

5G som drivkraft för hållbara energilösningar

Energy Management in 5G Networks

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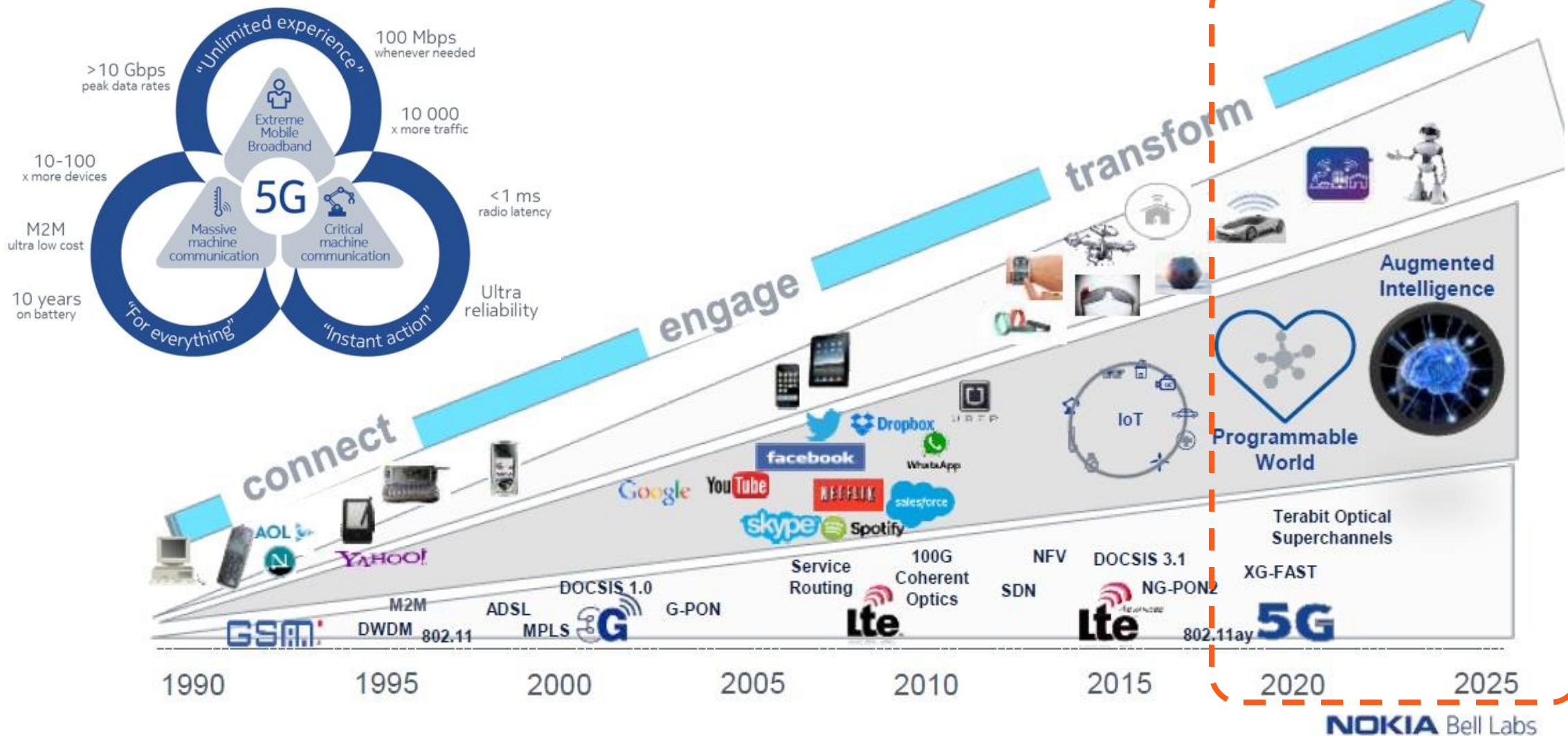
Energy Management in 5G Networks

AGENDA

- Introduction/Architecture
- Energy Management
 - *Management of Li-Ion batteries*
 - *Smart Grid functions*
 - *Hybrid energy sources*
- Communication protocols
- Security
- Summary Conclusion

