Water Mist Systems for Power Infrastructure Protection

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Water Mist for Power Infrastructure

Motivation for Water Mist Protection

- Refurbishment or extension of power infrastructure in growing mega cities
- Up to date fire protection measures required for the power grid
- Water mist is an established solution for cable tunnels and transformer sub-stations protection since 20 years
- Systems tested and certified based on international standards as prEN 14972 with approvals e.g. from VdS
- Reduction of down-times in case of fire

Water Mist for Power Infrastructure

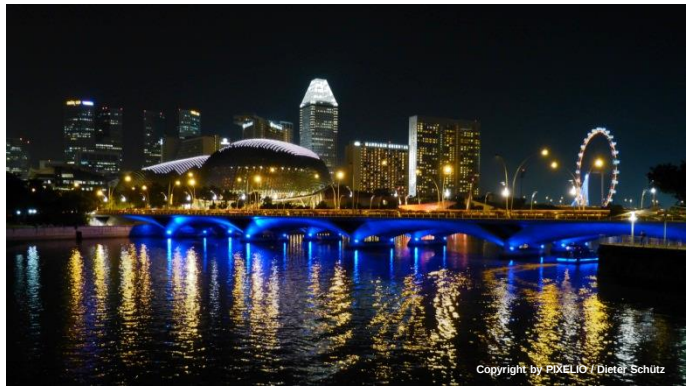
Cable Tunnel Case Study

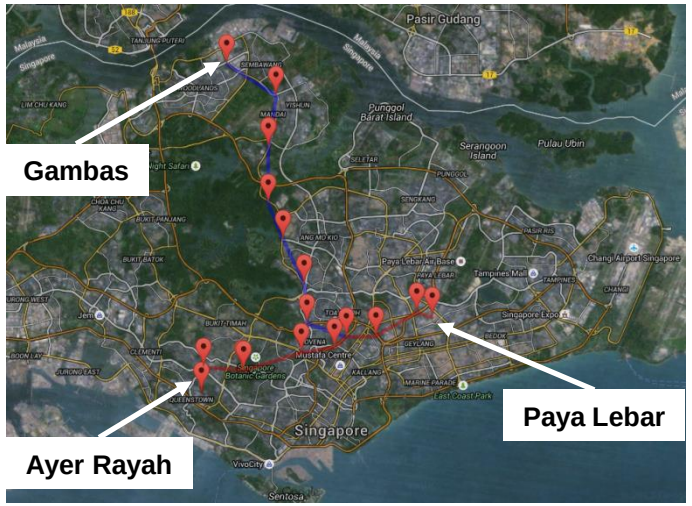
at Singapore Power

Transformer Sub-Station Case Study

at DEWA in Dubai

Cable Tunnel Case Study





Singapore Power Cable Tunnels

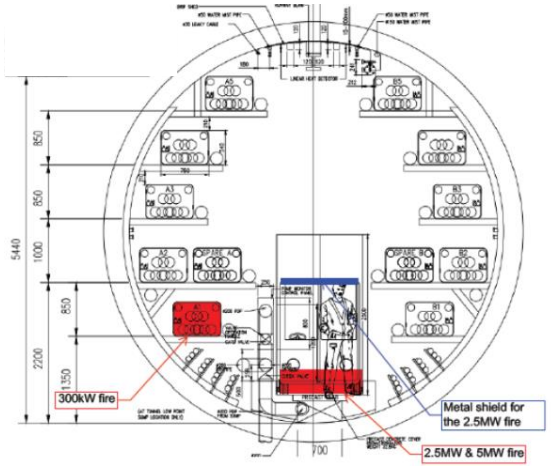
- Singapore Power (SP) ensuring power to 1,3 million industrial, commercial and residential customers via their power grid network
- SP investment of 1,25 billion USD to build a 35 km long high voltage power transmission cable tunnel located 60 m under the surface to cope with the increasing power demand
- Construction of two intersecting tunnels, 14 utility buildings and associated access shafts
- North-South tunnel with a length of 18,5 km intersecting with the east-west tunnel of 16,5 km length

