



Supercritical Water-Cooled Reactor (SCWR) Development through GIF Collaboration

GIF SCWR System Steering Committee

Vienna, Austria

Oct. 29, 2009

Outline

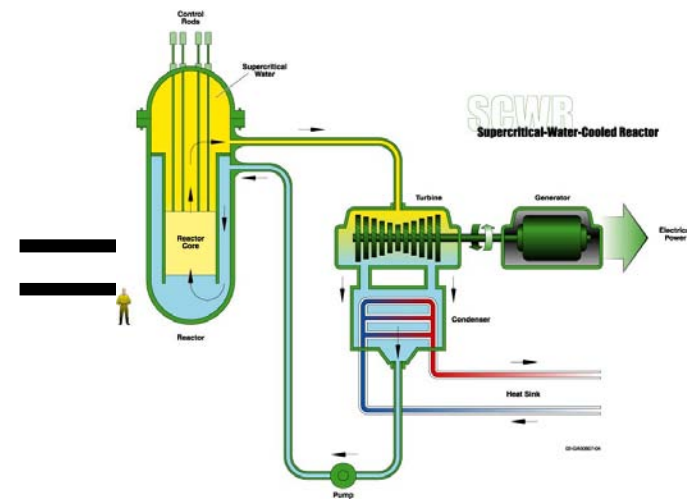
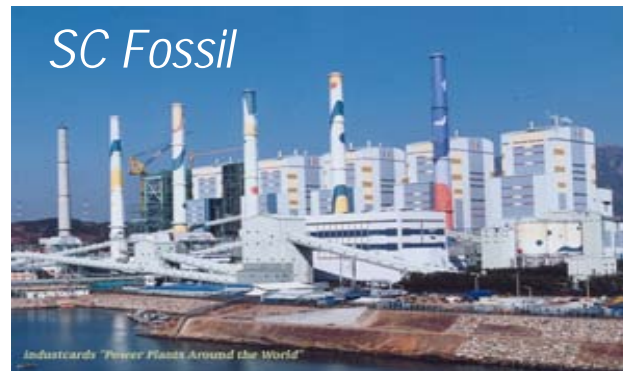
- ***Why SCWR?***
- ***SCWR Reference Parameters***
- ***Conceptual Designs under Consideration***
- ***GIF Collaborative R&D Projects***
- ***Conclusions***

Why SCWR?

- *Merging proven advanced nuclear and fossil technologies*
- *Many utilities operate both nuclear and supercritical fossil plants*

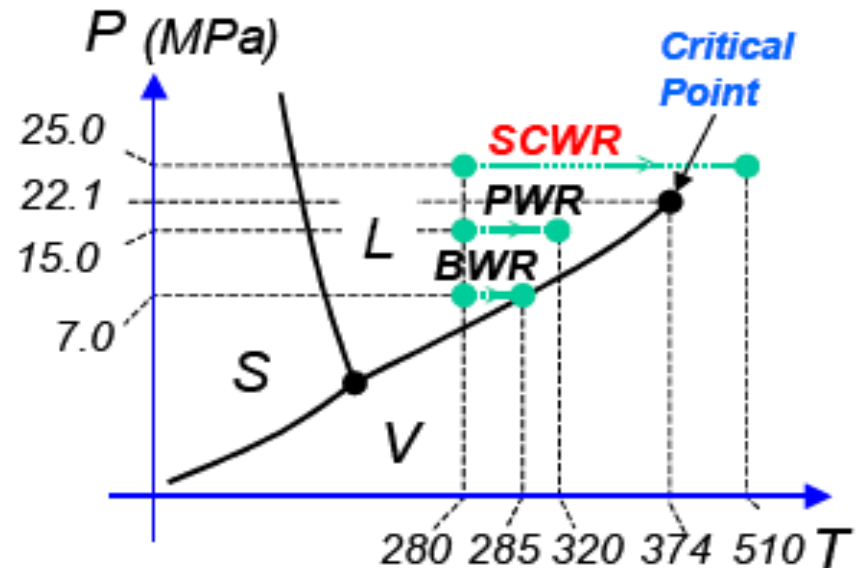


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Supercritical Water-Cooled Reactor