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Introduction



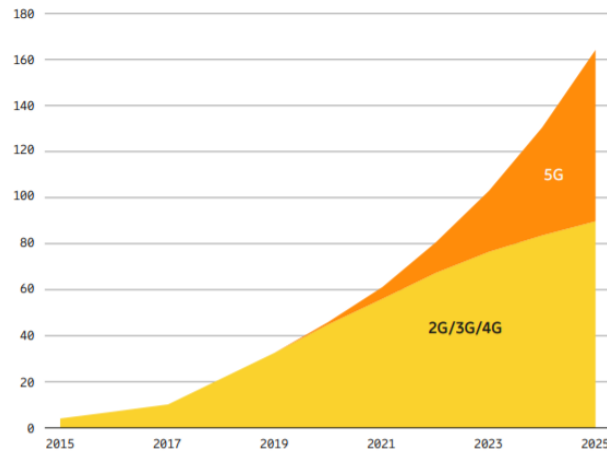
Better performance open up for new functionality, driving increased traffic

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Introduction

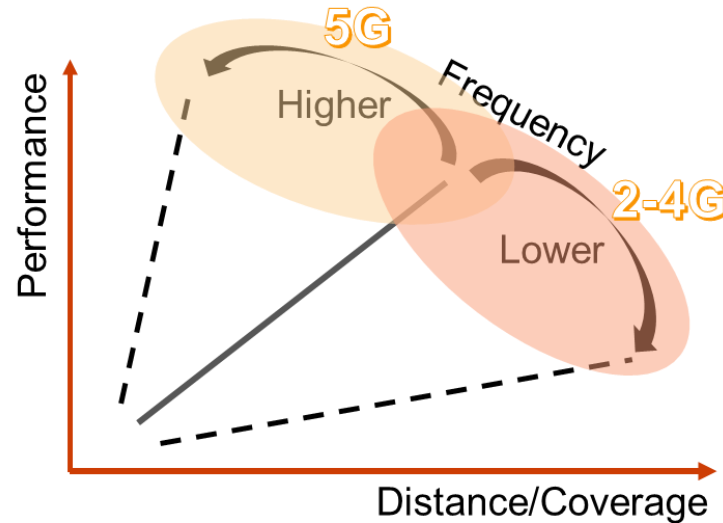
5G performance driving massive expansion of traffic

Figure 18: Global mobile data traffic (EB per month)

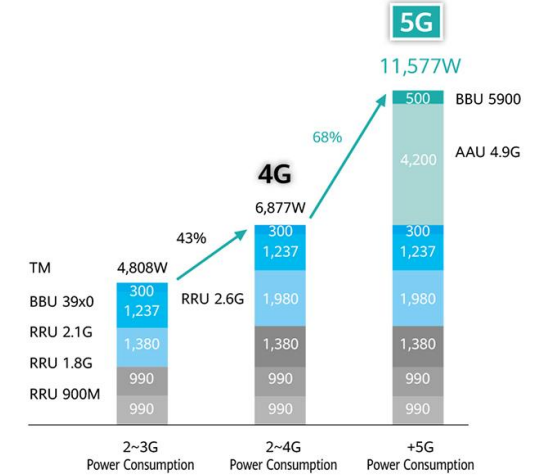


Source: Ericsson

Higher frequency used resulting in less coverage per site



Higher power consumption per site (due increased data)



Typical maximum power consumption of a single 5G base station

Source: Huawei

Challenges for the customer, e.g.

- **Network expansion**, upgrade current sites and development of new sites
- **Space constrains** requiring high density solutions, indoor and outdoor
- Increased energy consumption driving focus on **Energy Efficiency and alternate energy sources**
- Limited CAPEX open up for **Network Sharing** and a new customer segment, TowerCo's.

