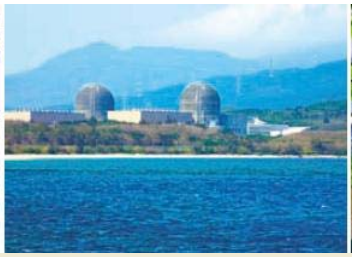




The performance of Taipower's NPPs in 2010

2011 AEC/NRC Technical Meeting

May 3-5 , 2011

Taipower



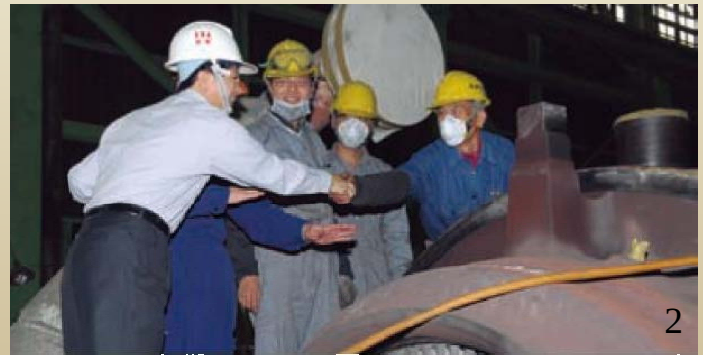
Contents

- Corporate Highlights
- Taiwan Power System
- Nuclear Power Plants in Taiwan
- Nuclear Power Plants Performance
- Contributors to performance Improvement
- Conclusion

Taipower

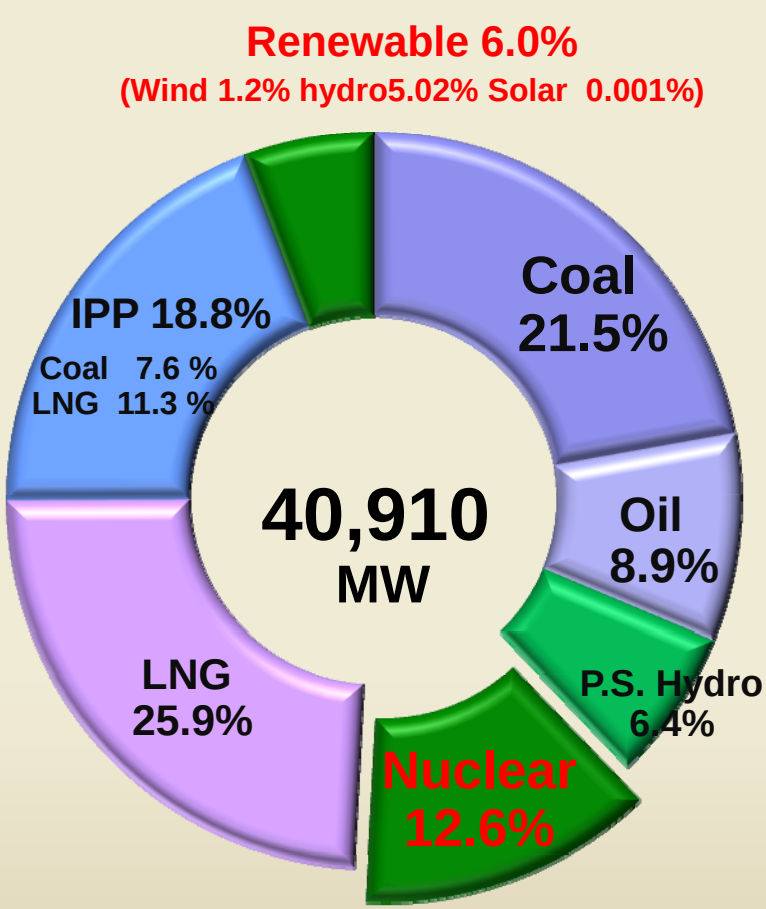
Corporate Highlights

- State-owned Electric Power Company
- The 16th Largest Utility in Installed Capacity in the World
- The Only One Utility Which Distributes Electric Power to Customers in Taiwan
- Total Assets ：US $ 54.5 Billion
- Number of Employees：26,828
- Customers：12.6 Million