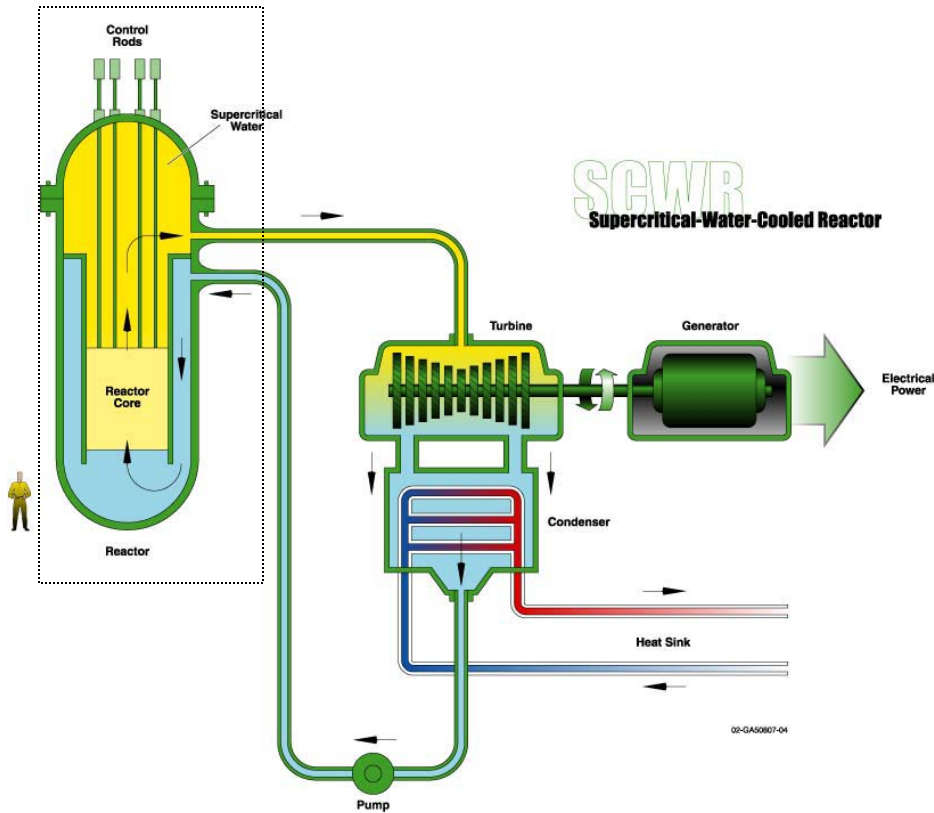
- **Many years of experience in**
 - Advanced water-cooled reactor
 - Supercritical fossil plant development
- **Proven advanced concepts and systems**
 - Advanced passive safety systems
 - Supercritical turbine technology
- **Main challenge**
 - Combine advanced reactor technology with supercritical fossil technology



