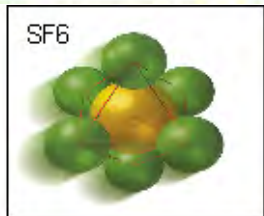


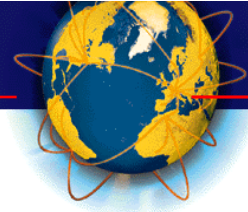
IEEE

## Gas Insulated Substation Experience Feedback

Compiled by Venkatesh Minisandram

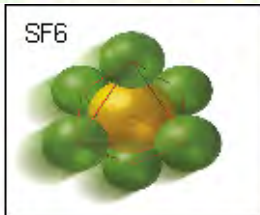
October 1, 2010

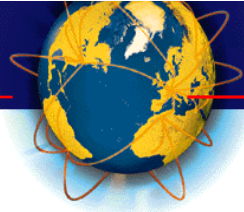




## GIS Population

- No of respondents- 15
- Total number of GIS-112 (Range 1 to 40)
- Outdoor GIS /Indoor GIS Split- 24 /88
- First GIS Installation
  - Prior to 1980 – 4
  - 1980 to 1990- 6
  - 1990 onwards-5
- Number of breaker bays- About 1000



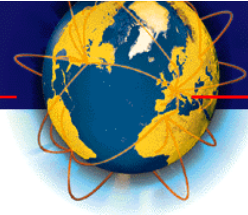


## Why GIS ?

● What factors resulted in the use of GIS over AIS (air insulated substation)?:

- Space constraints at site -11
- High GIS reliability -7
- Total life cycle cost benefit-4
- One to one replacement of existing GIS -3
- Environmental (pollution, areas near sea, adverse weather) -3
- Aesthetics due to site location-3
- Safety -1
- Other-0

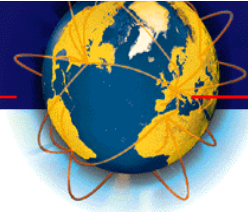




## Project Execution

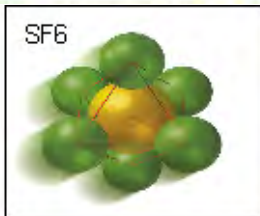
- How did you execute the GIS Project?
  - Turnkey (Engineer, Procure & Construct) Contractor -7
  - Seller responsible for GIS delivery and Purchaser unload, install, test & commission under manufacturer's supervision-7
  - Turnkey except Civil Works by Purchaser -3
  - Other -0

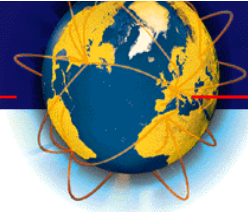




## Warranty

- What warranty period do you specify for the GIS?
  - 5 years -7
  - 1 to 2 years -6
  - > 5 years -1
  - 3 to 4 years-0

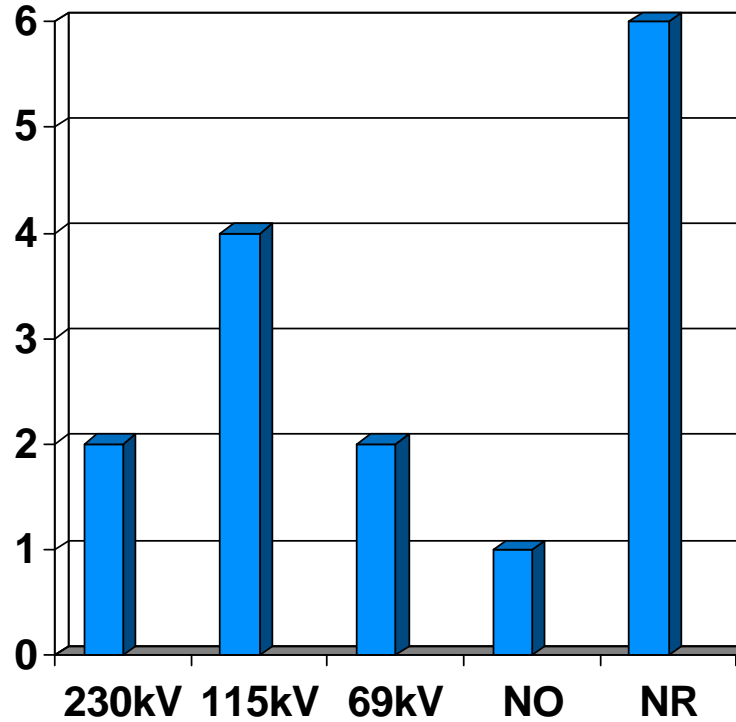


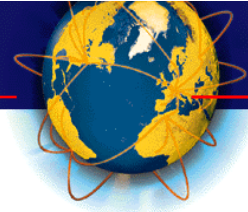


### 3 in 1 GIS

- Do you specify or accept three phase (3 in 1) GIS enclosures and if so, at what voltage levels?