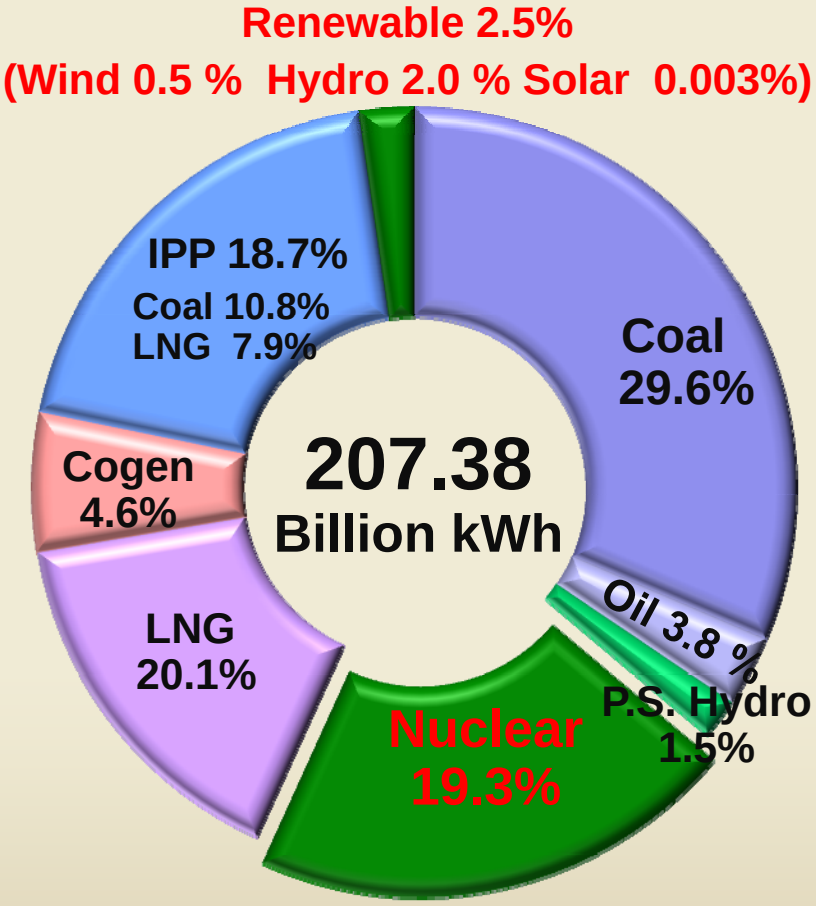


Taipower

Taiwan Power System



Installed Capacity In 2010



Electricity Generation In 2010

Taipower

Nuclear Power Plants in Taiwan

GE BWR-4 636 MWe x 2
Commercial Operation Date :
1 Dec. 1978
2 July 1979

Chinshan

Kuosheng

GE BWR-6 985 MWe x 2
Commercial Operation Date :
1 Dec. 1981
#2 Mar. 1983

Lungmen

GE ABWR 1350 MWe x2
(Under Construction)

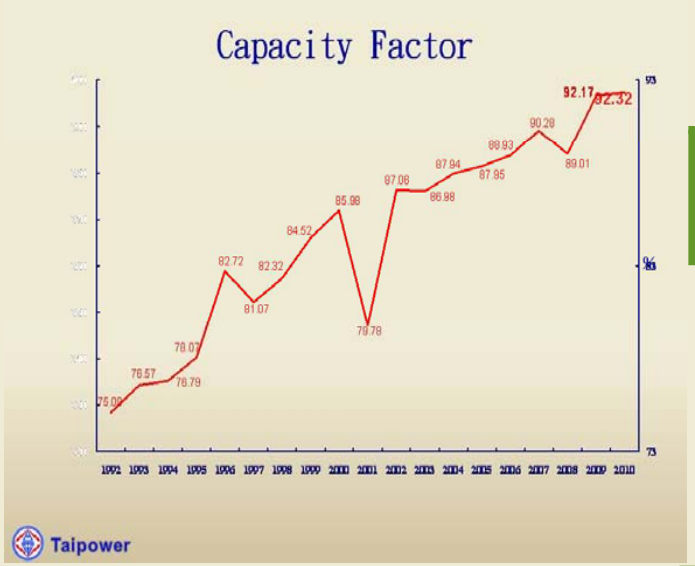
In 2010
Nuclear Installed Capacity
5,144 MW

