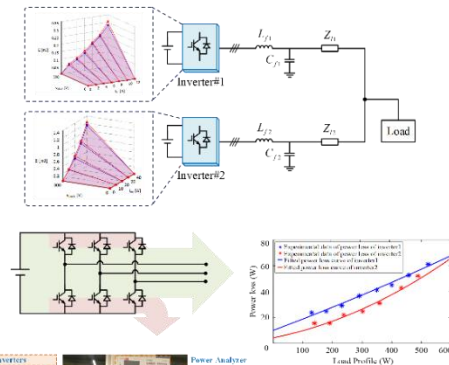
$$\min(P_{loss, tot})$$

$$s.t. \begin{cases} \sum_{i=1}^n P_i = P_{load} \\ \sum_{i=1}^n Q_i = Q_{load} \end{cases}$$

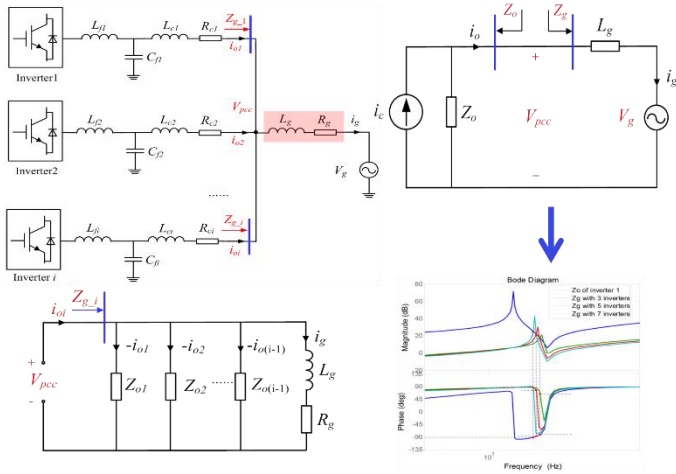
Optimization solution

$$\begin{cases} \frac{\partial P_{loss, 1}}{\partial P_1} = \frac{\partial P_{loss, 2}}{\partial P_2} = \dots = \frac{\partial P_{loss, n}}{\partial P_n} \\ \frac{\partial P_{loss, 1}}{\partial Q_1} = \frac{\partial P_{loss, 2}}{\partial Q_2} = \dots = \frac{\partial P_{loss, n}}{\partial Q_n} \end{cases}$$

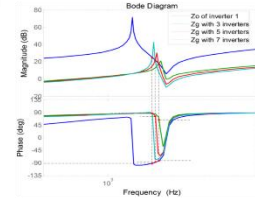
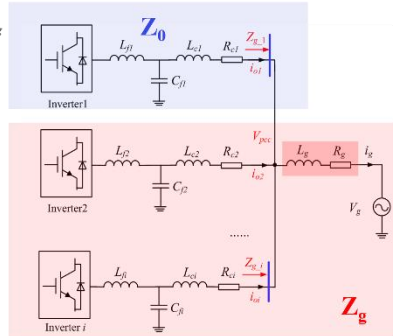
## Power loss Modelling and Analysis



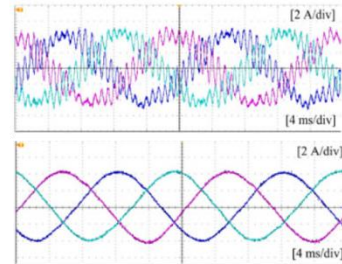
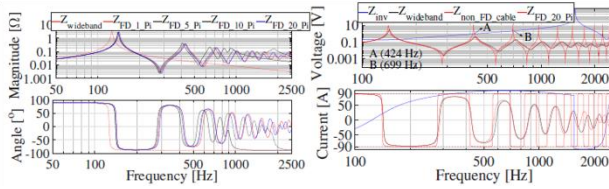
# Stability Analysis of Power Electronic System



