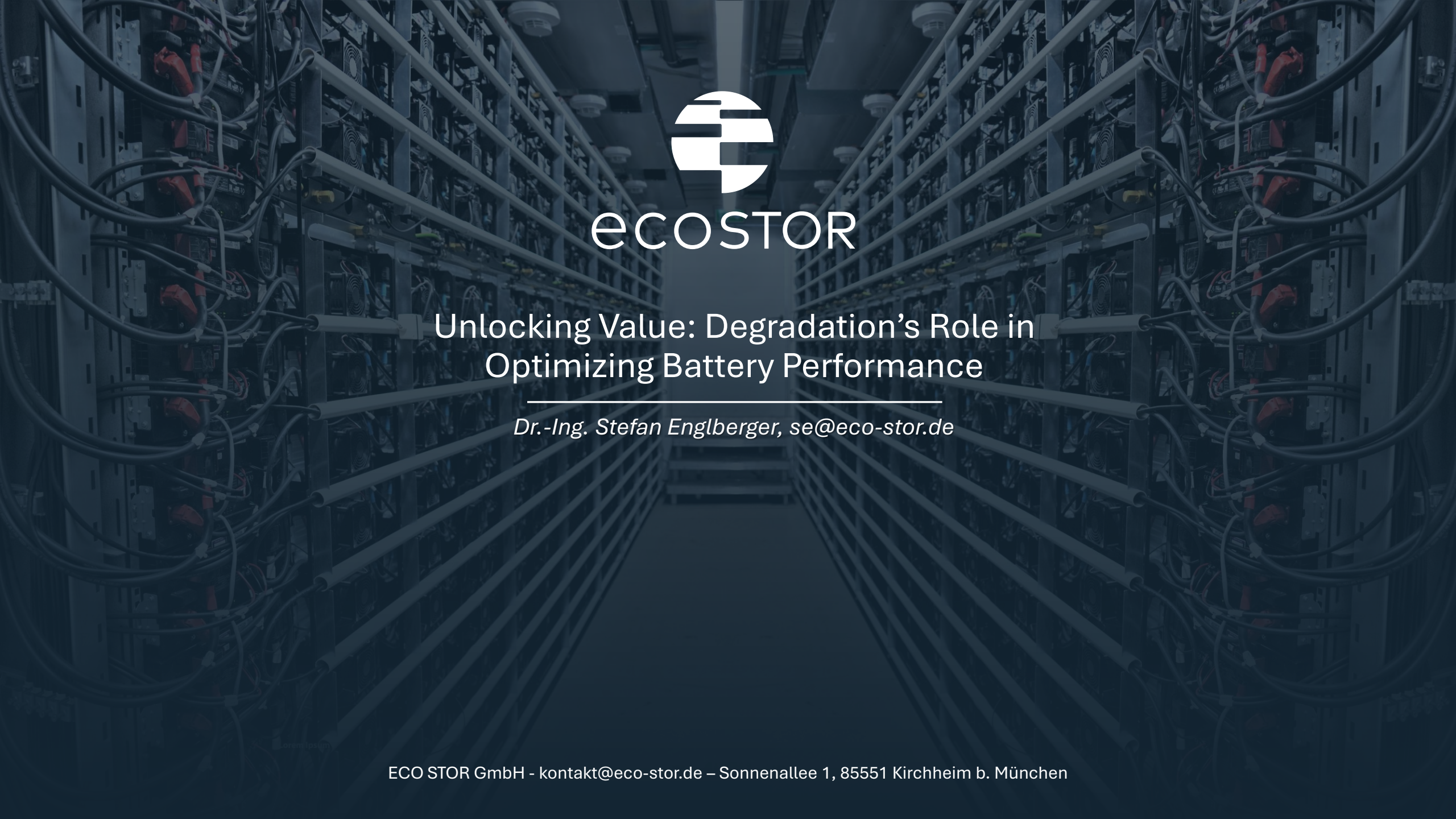

Unlocking Value: Degradation’s Role in Optimizing Battery Performance

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Topics

1. **Degradation is a key profitability driver**: Ignoring degradation erodes profits.

2. **Optimizing degradation enhances warranty terms and IRR**: Optimized investment period, better performance.

3. **Future technologies will improve degradation management**: Smart software solutions and ongoing hardware improvements are game-changers.