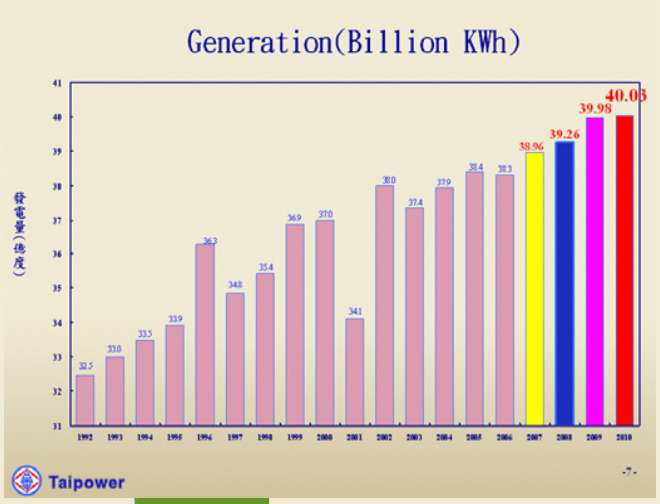
Maanshan

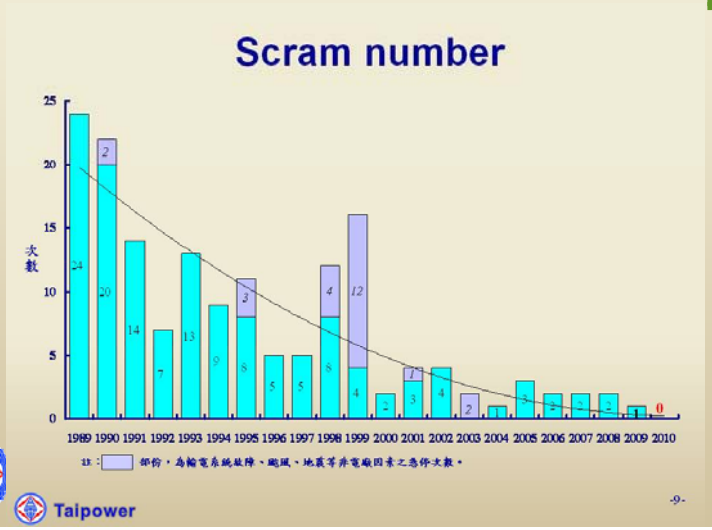
Westinghouse PWR 951 MWe x 2
Commercial Operation Date :
1 July 1984
#2 May 1985