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Introduction



ACCESS

EDGE

CORE

Indoor and Outdoor DC Power

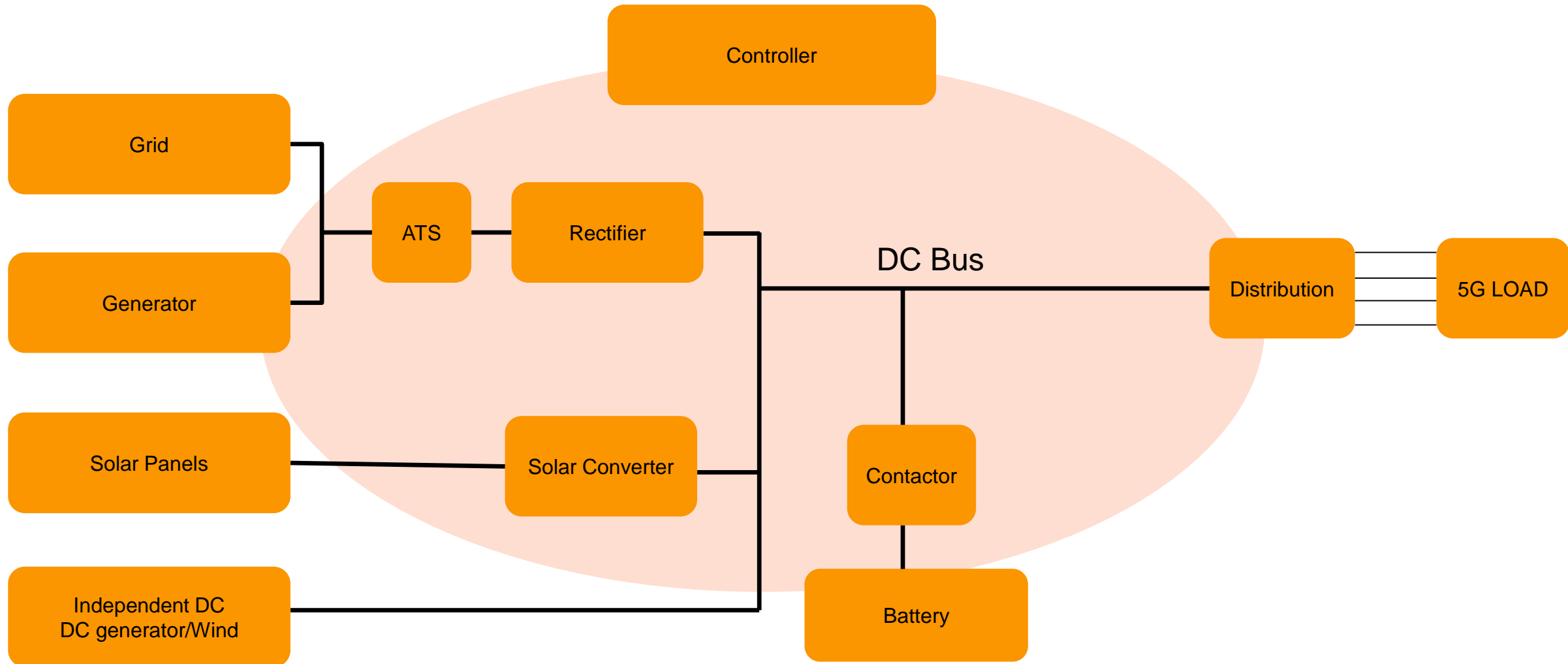


Lithium Batteries



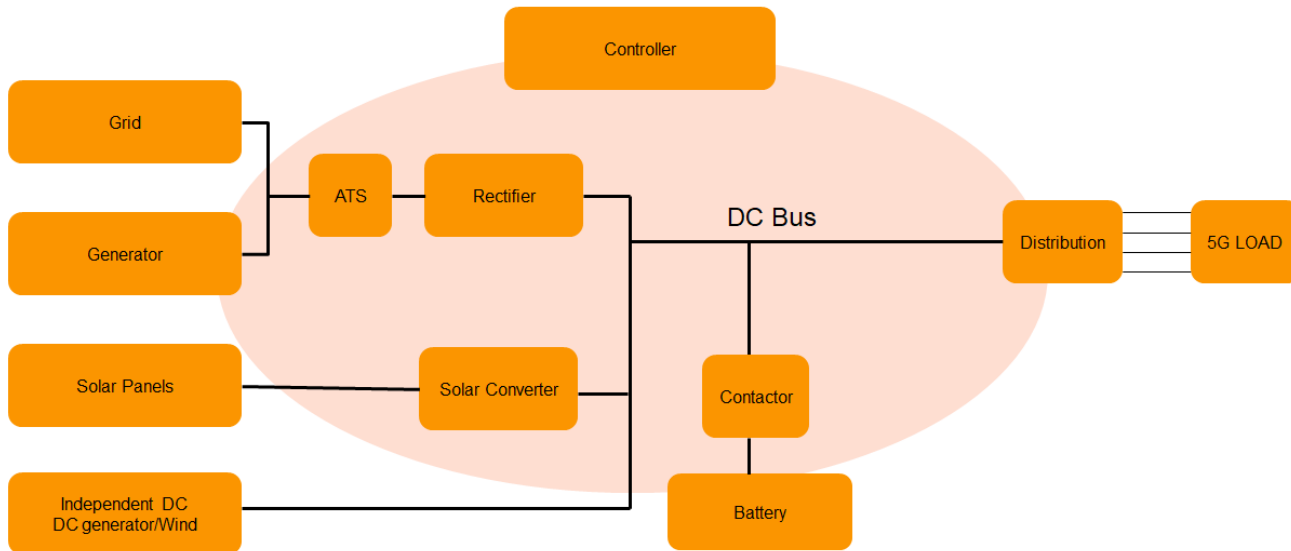
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Architecture DC Energy system