About ECO STOR



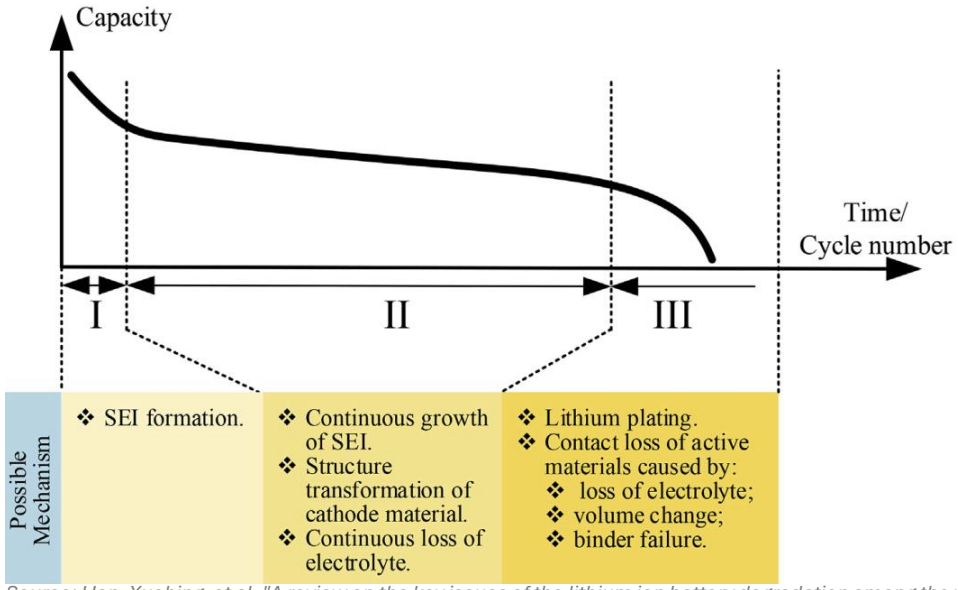

- Founded in 2021
- 60+ experts in battery technology and energy markets
- Strong financial support by Å Energi, NIC, X-Elio

- Home market Germany:
  - 100 MW in operation
  - Additional 800+ MW RTB by end-2024
  - COD of first 100 MW project in Q2'25

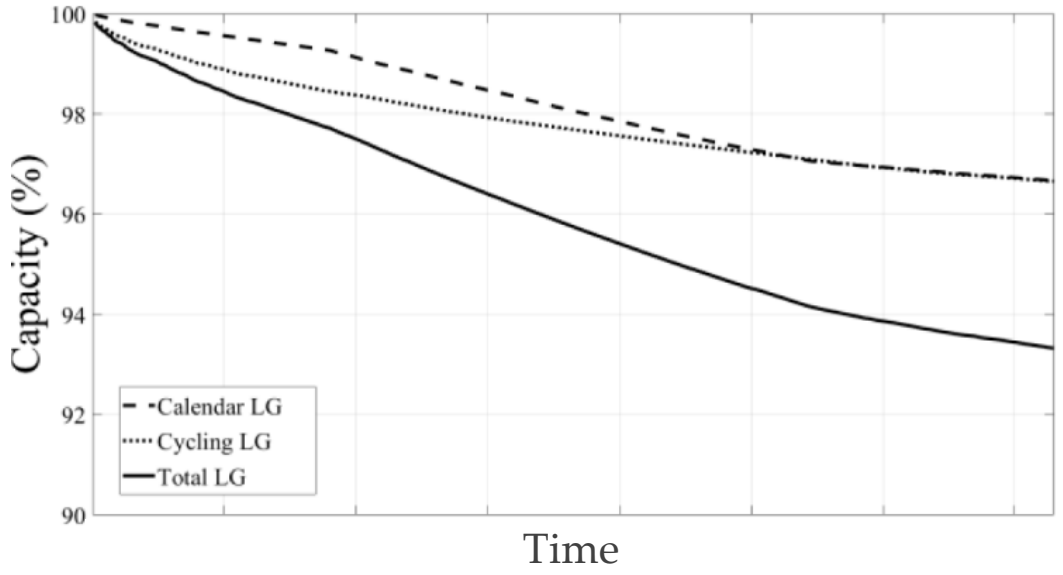



What is Degradation in Lithium-Ion Batteries?

- **Definition**: Gradual decline in performance due to chemical and physical wear.
- Types:
  - **Cycle Degradation**: Linked to battery usage (e.g., charge/discharge cycles, c-rate).
  - **Calendar Degradation**: Occurs with time, regardless of use (e.g., temperature and state of charge).