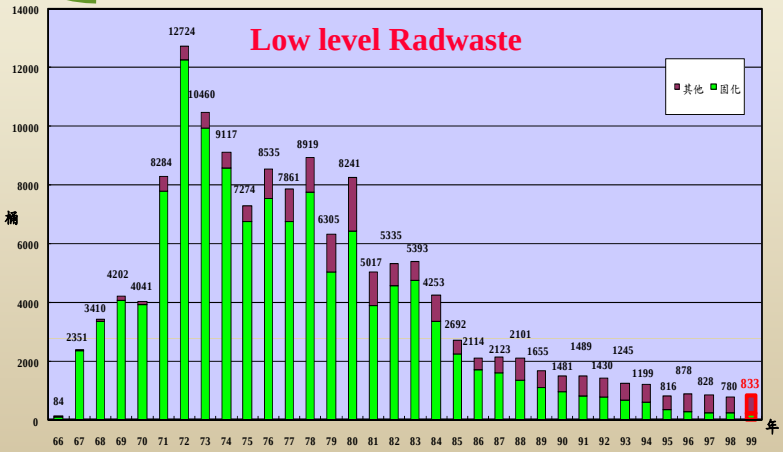
Taipower

Nuclear Performance in 2010









Nuclear Performance in 2010

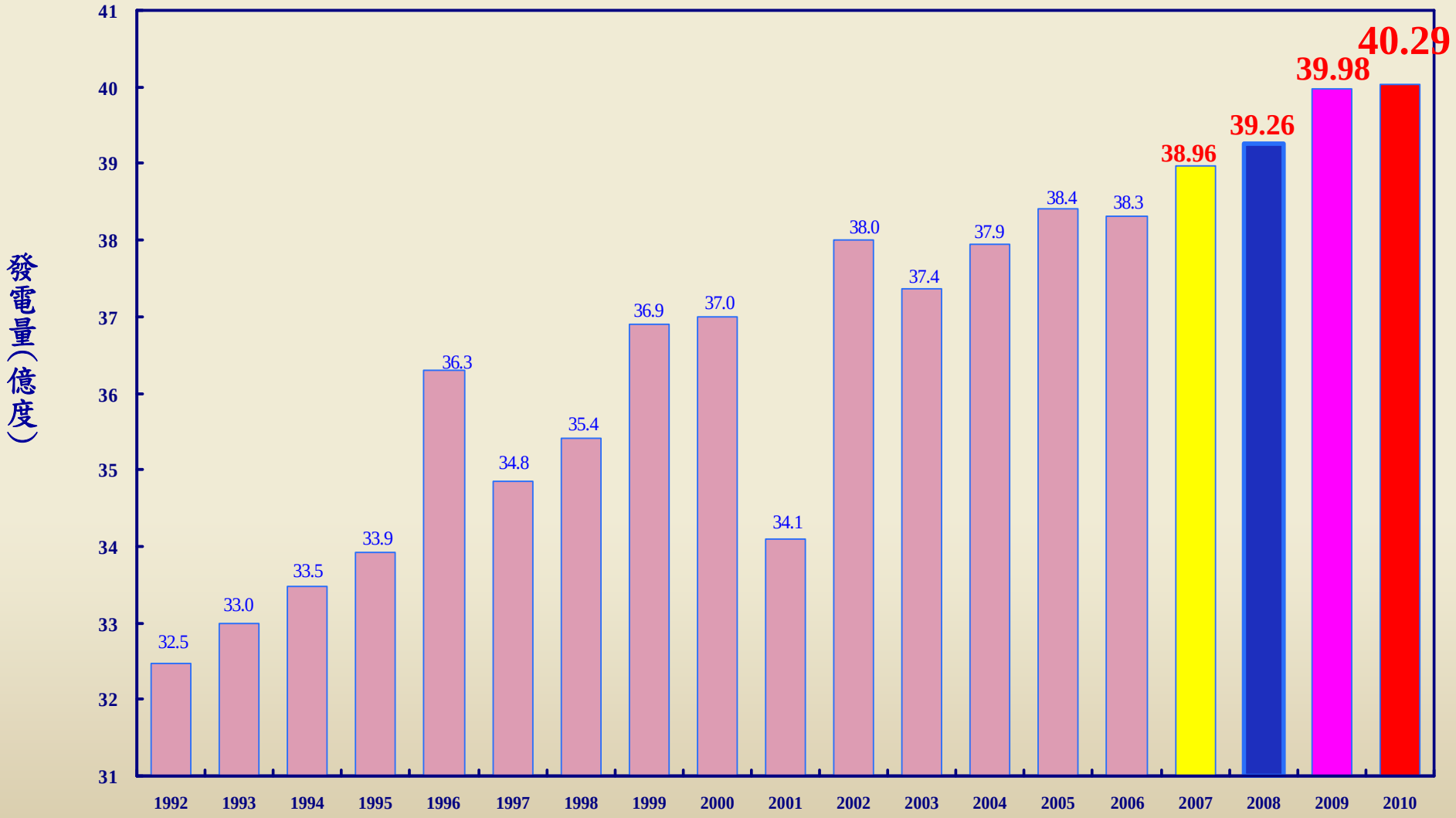
- Generation：40.29 Billion Kwh (The best record)
- Capacity Factor：92.32% (The best record)
- Scram：0 for all 6 units (The best record)
- RER：5 for all 6 units (The best record)

  (CS: 3、KS :2、MS :0)
- Radwaste ：833 Drums
- Continuous operation ： 539 Days(MS1)
- Outage ： 24.48 Days(KS1 EOC-21 Refueling)

  (The best record)

