Temelín Power Uprate

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Temelín Power Uprate

Temelín ... more efficient and powerful

Uprate of nom. reactor thermal power:
3000 => 3120 MWt (+ 4%)

Electric Power:
1016 => 1056 MWe (*)

+ 40 MWe / unit =
+ 80 MWe total
=> +0.6 TWh/year

(*) exact values are dependent on external conditions

Cheapest and cleanest new power source ...
Project Milestones

- 20.5.2010 – approved Project Intent
- 09.10/2010 – contracts (NRI, TVEL)
- 2010÷12 – analytical part of the uprate project
- Refueling outages 2011/12/13 – implementation of related equipment modifications
- 2012÷13 – personnel training
- 22.4.2013 – nuclear safety regulatory body (SÚJB) permission
- 18.8.2013 – 3120 MWt on unit 2
- 22.9.2013 – 3120 MWt on unit 1
Main Features …

The Temelín Power Uprate project key features:

- No change in:
  - fuel design
  - technological safety system’s design (flow rates, volumes, …)
  - safety analysis acceptance criteria
  - SG secondary pressure

- based on utilization of reserves existing in the current design
  => NO extensive modifications of plant equipment => unique economical parameters

- repeated project (… already implemented on several russian VVER-1000 units prior to Temelín)
**PROJECT SCOPE (2)**

**FUEL & LICENSING**
- Safety Analysis, SAR revision
- Update of methodologies for reload design and reload safety evaluation
- 1st 104% reload design

**NORMAL / ABNORMAL OPERATION**
- Analysis of operational modes (normal, abnormal, accidents), update of operational procedures
- Chemistry, radiation monitoring, ...

**SYSTEMS & EQUIPMENT**
- Strenght, lifetime, EQ evaluations
- Related equipment modifications (incl. new I&C settings)
PROJECT SCOPE

ENVIRONMENTAL IMPACT
- Proof of no significant environmental impact (all limits remain valid)

PERSONNEL TRAINING

STARTUP TESTS
Equipment modifications

Areas of main equipment modifications

I&C
- RPS and LS settings
- Few PCS settings
- Field instrumentation: expansion of span of several sensors
- NAPs / Beacon settings

Technology
- Increase of hydraulic head of condensate pumps

Electric equipment
- Uprate of generator Sn (1111 MVA => 1250 MVA) supported by several adjustments to provide better cooling, new PQ diagram settings (see picture)
- Modification of generator breaker cooling system
- Several protection settings
EQUIPMENT MODIFICATIONS (2)
Startup tests

3 startup stages:  0 => 96% => 98% => 100%

- Standard reactor physics tests, protection system calibrations
- Evaluation of main parameters incl. predictions …
- Tests of electric equipment – parameters, heatup (generator, outputs conduits, unit transformer) …
- Vibrations of main components, other diagnostics tests
- Abnormal process (dynamic) test (cond. pump trip)
STARTUP TESTS (2)

RESULTS … =>>> O.K.
SAFE OPERATION ON UPRATED POWER CONFIRMED

- All safety criteria met
- Small deviations not directly related to uprated power
  - High temperature of encapsulated conduits below generator – inoptimal constructional configuration
  - Elevated temperature of generator retractive plate in operational states with very negative reactive power (underexcited)
  - Inability of completion of valid steam humidity measurement using chemical method (Na concentration) – alternate method employed

Project continues till 2014
=> Evaluation of complete fuel cycle operation on uprated power, evaluation of equipment inspections performed in 2014 refueling outages
Questions, Remarks …

Thanks for attention