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Management of Li-Ion batteries

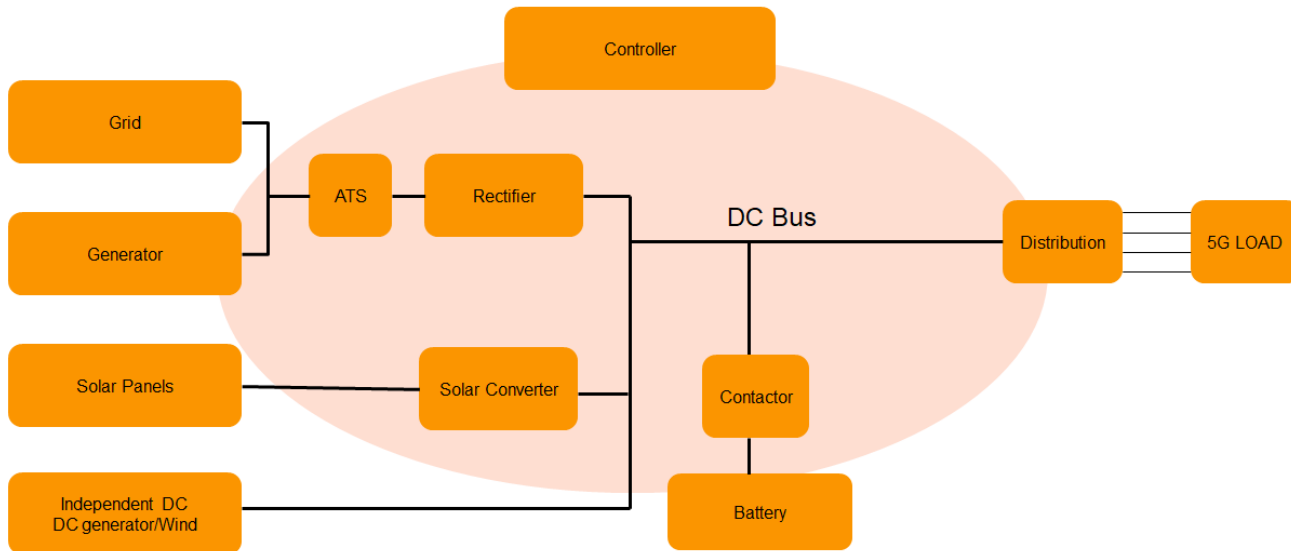


Management of Li-Ion batteries

- 5G load is intermittent, to not affect 5G load with a battery on charge rectifiers and solar converters needs to provide full power to load while at the same time limit current to Li-Ion battery
- With no active Battery Current Limit to battery recharge of battery will take longer time.
- Li-Ion requires different system voltage settings depending on chemistry, number of cells and application
- Use Li-Ion protection and/or contactor as protection
- Feedback from battery on battery current via modbus protocol or traditional battery shunt
- Controller use adaptive algorithm to control current to battery.