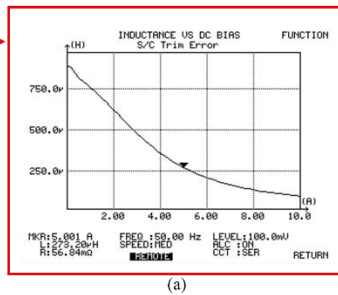
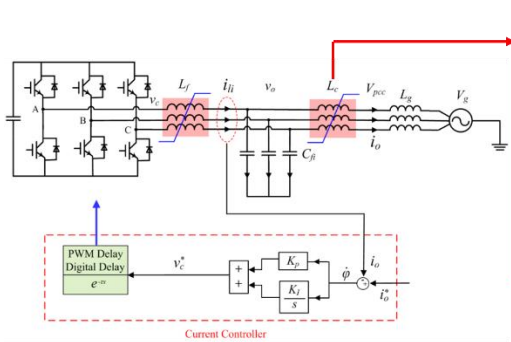
## Impedance modelling



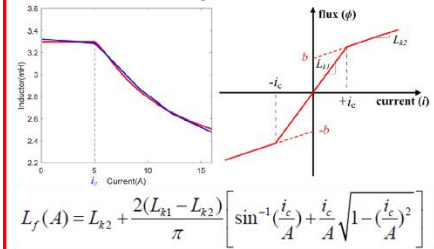
## Frequency response of power cable



# Nonlinear Analysis and Design of Power Electronic Converters

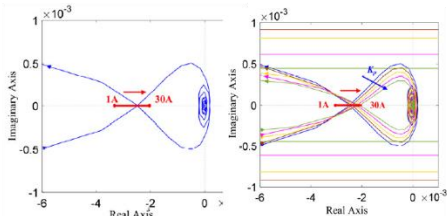


## Describing function

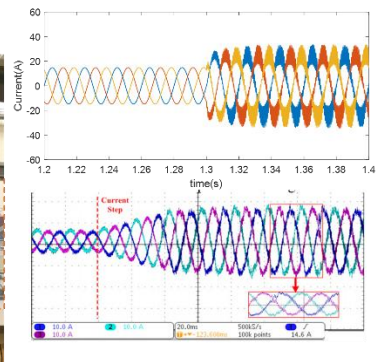
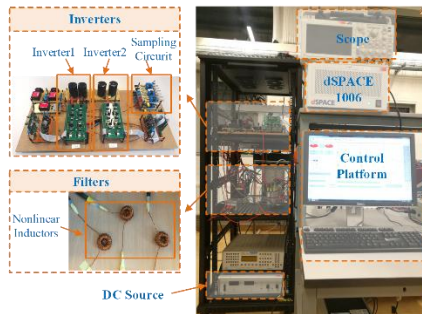


