CIGRE US National Committee

2013 Grid of the Future Symposium

Technology Readiness for the Smart Grid

Presented by

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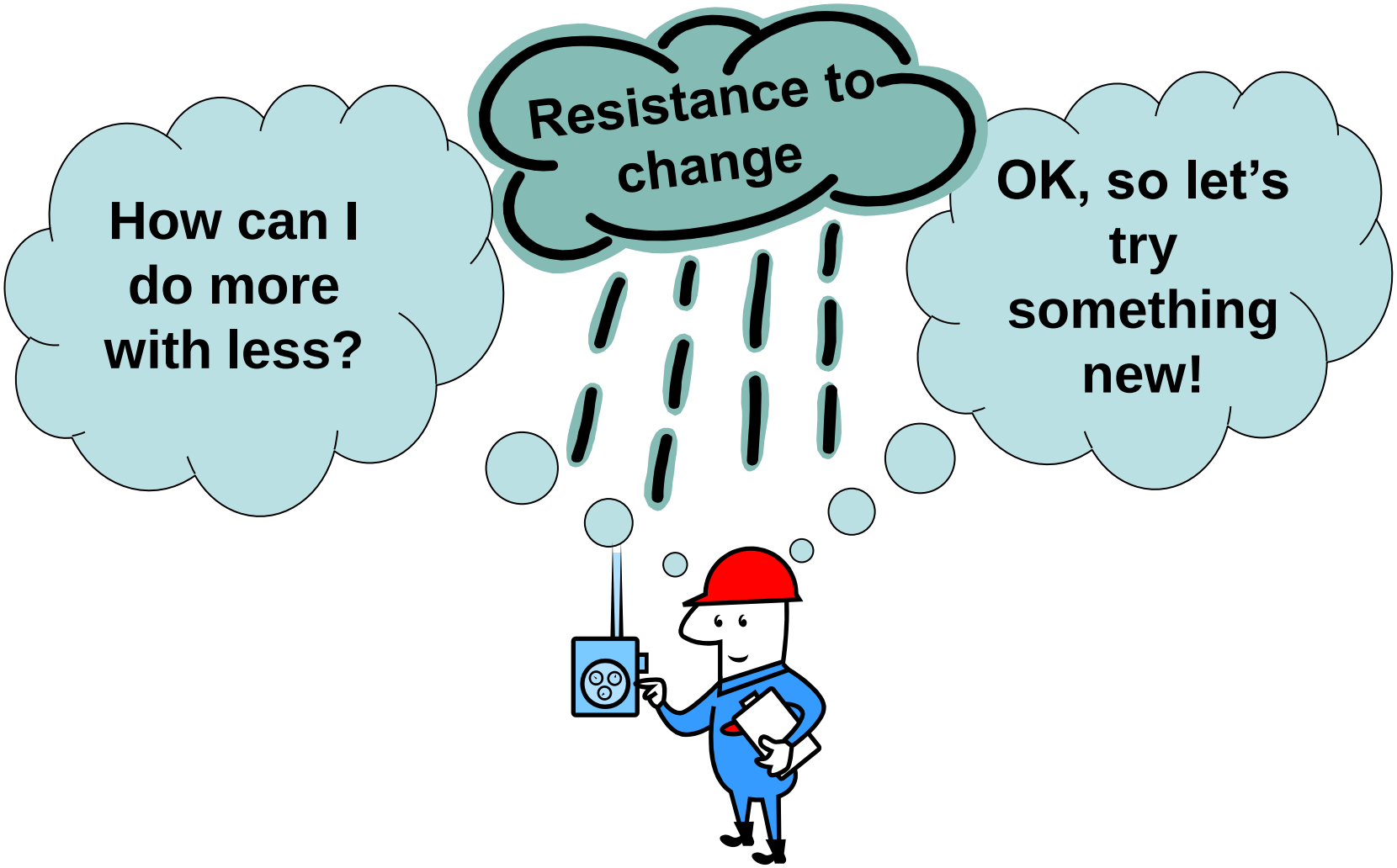
Outline

- What is Technology Readiness?
- Why the original NASA model does not work for power
- A version for power
- SGL 5 through 9 discussion
- Concluding remarks

WHY INNOVATE?