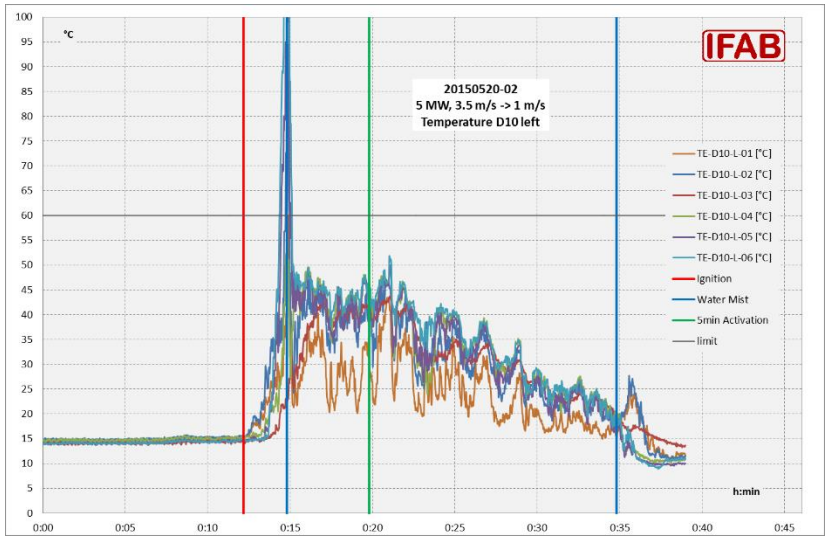
Cable Tunnel Case Study

The Challenge

- First part of the project completed in 2005 with a 1,7 km long cable tunnel with a diameter of 3,5 m connecting the power station on the north of Singapore to the tunnel
- High pressure water mist system selected as most suitable fire fighting system for the first part of tunnel based on existing system certification
- Water mist installation to be adopted to the new 35 km long high-voltage power transmission cable tunnels
- A cable tunnel cross-section of 6 m diameter and even up to 9 m diameter at the shaft areas represented a challenge

Cable Tunnel Case Study





The Solution

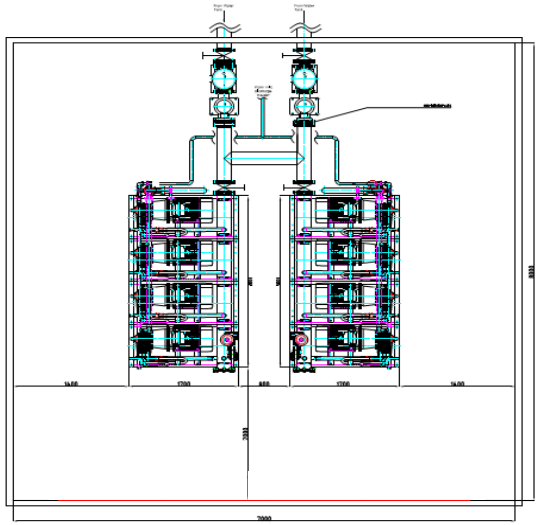
- Fire protection concept developed in close co-operation with the end client and the fire consultant
- Power cables routed in cable troughs, thus assessment of the fire risk to connection points between the cable troughs and to the service vehicle running trough the cable tunnels
- Longitudinal ventilation conditions up to 5 m/s in the cable tunnels
- The water mist system full scale fire tested in conjunction with the ventilation and the fire detection system
- Full scale fire tests up to 5 MW conducted in a 60 m long mock-up with 6 m diameter

Cable Tunnel Case Study

Protection Concept

- Deluge system along 35 km of cable tunnel with open nozzles based on full scale fire test results (25.700 nozzles)
- Cable tunnels zoned into fire fighting sections of 33 m length, equipped with a section valve (1.100 section valves) being activated by the fire alarm system
- Fire detection by linear optical heat detection
- Activation of 3 adjacent fire fighting sections in case of fire
- Cable supplies in the equipment buildings at the tunnel access shafts also protected by water mist

Cable Tunnel Case Study



Protection Concept

- Small bore stainless steel pipework installed at the cable tunnel ceiling to avoid interference with service vehicle
- High degree of pipework pre-fabrication (75.000 m of stainless steel pipes)
- Jockey pump to prefill main pipe from pump unit to decentralized section valves, assuring shortest delays between system activation and water mist discharge
- High pressure water supply via 6 pump stations located in the equipment buildings at the tunnel shafts with each 10+1 x 98 l/min (140 bar) pump units with additional 100% redundancy
- Water mist system supplied by fresh water from 35 m^3 tanks at each pump station assuring 30 minutes autonomy