Taipower

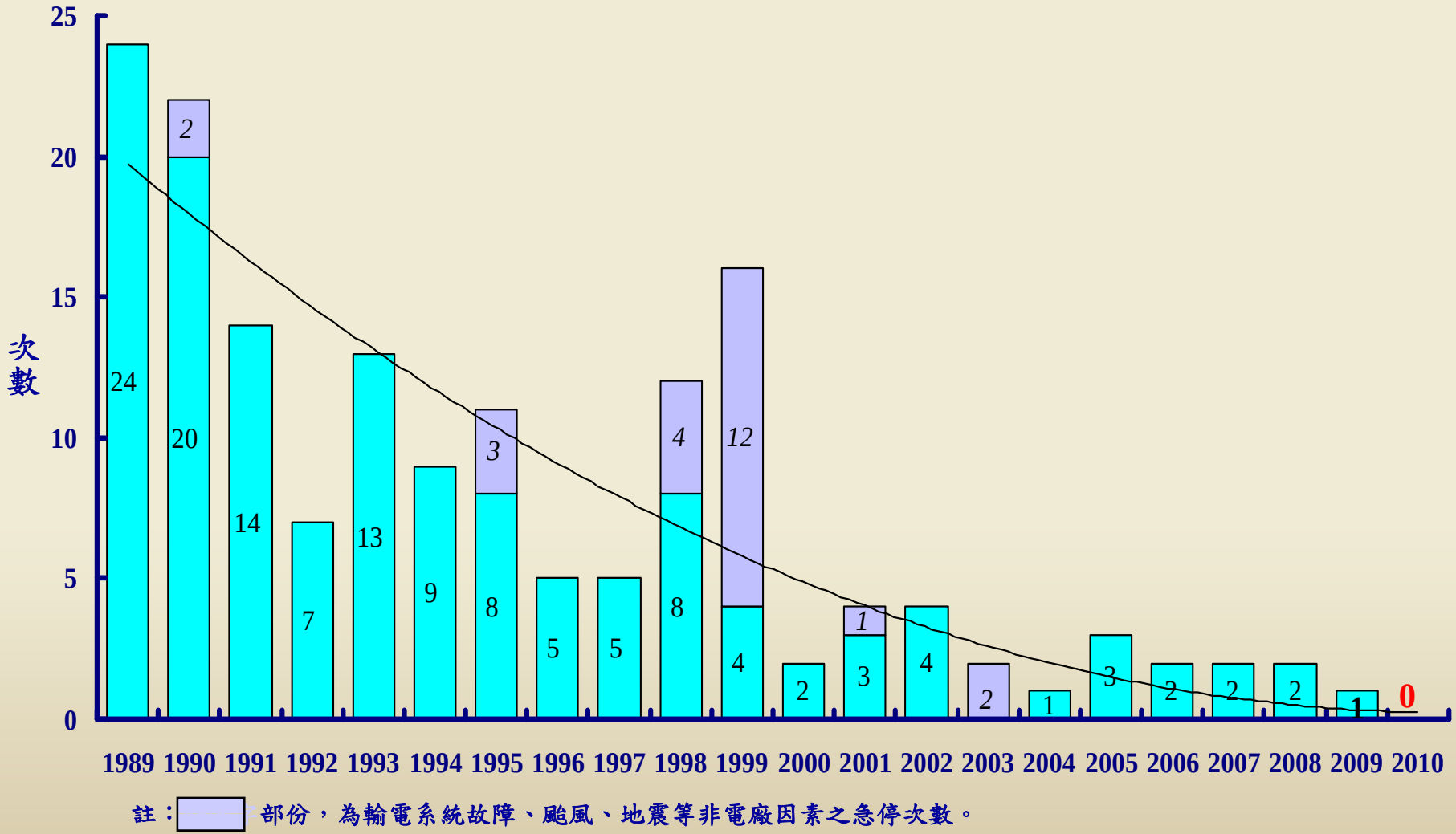
Generation(Billion KWh)