Review of some “new technology” on the power system

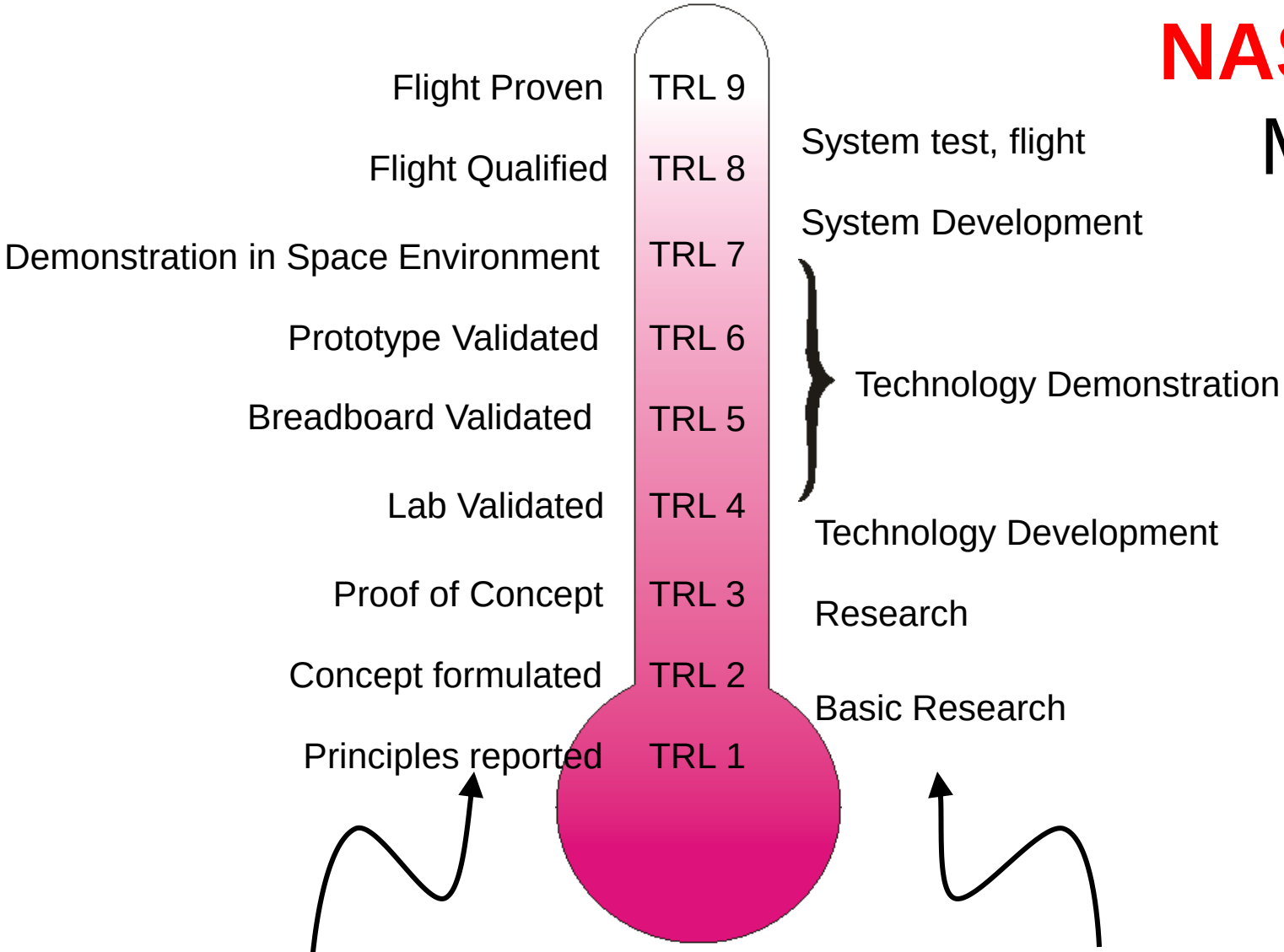
- Transistor circuits: reliable -- late 1960s
- Transistor equivalents of electromechanical relays
- Not a happy experience
- Many failures
- Failures caused by electromagnetic compatibility problems
- Transistors were susceptible to line transients

How do we overcome?