Note: NR= No response



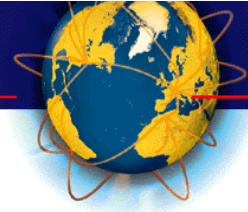


## Independent Pole Tripping for Circuit Breakers

Do you specify or foresee the need for independent pole tripping for circuit breakers? If so, at what voltage levels (check all that apply);

- 69kV -0
- 115kV -2
- 230kV -6
- 345kV-3
- 500 kV -2
- No Response-7





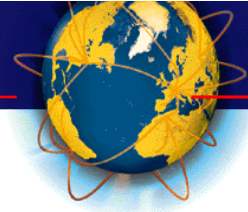
## CB Operating Mechanism

- What is the preferred circuit breaker operating mechanism in order of priority (rank 1 through 4, with 1 being “most” preferred and 4 being “least” preferred; quantity in parenthesis below indicate # of respondents):

- Spring-Spring- 1(14)
- Hydraulic with spring storage- 2(8)
- Air pneumatic-3
- Hydraulic with gas accumulator-4
- No preference-0





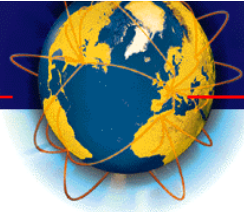


## Factory Testing- GIS Assembly

● Extent of GIS assembly specified by the purchaser for factory testing:

- Left to GIS manufacturer's practice-6
- One full breaker bay (breaker, associated disconnect & grounding switches)-6
- Entire GIS assembly-1
- Shipping unit-0
- No Response- 2

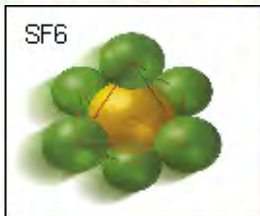


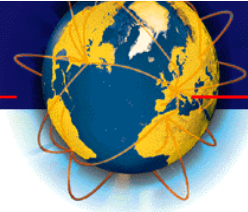


## GIS Project Implementation

GIS project implementation feedback (check all that apply):

- **No major issues, satisfactory outcome -10**
- **Coordination/communication deficiencies between GIS factory and GIS installer at site-7**
- **Factory acceptance testing failure-1**
- **Improper Local Control Cabinet design-1**
- Delayed GIS shipment
- Missing components/misalignments at site
- Site acceptance testing failure
- Lack of clean work area during GIS installation

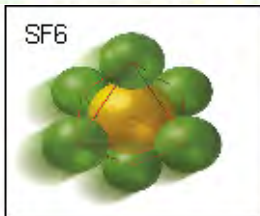


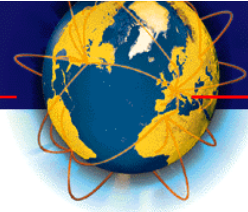


## Documentation

- User's satisfaction with the drawings and IOM (installation, operation & maintenance) manuals provided by the GIS manufacturer:

- Very good-2
- Good -9
- Fair-2
- Poor-1
- Scope for improvement (detail)
  - Proper translation to English
  - Interface details for future expansion

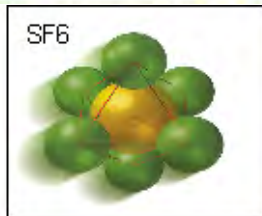


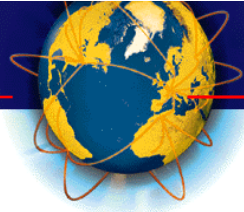


## GIS Maintenance

Who undertakes GIS maintenance?:

- Purchaser's personnel -13
- Long term maintenance contract with the GIS manufacturer -1
- GIS manufacturer-0
- Contractor (other than GIS manufacturer)-0

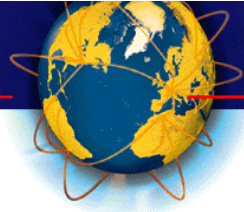




## SF6 leak monitor in Indoor GIS building

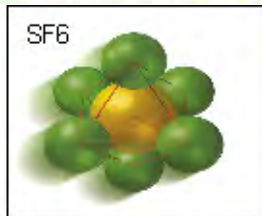
- For indoor GIS, what measures are taken to monitor SF6 gas leak into the building and warn operating personnel ?
  - Reliance on GIS gas compartment SF6 low pressure alarming-12
  - SF6 gas detectors installed in the building-3
  - Use of ventilation system switched automatically when there is excessive loss of gas pressure (2nd stage gas pressure low condition)-2
  - Oxygen detectors installed in the building to ensure safe oxygen levels-1

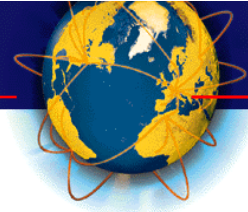




## O&M Issues with GIS in-service since 1/1/1991

- Reliance on manufacturer for maintenance is expensive
- Difficulty & delay in obtaining replacement parts
- Difficulty to reach the right contact at manufacturer's end
- Gas leaks (due to items overlooked during installation by the vendor)
- Rupture disk failure
- Motor operator failure
- Water leaking into outdoor gas pressure gauges
- Failure of auxiliary relays in LCC
- SF6 gas pressure/temperature transducer drifts & need for taking specific gas zone out of service for replacement
- Difficulty to read SF6 gas pressure gauges
- Constricted space for O&M





## Issues to be addressed

1. What issues would you like the GIS manufacturers to address from the user's perspective/concerns?:
  - Thorough testing of field installed joints for gas leaks
  - If outdoors, RTV on all seals & hardware
  - Manufacturer's recommendation for grounding system design at site
  - Interlock scheme testing before in-service placement
  - Adequate space to permit O&M
  - Accessibility of view ports
  - Bigger size view ports or camera with good display visibility outdoors
  - Smaller gas compartments-gas handling perspective /minimize SF6 release
  - SF6 & PD monitoring system
  - On-line gas quality monitoring system
  - Clear and detailed installation, operation & maintenance manuals
  - Interface details for future expansion
  - Weather proof density monitors/gauges suitable for outdoors
  - Integrated bay control & protection system offerings
  - Other comments:
    - Purchaser to witness installation to facilitate future maintenance
    - Schedule factory visit before contract award if no previous experience with the supplier