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Smart grid functions

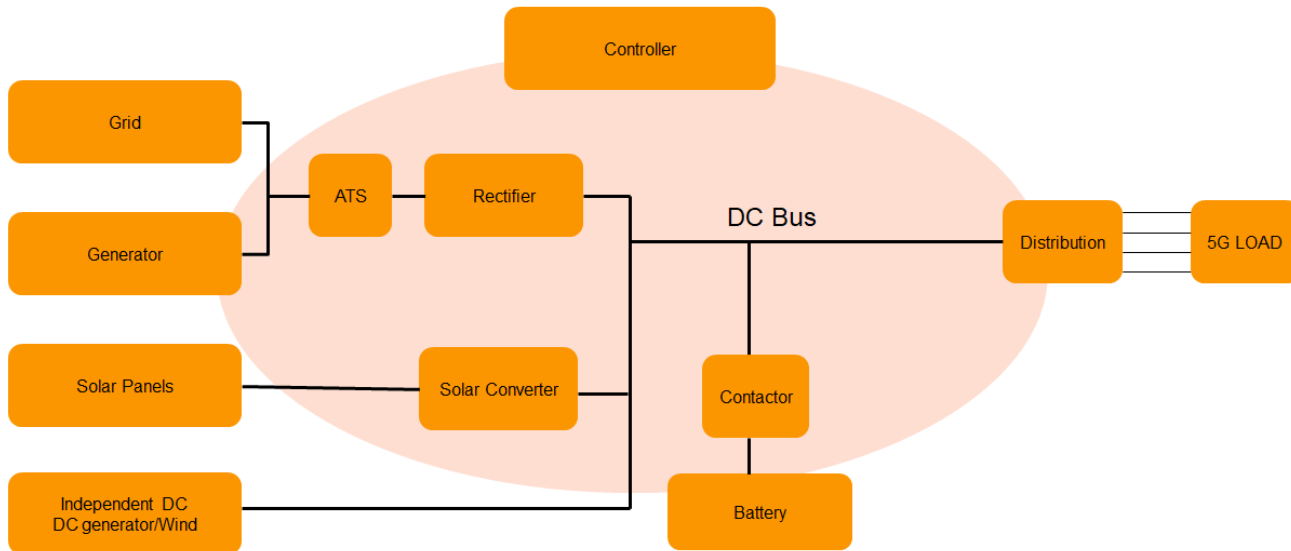


Smart grid functions

- Li-Ion positive cycling performance create possibilities to interact with the grid network.
- Balance the 3 phase load
- Peak load shaving
 - On demand
 - Based on TOD
- Support Frequency Regulation of the grid
- Those features will reduce output power
- Only applicable on a intermittent basis

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Hybrid Energy sources

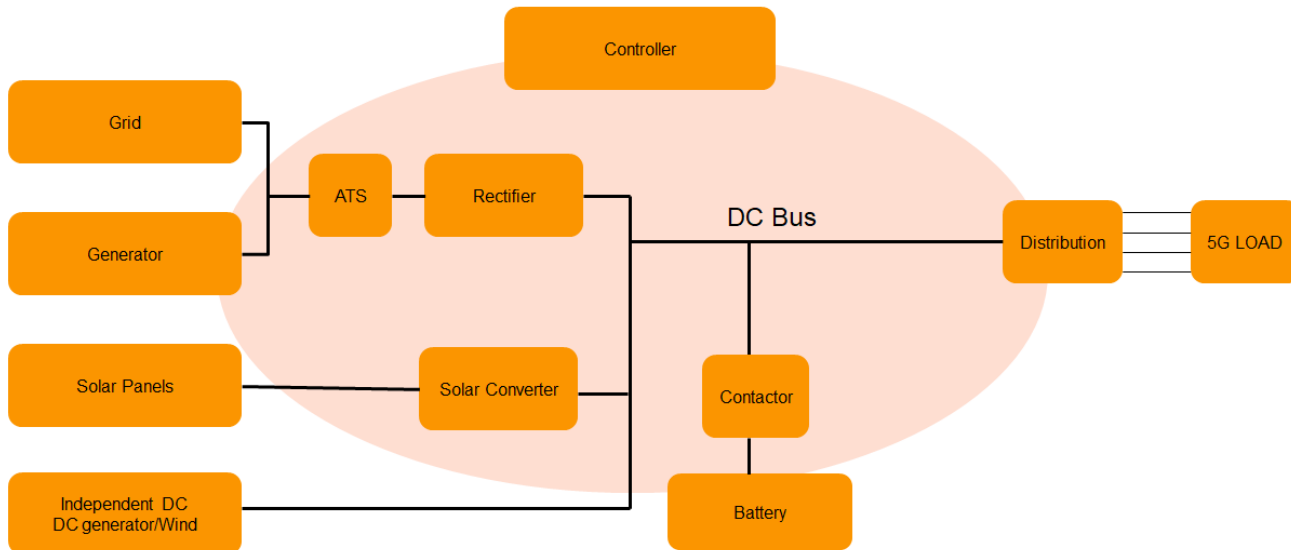


Hybrid energy sources

- Solar converter
 - Off grid
 - On grid
 - Bad grid
- Independent DC device
 - Wind
 - DC Generator
 - Fuel cell
- AC Generator
- Mixed energy sources need management
 - Control DC voltage
 - Optimize use of Solar and Wind Power
 - Optimize usage of generators to reduce fuel consumption
 - Li-Ion battery have a good fit for optimization

