Safety of Smart Meters

U.S. - Africa Rural Electrification and Smart Metering Standards Workshop

Ken Boyce, senior director, principal engineering, UL
January 18, 2021

Empowering Trust®

1

Smart Meters: benefits

Remote meter reading can occur through wireless communications.

Increased sophistication of the metering architecture is achieved.

More data on usage, real-time information is made available.

Demand-based pricing is enabled.

2

Smart Meter safety research

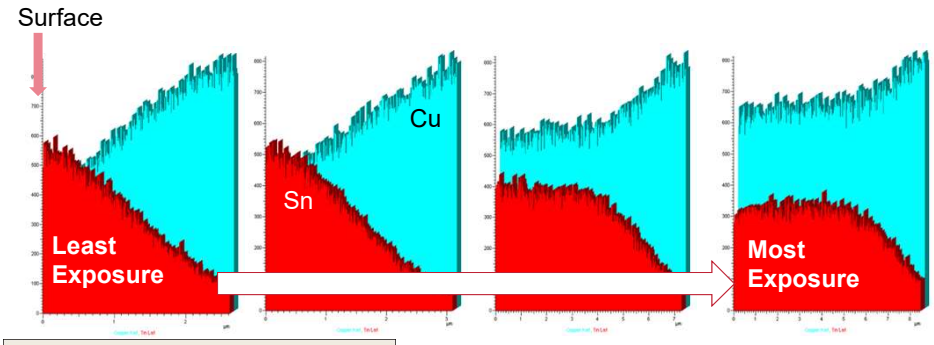
Based on fire incidents in the Americas, UL conducted safety research on smart meters.

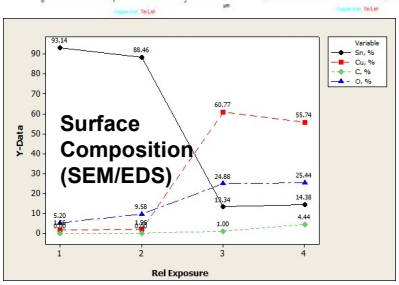
Meter fires have been linked to hot sockets.

Smart meter fires likely due to damage during installation and possibly change from metals/glass to plastic bases.

3

Heating effects on meter socket contacts





Confirmed physical changes in contacts

- What is the mechanism causing mechanical weakening?
- How does it relate to temperature/time exposure?
- Relationships of mechanical, electrical, and physical behavior.

4

Research conclusions

- Thermal aging will cause intermetallic diffusion, with rate dependent on temperature and duration.
- Mechanical strength of contacts increases, then decreases as diffusion progresses; only drops again when diffusion approaches steady-state.
- Contact resistance begins to increase only after diffusion steady-state is reached.
- Thermal aging alone is not expected to cause hot sockets on reasonable (<120 year) time scales.
- Thermal aging may contribute to hot socket formation, but only after contact is already heated due to another mechanism.
- Damage is irreversible and cumulative; contacts should be replaced once exposed to high temperatures (especially >150°C).

5

Smart Meter standards

UL's research and collaboration with industry drove the development of UL 2735, the Standard for Electric Utility Meters.

UL 2735 complements the performance requirements for meters in NEMA C12 and the IEC 62056 series, and safety requirements of IEC 62052.

Radioed wireless smart meters need to be assessed for compliance to applicable electromagnetic interference requirements.

6

Submetering

Submetering enables amore sophisticated understanding of distributed energy resource (DER) operations and load demands.

Demands for load such as EV charging can be precisely understood and addressed.

It is critical to manage electromagnetic compatibility, especially if wireless submeters are placed in proximity to protective devices e.g., within panelboards.

7

Other key safety standard developments relative to rural electrification

Energy storage is critical for enabling grid development and modernization, supporting renewables and clean energy technology, and empowering countries expanding their energy infrastructure.

UL 9540, the Standard for Energy Storage Systems and Equipment; UL 9540A, the Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, and NFPA 855 have been developed to support safety of the energy storage infrastructure and contain additional safety measures beyond IEC 62933.

8

Safely repurposing EV batteries

UL 1974, the Standard for Safety Evaluation for Repurposing Batteries, addresses methods to determine safety and performance of repurposed batteries, modules, and cells from used EV batteries.

UL 1974 is unique as it covers a range of processes and battery chemistries using inherently nondestructive assessments but supports confidence in the safety of the battery in its second life.

UL is working with Hyundai Motors under a Memorandum of Understanding to address bilateral efforts to advance safe assessments and use of repurposed batteries.

9

Microgrid safety

Requirements in UL 3001, Standard for Safety for Distributed Energy Generation and Storage Systems address safety of microgrids in all modes of operation.

