

Building the Next- generation Fleet of Large Coal-fired Power Plants

發展和建设下一代的燃煤电厂

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What Will Be Needed in New Coal Power Plants?

新燃煤电厂的需要

- Lower Operating Costs
- Lower Environmental Impact
- Greater Operating Flexibility

- 降低运营成本
- 降低环境影响
- 增加操作活性



Lower Operating Costs

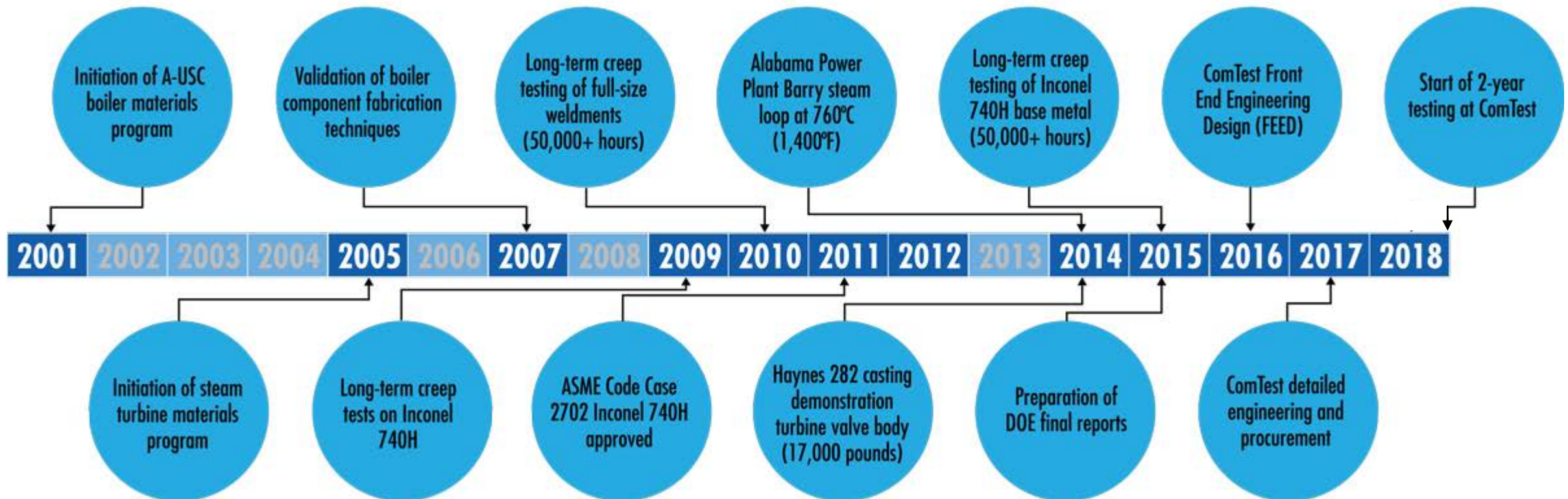
降低运营成本

- Higher Efficiency = Lower Fuel Costs
 - More Automation = Less Labor Costs
 - More Reliability = Lower Maintenance Costs
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- 高效率 = 低燃料成本
 - 高自动化 = 低劳工成本
 - 高可靠性 = 低维护成本



History of A-USC Materials Programs in U.S. – The Path to Higher Thermal Efficiency