Capacity Factor

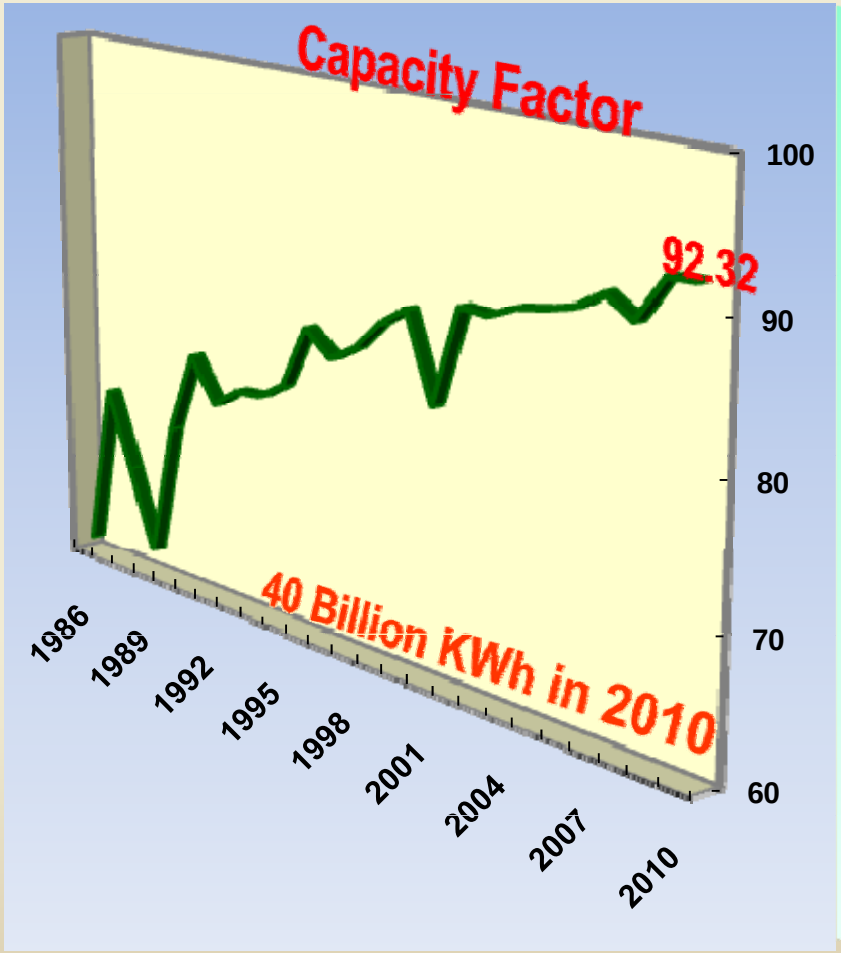
Taipower

Scram number



註：[ ] 部份，為輸電系統故障、颱風、地震等非電廠因素之急停次數。

Key Contributors to performance Improvement



- Improved Equipment Reliability
- Shortened Refueling Outages
- Improvement of Operation Management
- Power Uprate
- Equipment Renovation

Taipower

➢ Contributors to performance Improvement

- ❑ Reduce Forced Shutdown (Improved Equipment Reliability)
- ❑ Shortened Refueling Outages
- ❑ Improvement of Operation Management
- ❑ Implementation of Power Uprate (Measurement Uncertainty Recapture)
- ❑ Equipment renovation

❑ Reduce Forced Shutdown (Improved Equipment Reliability)

■ Maintenance Effectiveness Improvement

- Continuing equipment modification / replacement to achieve higher reliability (Turbine Rotor Replacement, Digital I&C Replacement, etc.…)
- Continuing Training for Maintenance Personnel
- Skill certification Requirement for Contractors
- Experience feed back from Industry (INPO, WANO, EPRI.…)
- Continuing adjustment to PM task and frequency based on industry experience

Human Error Prevention

- A training named “Good Work Practice Training Program” has been developed in recent years to integrate all the human error prevention tools
- The Training Program is conducted with a “Full Loop Simulator” training facility
- The “Full Loop Simulator” training facility consists of pump, valve, piping, tank, instrumentation etc as a close flow loop

Human Error Prevention

- This training applies to both operation and maintenance people
- Training objective