Considerations include grid compatibility, safe islanding, suitable combinations of safe technologies, power quality and similar considerations.

These requirements also address nanogrids, single site energy systems, and the like.

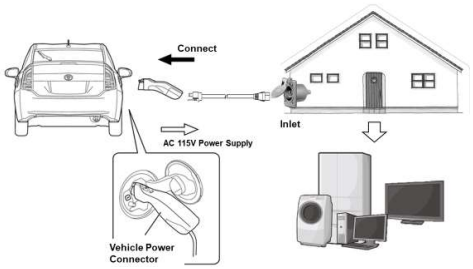
10

Vehicle power export (V2X)

Convergence of the automotive fleet and electrical infrastructure continues to occur with V2X technologies.

This allows an EV to become a dispatchable energy storage system when needed.

UL 9741, Electric Vehicle Power Export Equipment (EVPE), contains requirements for safety of EV Power Export Equipment.



11

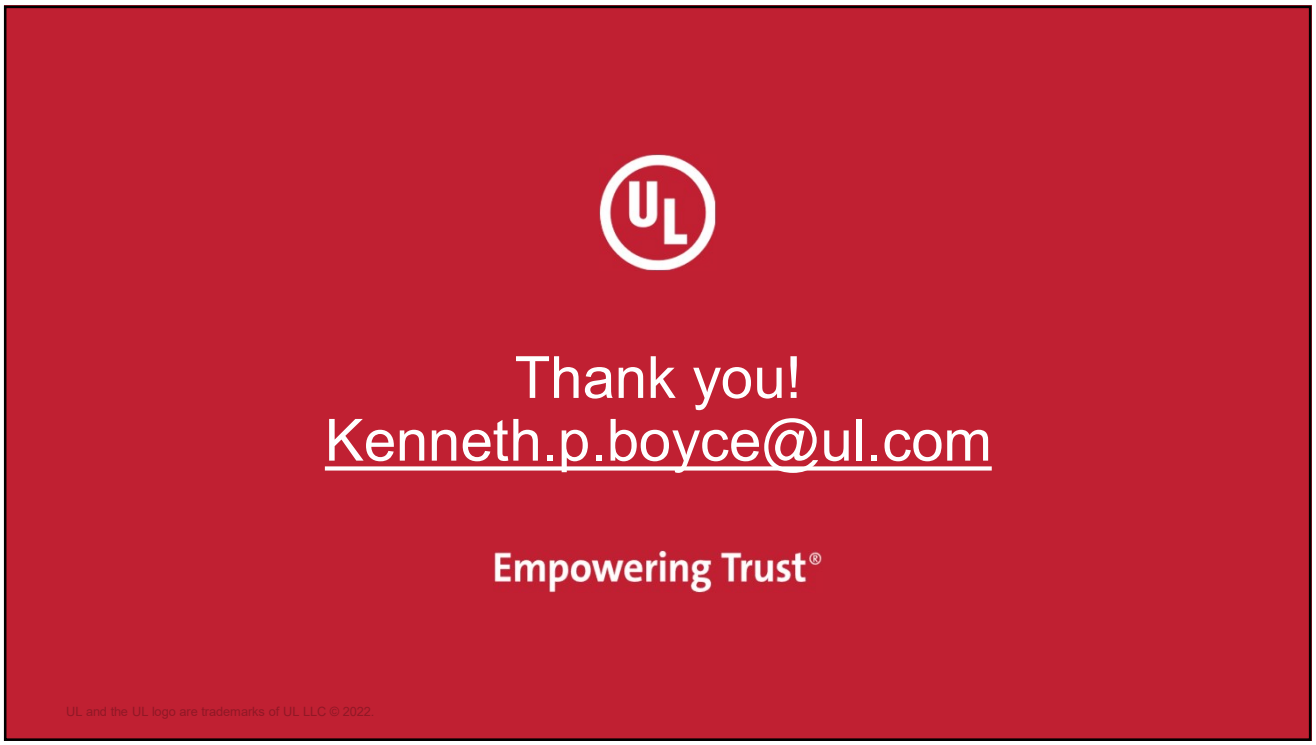
Conclusion

Renewable energy, sustainable storage and clean electrification solutions are opening up new options for safe rural electrification and will all play a critical role for the future of our planet and its people.

As we collectively move to a decarbonized energy future state, renewable energy will be critical for sustainable and just solutions that will be essential for humanity.

Safety standards support rapid and sustainable deployment of these energy technologies and will be essential to sustained success.

12


Thank you!
Kenneth.p.boyce@ul.com
Empowering Trust®
UL and the UL logo are trademarks of UL LLC © 2022.

13