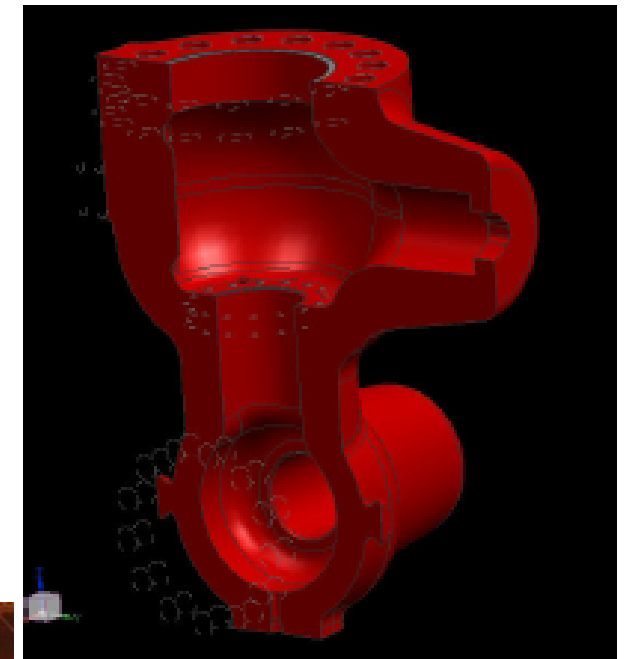
美國先進超超臨介的材料計劃 - 更高的熱效率路徑



Nickel Alloy Casting Development

镍合金的铸造开发

- Haynes 282 Nickel Alloy
 - Casting of half of full-size steam turbine stop and control valve
 - Suitable for use up to 760°C
-
- Haynes 282 镍合金
 - 铸造了半全尺寸的蒸汽止动器和控制阀
 - 使用温度高达760度C



Volume: 19,804 cub. Inches
Approx. Weight~ 5,942 Lbs.



Improved Instrumentation, Controls & Automation

改进的仪器,控制,和自动化

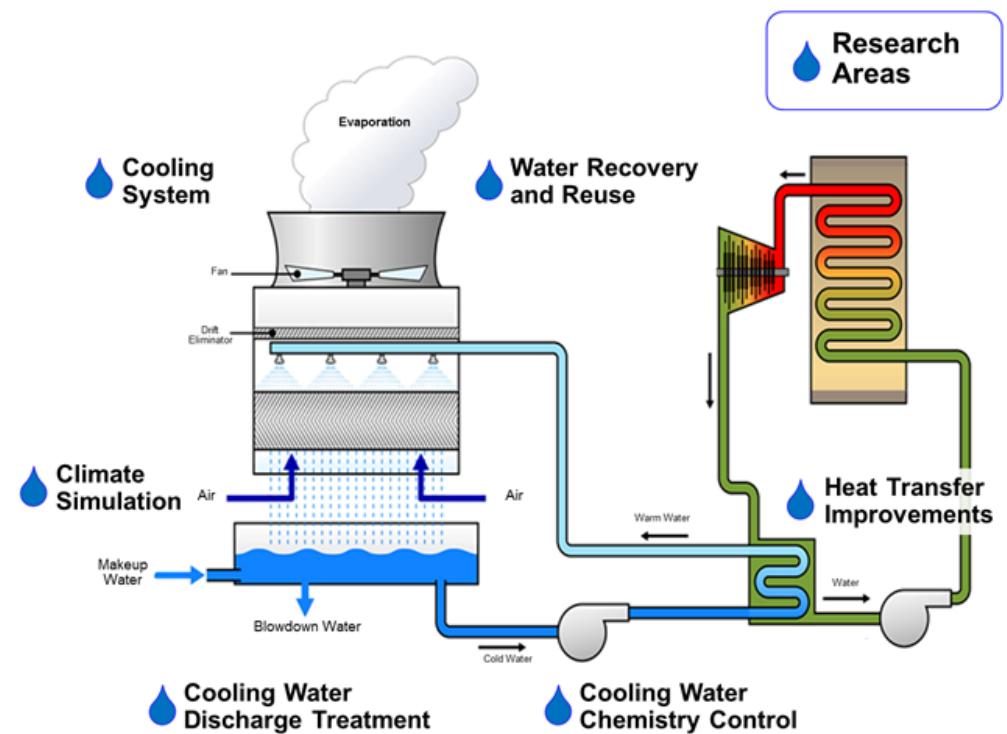
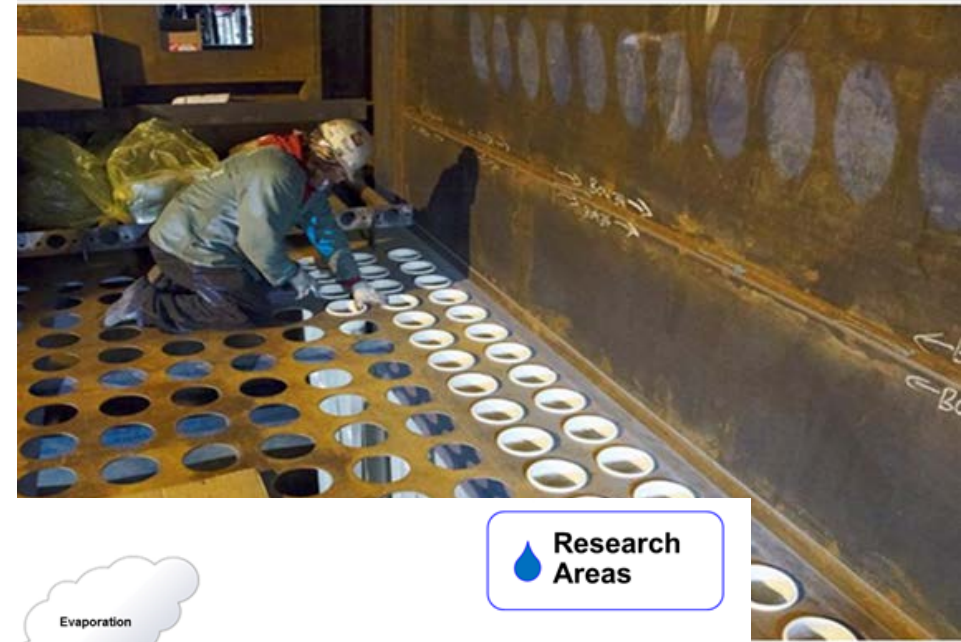