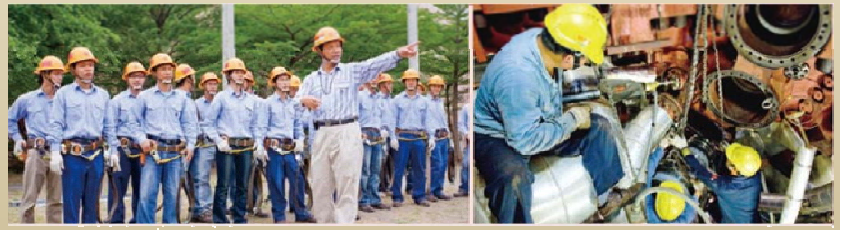
  To practice and familiar with all the human error prevention tools including:

  - Job-Briefing (Tool Box Meeting)
  - Self Check
  - Double Check
  - Foreign Material Exclusion (FME)
  - Procedure Adherence
  - Work Safety

Taipower

Human Error Prevention

- Implementation and Results
  - This training has been included in annual maintenance & operation training program. In addition, a contest is held every year
  - Human error events both in operation and maintenance has been reduced in recent years



Taipower

Full Loop Simulator Facility

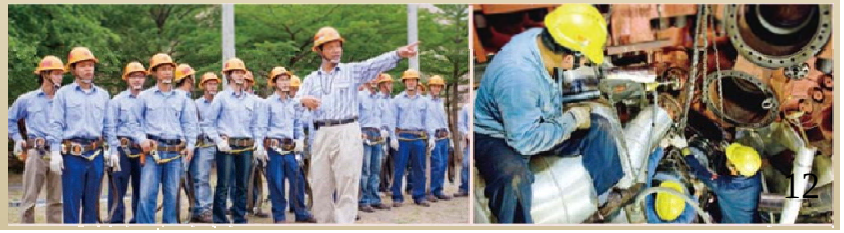
- KS Station Training Facility

- MS Station Training

- Good Practice Campaign

Shorten Outage Duration

- Upper management involvement, guidance, support
- Adequacy of pre-outage planning and preparation
- Lessons learned program
  - ✧Sharing industry experience
  - ✧Outage schedule gap analysis
- Equipment / tool Innovation
  - ✧360° work platform on cavity
  - ✧Refueling bridge upgrade to increase fuel shuffle speed



Taipower

Shorten Outage Duration

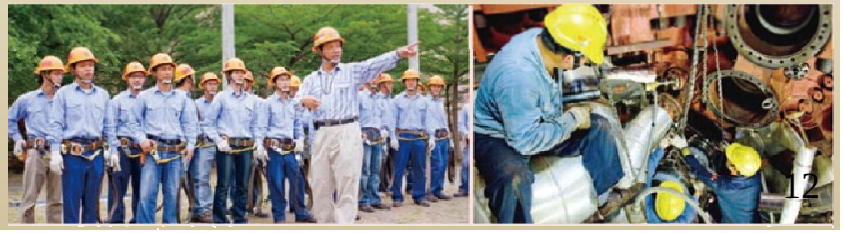
360 degree Platform on Refueling Cavity of KS Unit 1 & 2 (2009 / 2010)

- Multiple tasks can be performed at same time

Taipower

Shorten Outage Duration

- On-Line maintenance to reduce outage workload Such as EDG overhaul has been moved to on-line maintenance, will expand the scope based on Maintenance Rule Implementation



Taipower



❑ Improvement of Operation Management

- Prevent reactor trip or power reduction caused by single failure
- Reinforce Nuclear Safety Culture
- Surveillance performed at scheduled reduced power to avoid unnecessary power reduction




❑ Implementation of Power Uprate

- Measurement Uncertainty Recapture：
  - Chinshan unit 1,2 (2009/2008, Total 11.34 MWe)
  - Kuosheng unit 1,2 (2007, Total 20 MWe)
  - Maanshan unit 1,2 (2009/2008 , Total 24.3 MWe)




❑ Equipment Innovation

- Low pressure turbine rotor replacement of K.S Unit 1 (2007, 34 MWe↑) Unit 2 (2011, ≈ 30 MWe↑)
- High pressure turbine rotor replacement of Maanshan Unit 1 & 2 (2012/2011, 10/10 MWe↑)




Conclusion

- Good performance is the results of year after year accumulation efforts of dedicated teamwork
- It is clear that the safe operation of nuclear power plant is of utmost importance to the continued success and growth of nuclear electric industry.


Taipower


Thanks for Your Attention
Welcome to Taiwan