Transformer Case Study

DEWA Transformer Sub-Stations

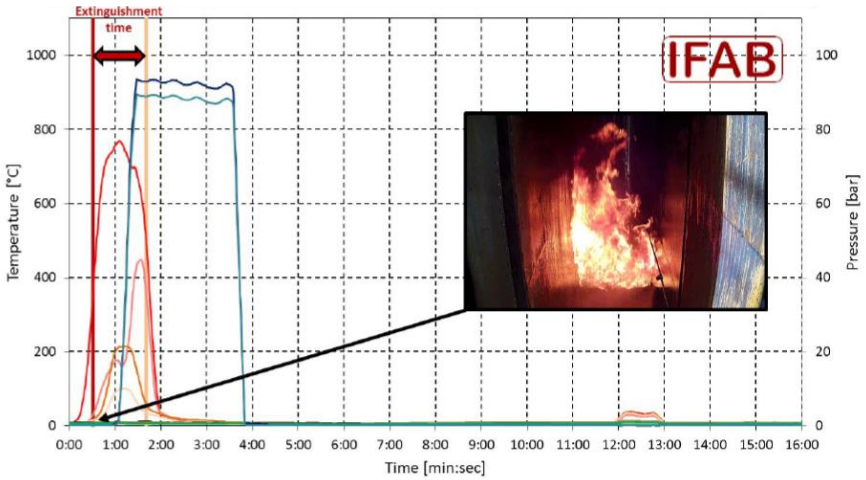
- Dubai Electricity & Water Authority (DEWA) ensures power supply to 670.000 customers with around 10 MW
- DEWA extends its power network with additional transformer sub-stations, due to increased power demand
- Further improvement of availability and efficiency of the electric supply to reduce power transmission and distribution network losses
- Water mist technology identified by DEWA as most suited to protect the new large scale transformers in their sub-stations

Transformer Case Study

The Challenge

- Transformers with overall sizes of up to 5,7 m by 8,4 m and 5,4 m height located in enclosures with more than 60% front wall and roof opening
- Enclosure size 10,5 m x 8,0 m with 7,5 m height
- Expected ventilation conditions within the enclosures of up to 4 m/s
- System to be tested and certified by a certification body accredited by Dubai Civil Defense
- System acceptance based on VdS and TÜV certification
- First part of the project includes protection of 42 transformers in 6 sub-stations

Transformer Case Study



The Solution

- Full scale fire tests with a representative mock-up
- Water mist system performance evaluated in full scale fire tests following the requirements of NFPA 750 and prEN 14972 standards
- Test mock-up of 10,5 m x 8,0 m with 7,5 m height with open top and more than 60% front opening
- Pool and flowing fire tests with fire sizes of up to 10 MW at forced ventilation of 4 m/s

Transformer Case Study

Protection Concept

- Grit soil underneath transformers to limit transformer oil spread in case of leakage
- Deluge local protection system surrounding the transformers with open nozzles based on full scale fire test results
- Transformers equipped with flame detectors for identification of fires at the fire alarm panel
- Each transformer equipped with a section valve being opened by a thermally activated glass bulb via a hydraulic sensor line or by the signal of the fire alarm panel via a push button
- Safety concept foresees activation of one transformer in case of fire

Transformer Case Study

Protection Concept

- Small bore stainless steel pipework installed at the perimeters of the transformer walls minimizing interference with service and maintenance
- Jockey pump prefilling main pipe from pump unit to decentralized section valves assuring shortest delays between system activation and water mist discharge
- High pressure water supply via 6 pump stations located in the sub-station sprinkler pump rooms with 4 x 120 l/min (120 bar) pump units with 100% diesel unit redundancy
- Water mist system supplied by fresh water from tanks at each pump station / 15 m^3 water requirement for 30 minutes system autonomy

Conclusion

- High pressure water mist offers a proven and certified fire protection solution to ventilated large scale cable tunnels and transformer sub-stations in power infrastructure projects

- Due to its physical properties water mist is providing effective and safe fire protection to assure business continuity to power network operators and businesses depending on energy supply

Thank You for Your Attention