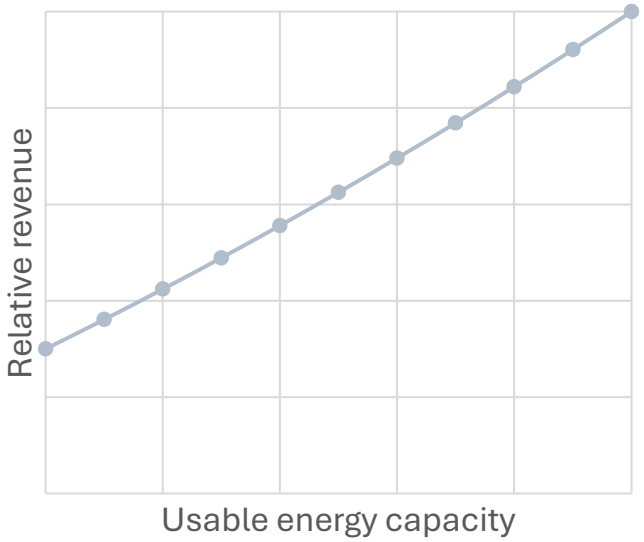
Source: Han, Xuebing, et al. "A review on the key issues of the lithium ion battery degradation among the whole life cycle." ETransportation 1 (2019): 100005.

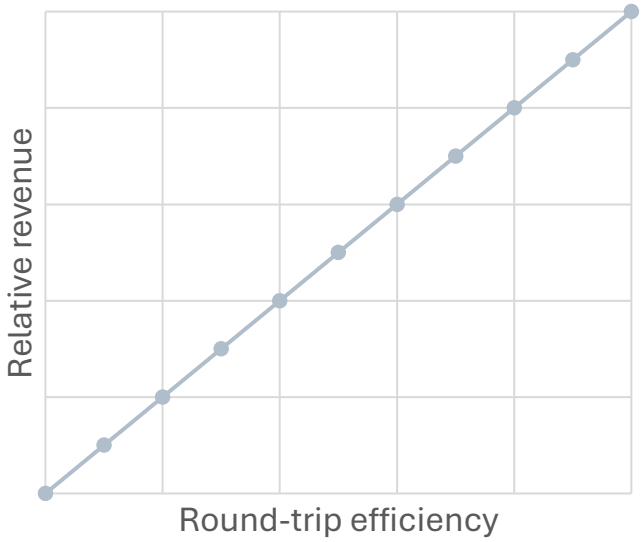


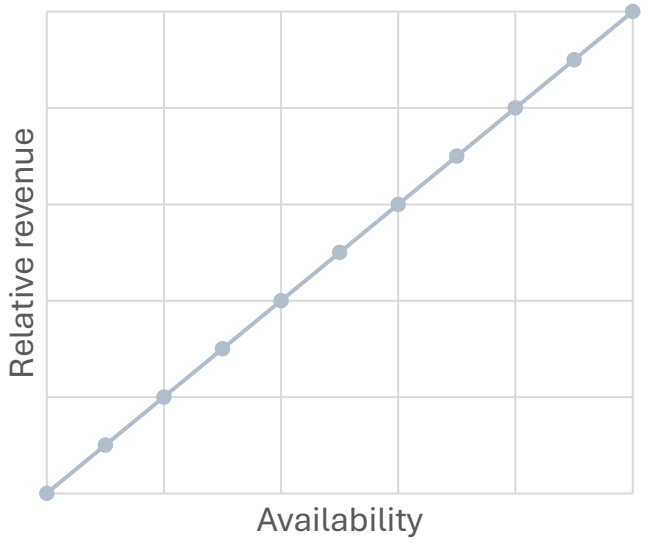
Source: Beltran, Hector, et al. "Lifetime expectancy of Li-ion batteries used for residential solar storage." Energies 13.3 (2020): 568.

Why Degradation Matters

- **Technical Drivers for Battery Revenue**:
  - **Usable Energy Capacity**: Reduced capacity reduces the technical flexibility.
  - **Round-trip Efficiency**: Higher losses over time reduce profitability.
  - **Availability**: Downtime impacts revenue.
- **Key Point**: Unmanaged degradation = Lower revenues, Lower IRR.