- **Advanced process control strategies, automated startup and turndown**
- **Enhanced reliability through monitoring & prognostics**
- **Low-cost sensing & data analytics for advanced system diagnostics**
- **Smart devices & automated operations to support a new workforce**

- **先进的过程控制策略自动启动和停机**
 - **結過监测和預測去增加可靠性**
- **用低成本传感器和数据分析方法去增强先进系统的诊断力**
- **用高智能设备和自动化操作去增加新员工的劳动力**

Lower Environmental Impact 降低环境影响

- Lower SO_x, NO_x, Particulates (PM), Hg and CO₂ emissions
- Less water consumption
- Beneficial use of by-products (flyash, CO₂, etc.)
- 降低 SO_x, NO_x, 颗粒物 (PM), 汞和二氧化碳的排放
- 减少用水量
- 有效的利用副产品 (例如粉煤灰, 二氧化碳等等)



More Operating Flexibility

更多的操作灵活性

- Quicker starts
- Rapid ramping up and down
- Deeper turn down (lower minimum load)
- 更快的开机
- 快速上升和下降温度
- 更深的调低（降低最低发电需求）



**Boiler header ligament
cracking due to thermal fatigue**

由于热疲劳造成锅炉蒸汽头管破裂

Bulk Energy Storage: An Alternative to Operating Flexibility?