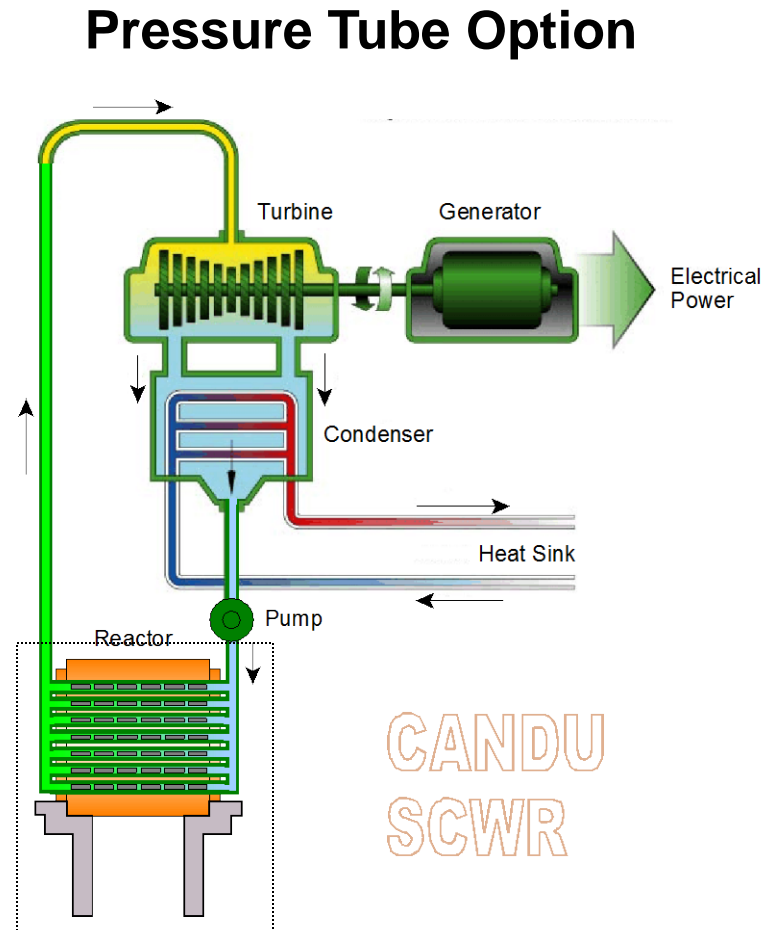
SCWR Features

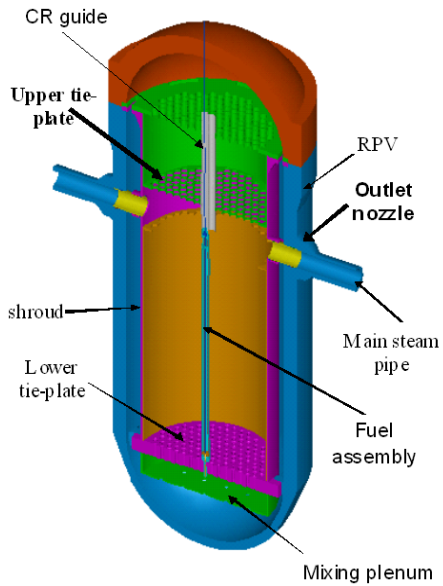
- ***Improved economics***
 - ***Higher thermal efficiency***
 - ***Plant simplification opportunities***
 - » ***Once-through reactor***
 - » ***Direct thermodynamic cycle***
- ***Enhanced safety, sustainability, proliferation resistance and physical protection***
 - ***Design flexibility for fast and thermal spectra***
 - ***Opportunities to utilize conventional or advanced fuel and fuel cycles***
- ***Applications***
 - ***Design for electricity production***
 - ***Hydrogen and heat generation***

Two SCWR Design Options

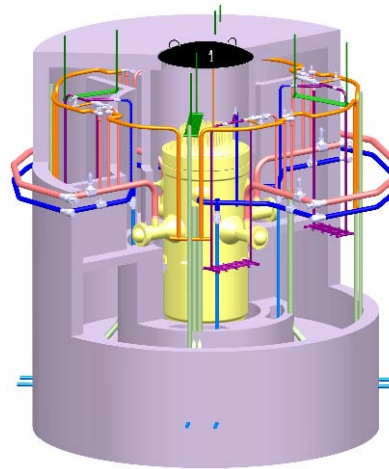


Pressure Vessel Option

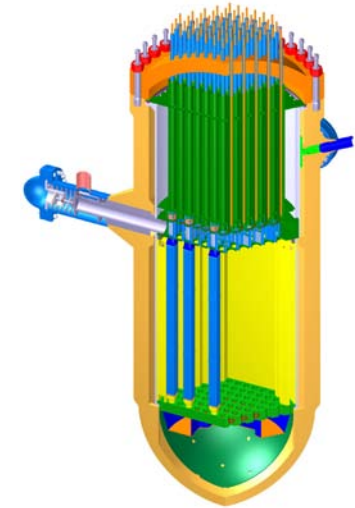




Super Fast Reactor (Japan)

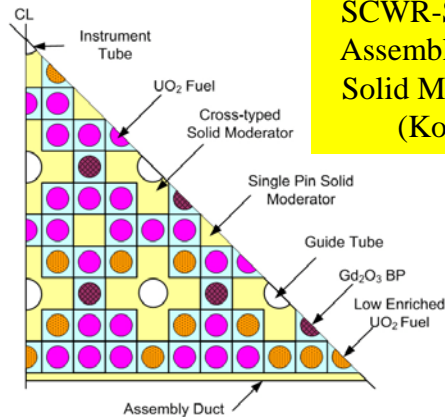


HPLWR (Eu)