## Nonlinearity of inverter

### Nonlinear design method

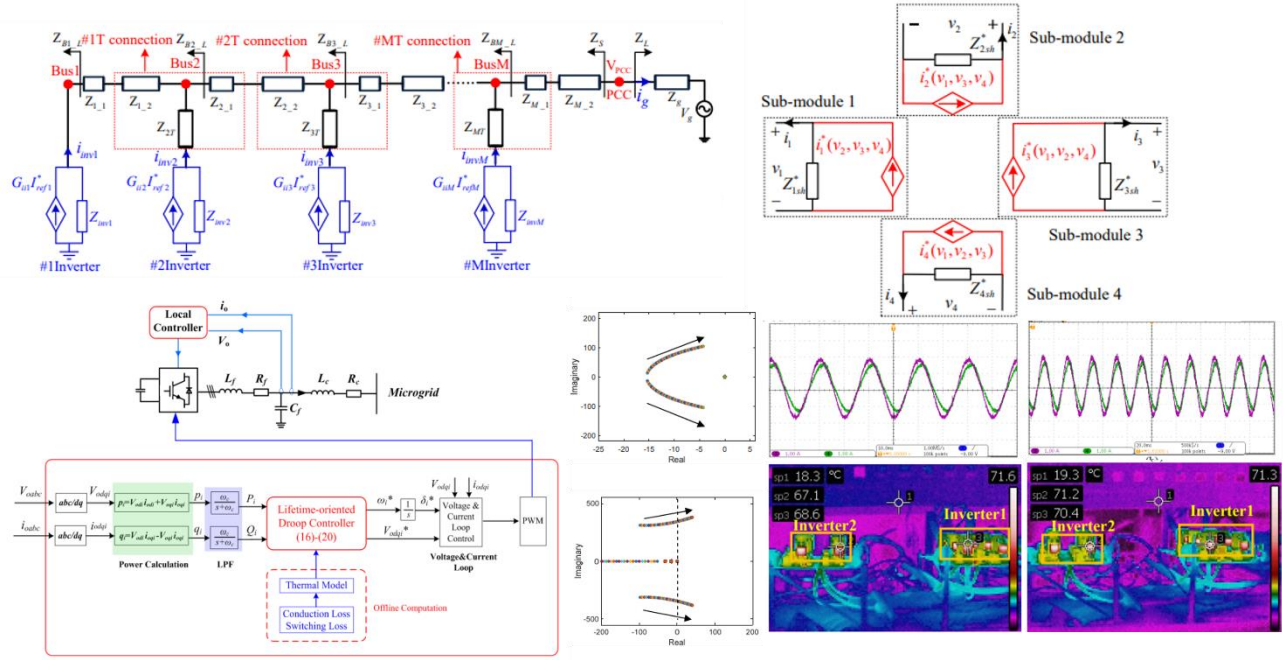


### Magnetic characteristic analysis