大量的能源储存：可能是运营活性化可行的方案



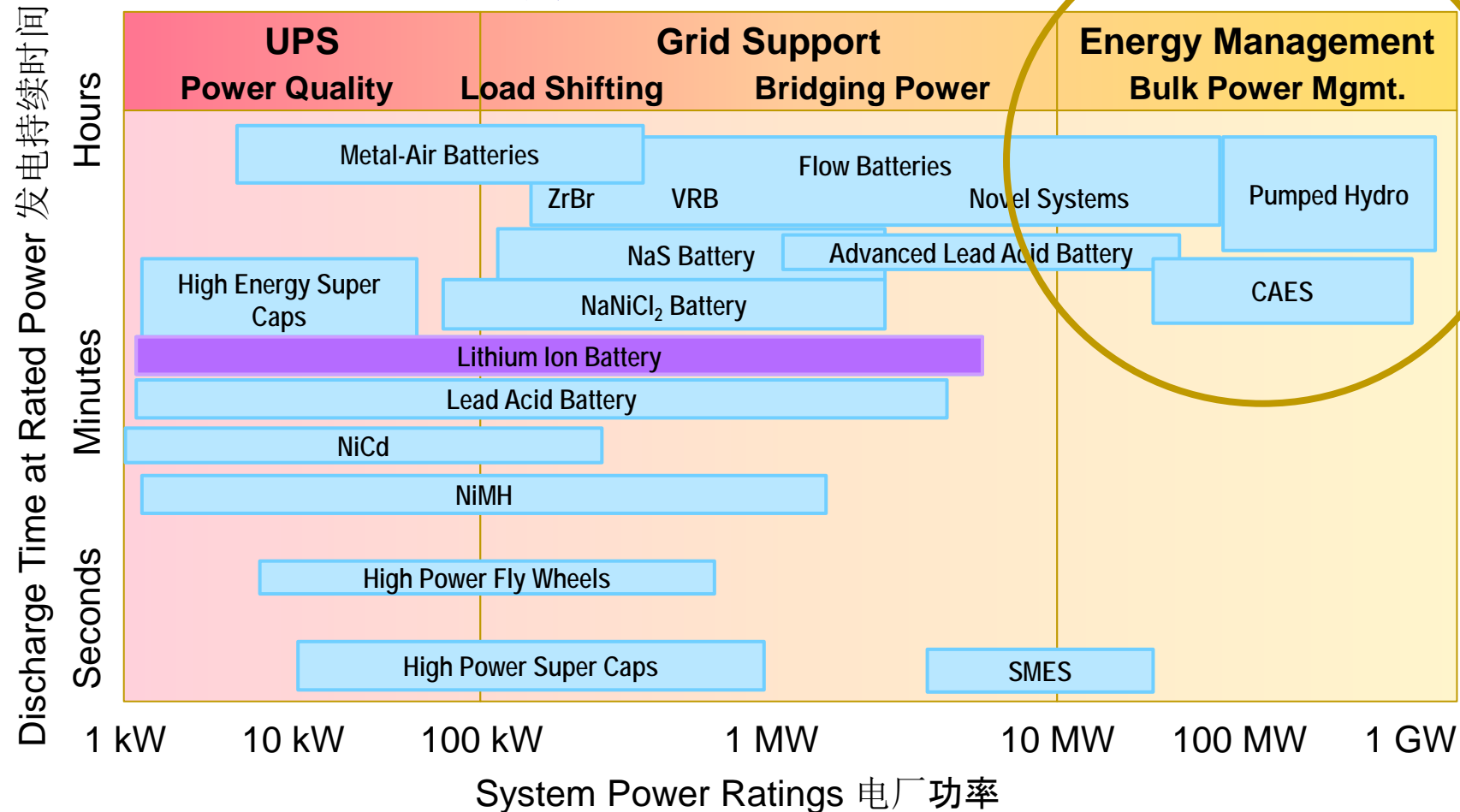
Fossil Power Plants without Energy Storage
没有能源储存的火力发电厂



Fossil Power Plants with Energy Storage
有能源储存的火力发电厂

Energy Storage Options – Power Rating vs Discharge Duration

储能选项 - 电厂功率与发电持续时间的比较



Only Bulk Energy Storage Can Help Avoid or Moderate the Effects of Cycling
 只有大量的能源储存才可以避免或缓和急速温度变化的影响

Conclusions 结论

- The current power generation market is very competitive
 - Lots of low marginal cost and environmentally-friendly options
- To remain competitive, coal power plants must become
 - More fuel efficient
 - More automated
 - Cleaner
 - Lower consumers of water
 - More flexible to operate
- 目前发电市场竞争非常激烈
 - 很多低成本和高环保的选择机会
- 为了保持竞争力，燃煤电厂必须成为
 - 更省煤
 - 更自动化
 - 更乾静
 - 降低用水
 - 更灵活操作



Together...Shaping the Future of Electricity