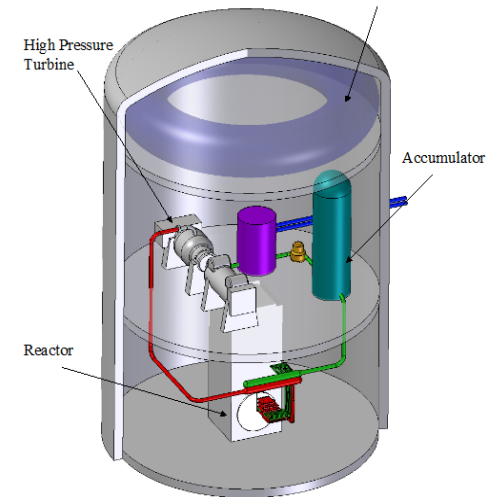


Heat sink

A number of designs are under consideration to provide a spectrum of possibilities for consideration for the next generation of water-cooled reactor technology



SCWR-SM Fuel Assembly with a Solid Moderator (Korea)



CANDU-SCWR (Canada)

GIF Collaborative R&D

- ***GIF SCWR collaborators***

Members

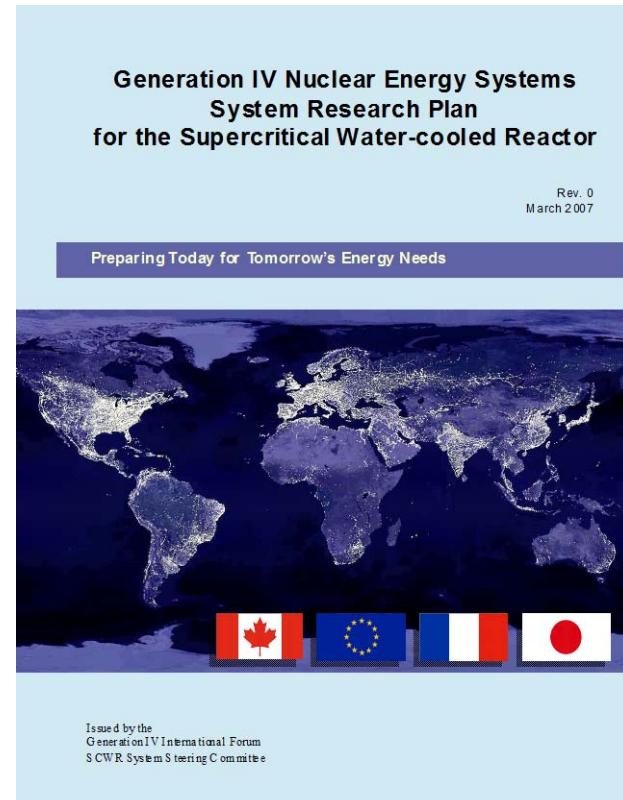
- ***Canada***
- ***Euratom***
- ***Japan***

Observers*

- ***Republic of Korea***
- ***France***

- ***Most of the R&D is common to all designs under consideration***

****China is a recent GIF member whose R&D Institutes are “invited observers”***



GIF Collaborative R&D Project: System Integration and Assessment

- ***Definition of a reference design(s) that meets the GIF Goals:***
 - ***Economics***
 - ***Safety and reliability***
 - ***Proliferation resistance and physical protection***
 - ***Sustainability***
- ***Identification of an achievable outlet temperature based on materials and fuel performance, and linkages to proven steam cycles in supercritical fossil plants***
- ***Design and construct an in-reactor fuel test loop to qualify the reference fuel design.***

GIF Collaborative R&D Project: Thermal-hydraulics and Safety

- ***Establishment of heat transfer and critical flow database for SCWR designs***
- ***Heat transfer tests at prototypical SCWR conditions***
- ***Stability***
- ***Safety system requirements and evaluation***

GIF Collaborative R&D Project: Materials and chemistry

- ***Testing of key materials for in-core and out-core applications***
- ***Selection of key materials for SCWR designs***
- ***Reference chemistry based on materials compatibility and radiolysis behavior***

Other R&D Projects

- ***R&D for specific designs***
 - ***Advanced fuel and fuel cycles***
 - » ***Thorium for the pressure-tube design***
 - » ***Fast core and mixed core options for the pressure vessel design***
 - ***Non-electricity applications (e.g., hydrogen production)***
- ***Projects to build major test facilities to qualify certain aspects of the SCWR (e.g., in-reactor fuel qualification loop)***

Conclusion

- ***The SCWR has a strong foundation in two advanced technologies***
 - ***Advanced Gen-III+ water-cooled reactor technology***
 - ***Advanced supercritical fossil power technology***
- ***Flexibility in design options to address GIF requirements***
- ***Most R&D needs are common to all designs under consideration***
- ***Major collaborative R&D projects are underway to address R&D needs***