A logical methodology to evaluate when a new technology is ready for the Smart Grid

NASA Technology Readiness Levels (TRL) ?

NASA TRL Model



This side is a status statement. It summarizes how far the system has got

This side is process description. It shows how you would get from one level to the next

NASA TRL process

TRL method: three purposes:

- estimating development cost
- recording progress
- check-listing project outputs

Work *expands* as you move up the scale (team gets bigger!)

Useful attributes for NASA

But it does not work for the smart grid

NASA TRL scheme not well suited for power grid

Combination not appropriate for smart grid, because:

- estimating development times …….manufacturer problem
- estimating costs……...manufacturer problem
- recording & verifying progress…….....developer problem
- Check-Listing……...only thing that matters to utility/customer

What is needed is something to convince the ultimate user

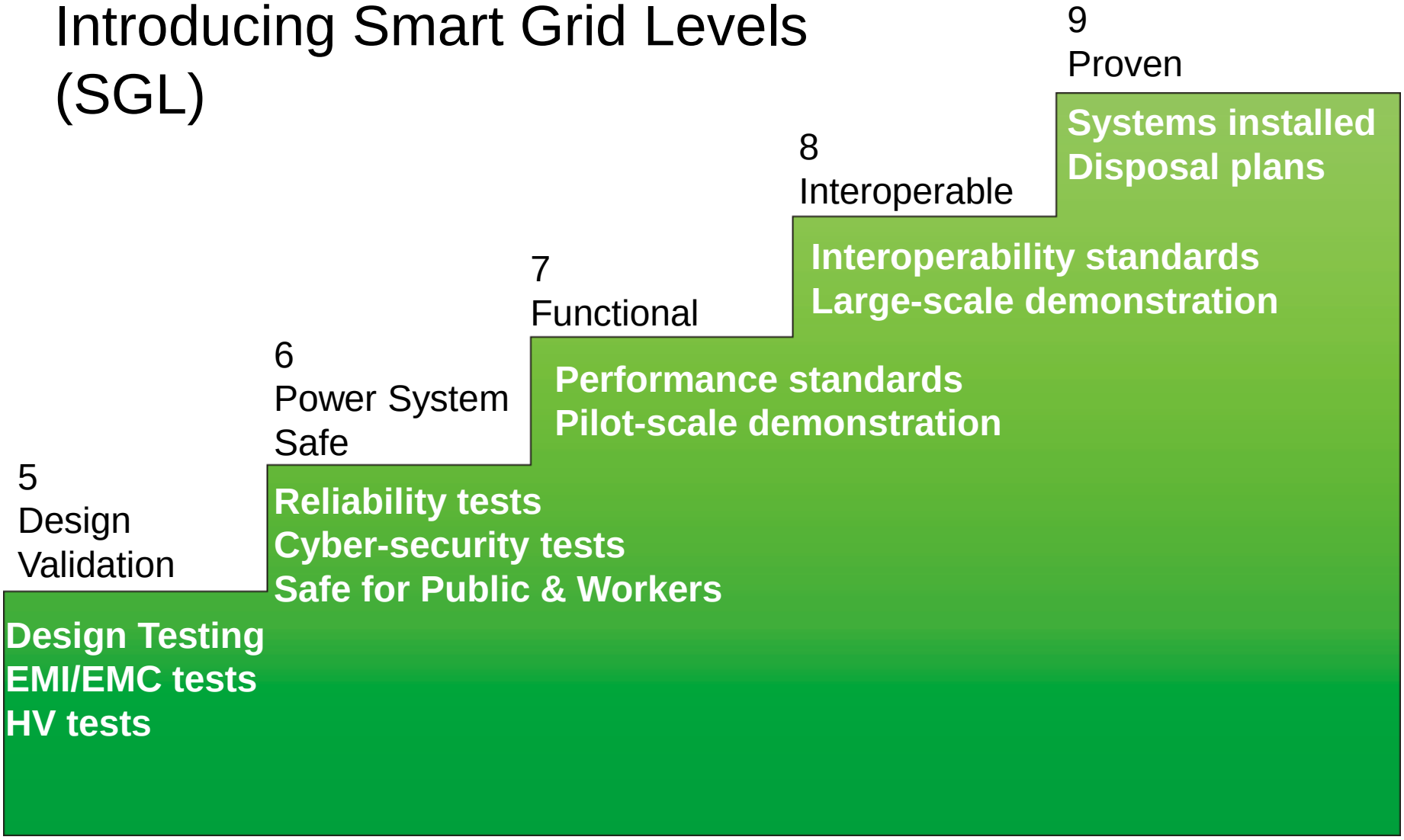
Mission Assurance

Maintenance needs drive design

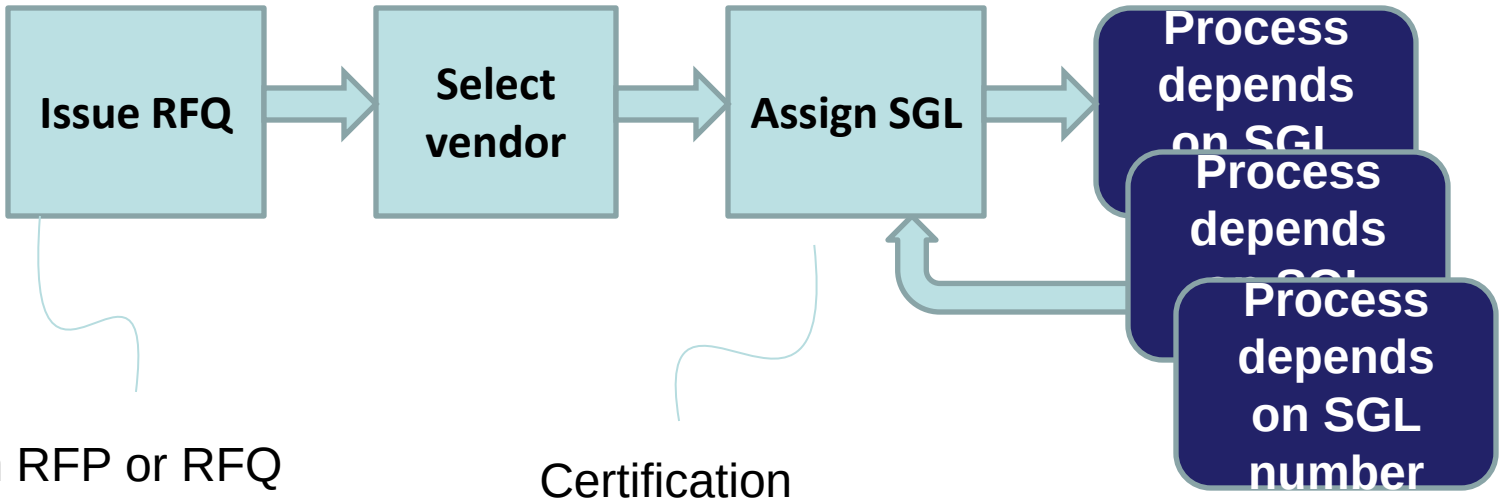
When maintenance is difficult & expensive, it's worth spending considerable time & energy to insure a long life, that's MA

Mission Assurance is principle behind the SGL numbers

Introducing Smart Grid Levels (SGL)



SGL scheme from Utility point-of-view



In RFP or RFQ specify standards

Certification done by?

Laboratory tests
Pilot test
Small-scale deployment
Full-scale installation

Smart Grid Levels

SGL 1-4: Manufacture's R&D effort

- Design tests complete

SGL 5: Design Validation

- Reliability testing
- Demonstrate hardware & software works
- Safe for people

SGL 6: Power System Safe

- Demonstrate pilot project in real world
- Works properly with external systems
- Respects security requirements

SGL 7: Functional

- Scalable – large pilot works
- Meets interoperability standards

SGL 8: Interoperable

There can be no technical objection to full scale deployment

- Going beyond what goes into an RFP
- Continued software development
- Warranty and maintenance
- Disposal plans for end of life

SGL 9: Proven Product

Documented along the way

Conclusion

Requirement for each SGL can be realistically tailored for each type of product.

Complying with a full set of requirements is not relevant at all points in the program.

New systems are only allowed if they are safe for the power system (SGL 6).

Functional (SGL 7) requires a real world pilot.

Interoperability, large scale demonstrations, disposal plans are required for Proven Products (SGL 9).

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