# Lifelong Learning in the Electrical Energy Transition with Wireless Power Transfer

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THUAS, Delft, The Netherlands

November 10-12, 2025

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### Introduction: Why WPT?

- Wireless Power Transfer (WPT)
- Enables efficient energy transfer
- Without physical connectors
- Applications: toothbrush to vehicles
- Lifelong Learning (LLL) essential

# Share knowledge

# N Electrical Energy Transition Hub N Society EETH Education Companies Institutes

Figure: Share knowledge in EETH

### Overview

#### <u>Society</u>

#### Public Engagement Create short, engaging votes

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techniques (like the shift From AC C. and smart gride), men if these require higher little costs or new ways of theking.

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#### Companies

Business Oriented

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Objective Ensure companies indenstrati and adopt these new

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### Education

Student Targeted

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#### <u>Integration</u>

- Target Audience: General public (young, old, non-technical individuals)
   Objective: Raise awareness and understanding of the energy transition using relatable, everyday examples.
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    expected on solutions.
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  - Expert Stories: Real-life examples from experts explaining how energy transition impacts their daily lives (e.g., how solar panels or energy storage systems have made their bornes more efficient).
     Internative Sciences Scientific Science or Choose your own advertise's operation where participants can see how different
  - energy choices affect their hories or communities.

    Discussion Topics: Simple prompts to encourage family or community conversations about the future of energy, framing it as
  - an everyday, relatioble resus.
- Target Audience: Professionals in the energy sentor, businesses, and companies facing energy related shallenges.
   Objective: One designs into the inchrical impacts, providing solutions that businesses can object.
   Course Societies.
   Class Societies: Real-level'd examples of companies that successifyly implemented solutions to energy challenges (e.g., using
- Use bodder sub-lecte examples of comparing and sub-construity implemented solutions to energy challenges (e.g., using small grides) is being congestion issued;
   Simulations: Simple simulations demonstrating how smart grid solutions work and how they can alleviate problems like momentum energy distribution; and efficiency
- congretion, energy definitions, and efficiency.

  Demonstrations: Plactical demonstrations or waitstrictings of now certain technologies (e.g., battery storage systems, grist management software) can be integrated into existing infrastruture.

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- Annowadge Cupix into consists explanations or continuous automa, incorporating reservisive with industry sectors who share insight on how to dust by other energy challenges.
   Interviews: Conventations with businesses that have already transitioned to smart energy solutions, offering insights into their strategies, challenges, and accesses.

#### Advanced Level (Student-Focused)

Target Audience: Engineering students or trainess in the energy sector.
 Objective: Provide in depth technical wrowledge and hands on experience with energy transition solutions.
 Course Contest.

- Textiscal Modulais Detailed resource on the engineering principles behind AC and DC systems, grid management, solar and builties integration, and small grid.
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- controllinity and what is convertly available on the market.

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  The configuration of the configuration of the controllinity of the configuration of apportunities infrared to energy any properties of the configuration of
- management, observing real-time effects on grid stability or efficiency.

   Project-Bosed Learning: Group projects or assignments where students design a small-scale solution to a real-world energy problem, sesting their theoretical knowledge in practice.

### Target audience

### Society.

### Public Engagement

- Create short, engaging videos or infrographics that break down the energy transition into 'bite-sized' concepts (e.g., 'What is a smart grid?').
- Organize community events or online discussions where both young and older generations can participate and share their views, making it more conversational.
- Objective Educate society on the mportance and benefits of new techniques (like the shift from AC to DC and smart gnids), even if these require higher nitial costs or new ways of thinking.
- Integration By making these concepts understandable for everyone-from children to senior citizens-you help Foster acceptance of new energy technologies and policies. This societal buy-in is crucial for the successful implementation of energy transition solutions.

### Companies

#### Business Oriented

- Develop workshops or webinars featuring the latest technologies and market trends, explaining how businesses can implement them.
- Include brainstorming sessions to encourage innovative solutions and networking opportunities between students and companies to Foster Fresh perspectives.
- Objective Ensure companies understand and adopt these new techniques, with a Fecus on Knowledge transfer between experienced employees and the new generation of iskilled students. Companies need to stay updated on the latest southons rather than relying on outdated methods.
- Integration Businesses engage with students, ensuring that they are hiring individuals who are well-versed in current and energing technologies. At the some time, businesses may need to upskill their current employees to align with the knowledge these students bring.

### Education

### Student Targeted

- Create interactive simulations or hands-on projects that demonstrate key concepts like renewable energy systems (solar, wind, batteries) or smart grids.
- Use case studies of realworld applications to make it relatable and tie these lessons to problem-solving activities.
- Objective Equip students with practical knowledge and techniques (like the difference between AC and DC) to solve real-world energy problems.
- integration These students become the future work-force. directly applying their learning to address critical issues such as grid congestion offering innovative solutions like using smart technologies instead of traditional infrastructure.

### Integration

#### <u>Integration</u>

Beginner Level (Society-Focused)

- . Target Audience: General public (young, old, non-technical individuals)
- . Objective: Raise awareness and understanding of the energy transition using relatable, everyday examples.
- Course Content
  - Knowledge Clips: Short, animated videos explaining energy transition concepts (like smart grids, renewable energy, AC vs. DC) using simple analogies. For example, compare the energy grid to a smartphone's battery management to explain grid concepts in solutions.
    - Expert Stories: Real-life examples from experts explaining how energy transition impacts their daily lives (e.g., how solar panels or energy storage systems have made their homes more efficient).
    - Interactive Scenarios: Small quizzes or "choose your own adventure" scenarios where participants can see how different
    - energy choices affect their homes or communities.