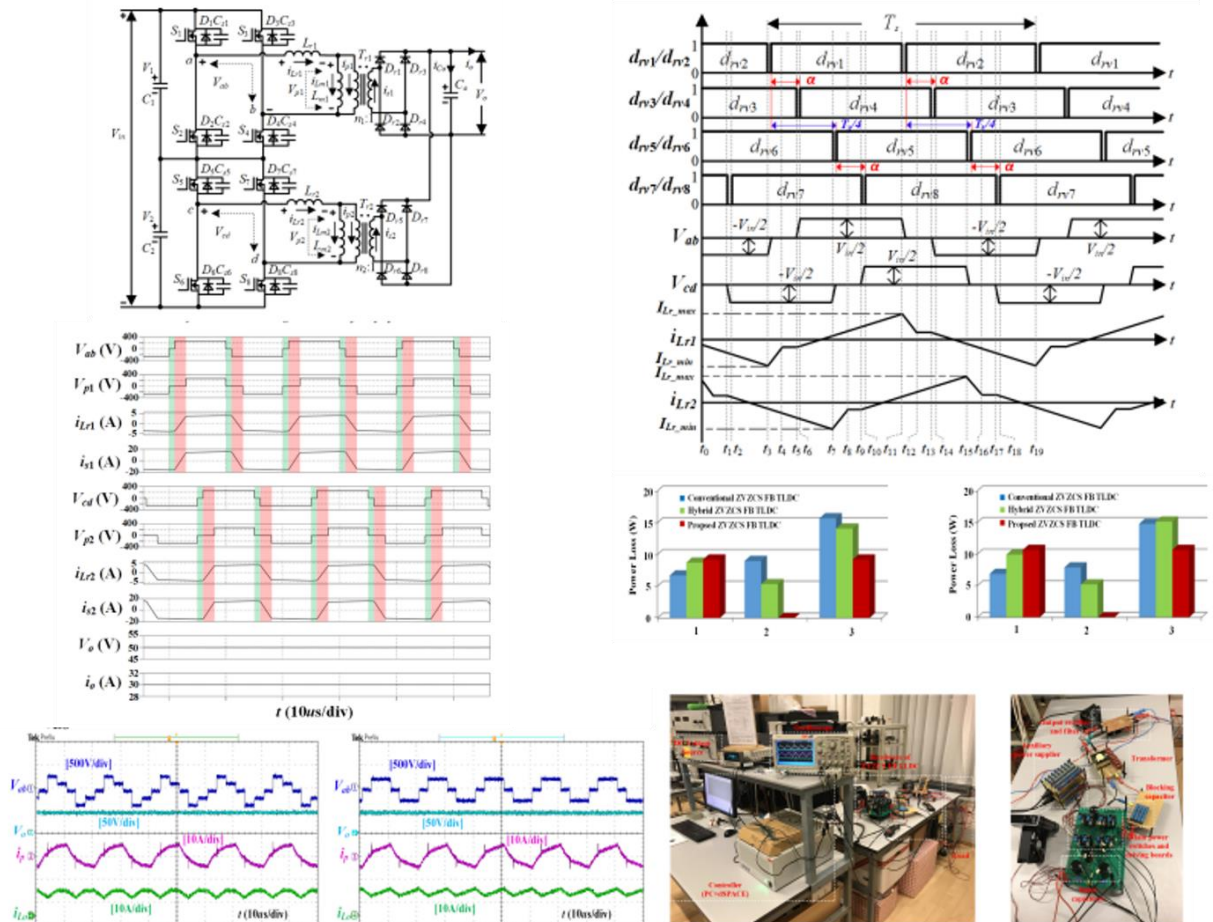




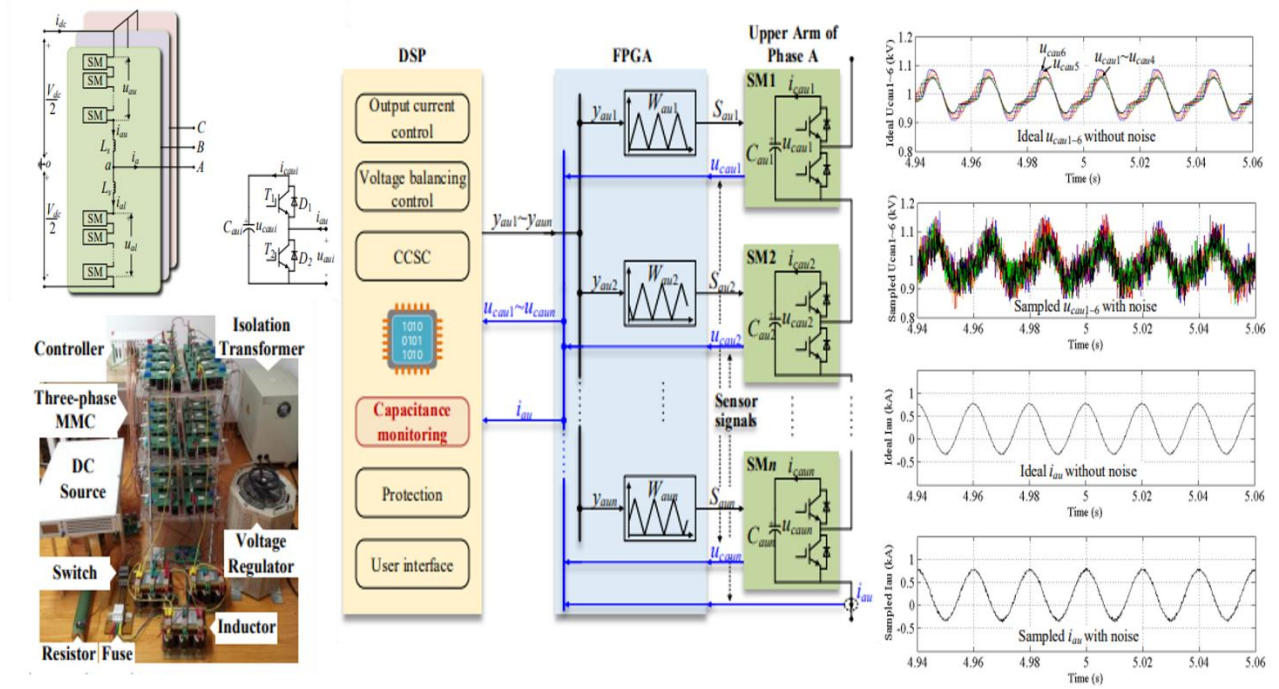
## Electro-thermal Analysis of Paralleled Power Electronic Converter