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Communication protocols



North Bound

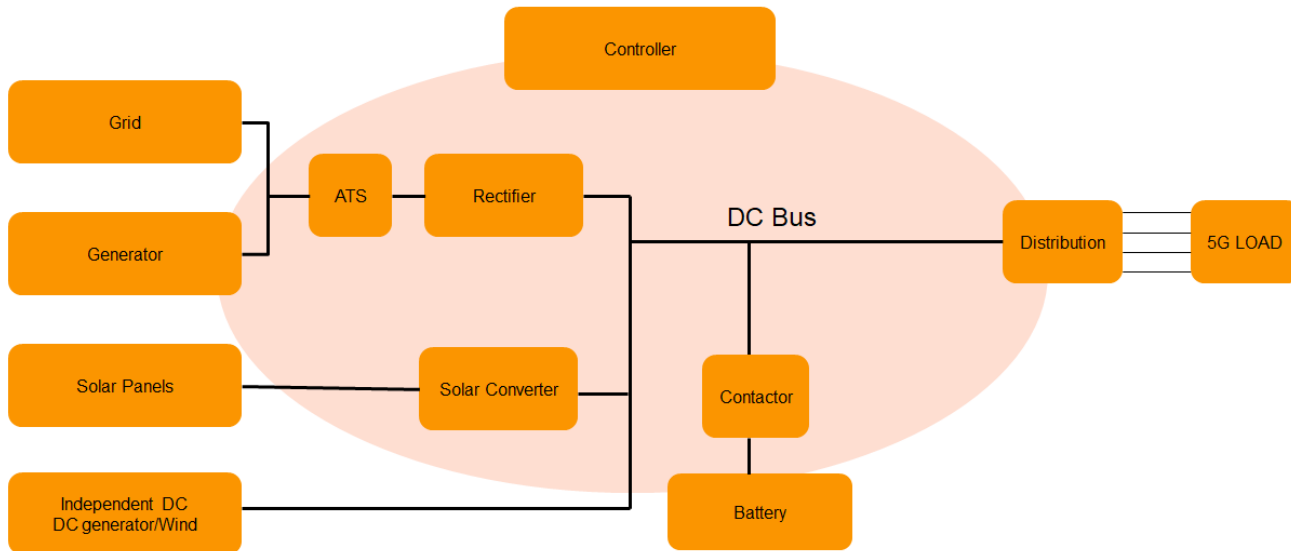
- SNMPV2, SNMPV3
- HTTP/ HTTPS, URL based M2M
- Modbus
- MQTT
- YDN 23/Proprietary protocols

South Bound

- CAN protocols
- Modbus protocols
- HW interfaces

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Security

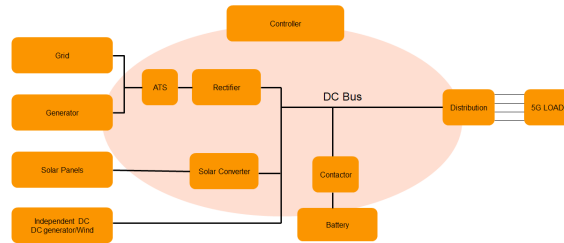


Security

- Need constant development
- Require management/administration
- HTTPs, SNMP V3
- Radius
- API for management of security certificates and security keys.
- Security part of architecture for cost optimization
- Remote management increase vulnerability
 - Firmware upgrade
 - Distribution load management.

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Summary



Summary

- Increased diversity
 - AC, 400V DC, 60V DC, +-48V DC
 - Smart batteries, Smart distributions
 - Multiple energy sources
 - Integration with Utility networks and local wifi networks
- High demands on Security
 - Connectivity and M2M management increases vulnerability.
- Old POTS value for Energy System apply today

Reliability!

Tack!

Frågor?

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