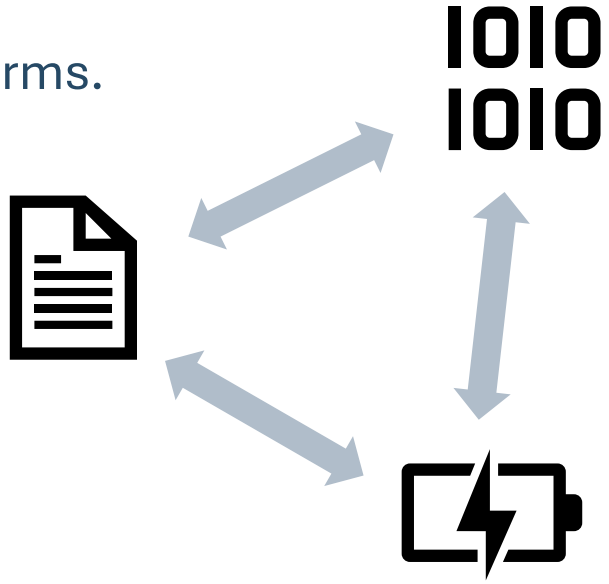






Optimizing Degradation To Improve Warranty Terms

- **Cell-Specific Optimization**:
  - Tailored degradation management improves battery lifespan and reduces performance variability.
  - Manufacturers may offer warranties based on real-world usage patterns.
- **Impact on Warranties**:
  - Flexible, performance-based warranties.
  - Extended warranties if degradation is well-managed.
- **Result**: Better degradation management = Better warranty terms.

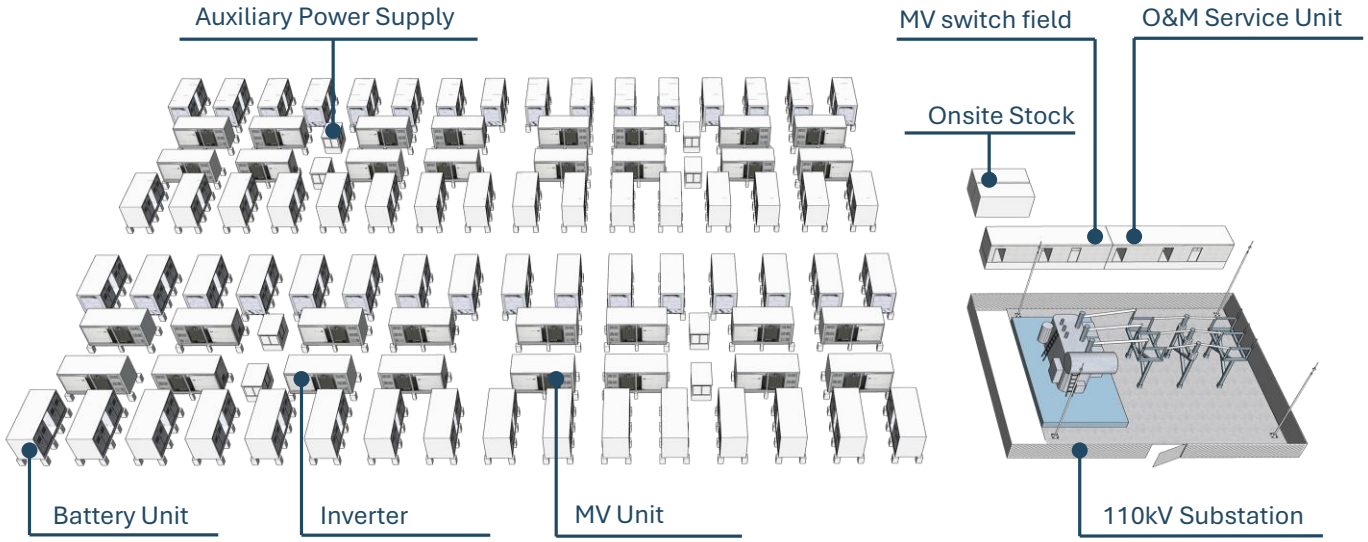


Degradation-Informed Business Case

- **Prerequisites:**
  - Know your technology.
  - Understand the impact of degradation and its drivers.
- **Predictable Degradation Models**:
  - Lower risk in financial modeling.
  - Reduce uncertainty for investors and operators.
- **ECO STOR's Role**:
  - Partnering with all necessary players in the battery value chain.
  - Ensuring optimal dispatch of batteries to optimize battery utilization and investment period.

Future Outlook: What's Next?

- **Material & Design Innovations**:
  - Constantly evolving technologies.
  - Changing system designs with optimized drivers.
- **Smart Software Solutions**:
  - Real-time degradation monitoring.
  - Predictive maintenance and lifecycle optimization.



Key Takeaways

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2. **Optimizing degradation enhances warranty terms and IRR**: Optimized investment period, better performance.

3. **Future technologies will improve degradation management**: Smart software solutions and ongoing hardware improvements are game-changers.

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