## Advanced Power Converter Topology

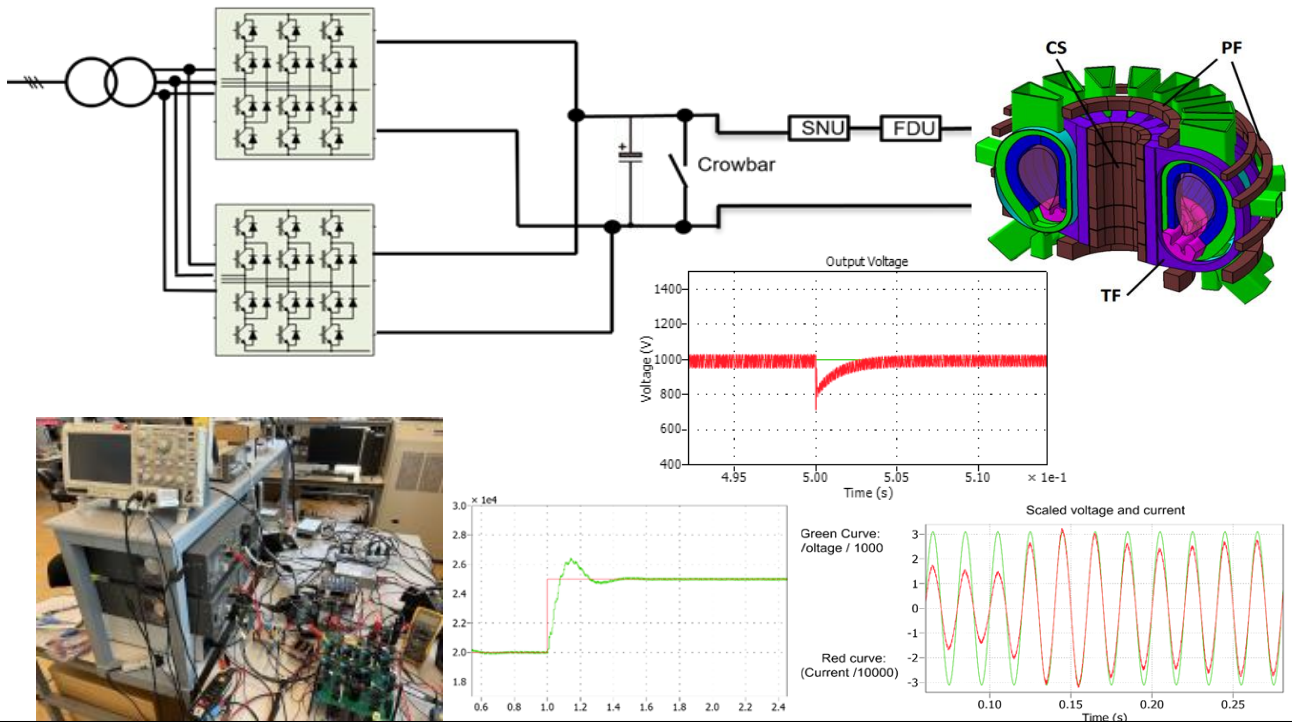


## Modular Multi-level Converter



## Power Electronics Technology for Fusion

### Power Converter Technologies for Superconducting Coils Supply System in Fusion Power Plant



# DC Circuit Breaker Design for Backup Protection of Fast Discharge Units of Superconducting Coils in Fusion Power Plant