      Discussion Topics: Simple prompts to encourage family or community conversations about the future of energy, framing it as an everyday, relatable issue.

#### Intermediate Level (Business-Focused)

- Target Audience: Professionals in the energy sector, businesses, and companies facing energy-related challenges.
- Objective: Dive deeper into the technical aspects, providing solutions that businesses can adopt.
- Course Content:
  - Case Studies: Real-world examples of companies that successfully implemented solutions to energy challenges (e.g., using smart grids to solve congestion issues).
  - Simulations: Simple simulations demonstrating how smart grid solutions work and how they can alleviate problems like
    congestion, energy distribution, and efficiency.
  - Demonstrations: Practical demonstrations or walkthroughs of how certain technologies (e.g., battery storage systems, grid management software) can be integrated into existing infrastructure.
  - management sortware) can be integrated into existing infrastructure.

    Knowledge Clips: More detailed explanations of technical solutions, incorporating interviews with industry leaders who share insights on how to adopt to new energy challenges.
  - Interviews: Conversations with businesses that have already transitioned to smart energy solutions, offering insights into their strategies, challenges, and successes.

#### Advanced Level (Student-Focused)

- . Target Audience: Engineering students or trainees in the energy sector.
- Objective: Provide in-depth technical knowledge and hands-on experience with energy transition solutions.
- Course Content
  - Technical Modules: Detailed lessons on the engineering principles behind AC and DC systems, grid management, solar and battery integration, and smart grids.
  - Component Overview: Exploration of key components required for energy transition (e.g., converters, batteries, and controllers) and what is currently available on the market.
  - Simulations and Coding: Hands-on experience with software to simulate grid operations, allowing students to model the
    effects of different configurations (e.g., how switching to DC grids can reduce losses).
  - Demonstrators: Practical sessions where students can build, measure, and test circuits or algorithms related to energy management, observing real-time effects on grid stability or efficiency.
  - Project-Based Learning: Group projects or assignments where students design a small-scale solution to a real-world energy problem, testing their theoretical knowledge in practice.

### Beginner Level: Society

# <u>Integration</u>

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  - Discussion Topics: Simple prompts to encourage family or community conversations about the future of energy, framing it as
    an everyday, relatable issue.

# Beginner Level

- Society-focused
- Public engagement
- Short engaging videos
- Simple graphics
- Raise general awareness

# Focus: Society



Figure: Kickstand charging, society focus

### Intermediate Level: Industry

#### Intermediate Level (Business-Focused)

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  - Interviews: Conversations with businesses that have already transitioned to smart energy solutions, offering insights into their strategies, challenges, and successes.

### Intermediate Level

- Companies-oriented
- Business workshops
- Explore industry trends
- Include hands-on sessions
- Perspective on opportunities

# Focus Industry

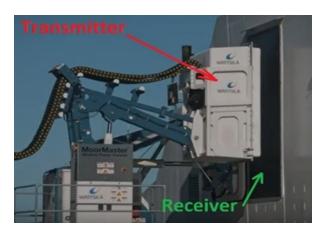


Figure: Ferry charging, industry focus

### Intermediate Level

#### Advanced Level (Student-Focused)

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    - Project-Based Learning: Group projects or assignments where students design a small-scale solution to a real-world energy problem, testing their theoretical knowledge in practice.

### Advanced Level

- Education-targeted
- Student interactive simulations
- Key concepts like renewable
- Practical knowledge and techniques
- Solve real-world problems

### Focus: Education

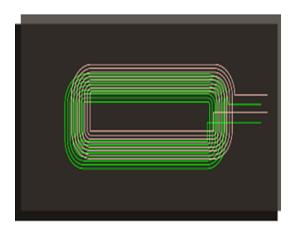


Figure: Wireless coupling, education focus

### **Educational Set-up**

- Demonstrations: repeat assignments
- Adjust distance, alignment
- Control frequency, load
- Observe effectiveness

### Hardware trainer



Figure: Hardware trainer setup

### Hardware trainer losses

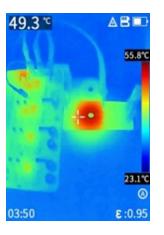


Figure: Thermal image, see losses

# Component design

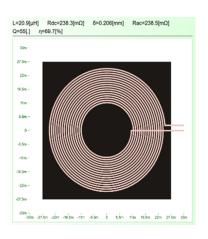


Figure: Coil design in Caspoc

# Typical Educational theoretical assignment

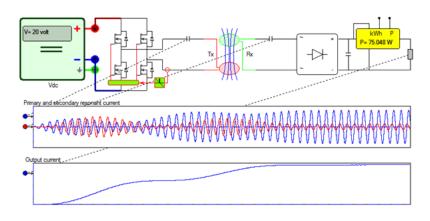


Figure: Simulation 75 Watt transfer

## What do you learn: Society

- Introductory lessons
- Familiar: phone charging, Toothbrush wireless charger
- Resonant coupling for transfer
- Demonstrate with setup
- Advantages over plug
- Convenience, contactless

# What do you learn: Industry

- Gain insight into possibilities
- Align with LLL
- Kitchen appliances developing
- Electric vehicle charging
- Industrial floor: automated systems
- Recharge carts wirelessly
- Wet environments suitable
- Electric ships charging
- Ferries, tour boats
- Short docking times

### What do you learn: Education

- Simulations analyze system
- Interaction of components
- Measure performance
- Compare calculations, measurements
- Develop problem-solving skills

### Conclusion

- Lifelong learning for three different groups
- Low level to detailed technical level
- Design and Simulation Tools
- Practical measurements

Thank you! www.dc-lab.org P.J.vanDuijsen@hhs.nl

