Digital Transformation of Power Electronics Towards Carbon-Free World in 2050

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Digital Transformation WG in NPERC-J

Carbon-free world in 2050

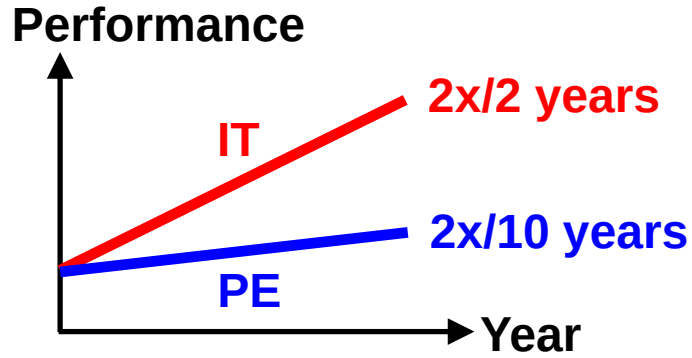
Backcast roadmaps for four possible future visions are created.

Power electronics (PE)

Information technology (IT)

In 2050, unlimited performance is available almost for free.
- **Computing**
- **Memory**
- **Communication**

【Mission】
How to increase the value of PE by utilizing IT?



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Energy Self-Sufficiency within Each Town

Year 2030 2040 2050

Technologies to be developed

- Framework that provides optimal combination of energy sources
- Real-time supply and demand balance

Challenges

- Available renewable energy sources are diverse from town to town.
- Supply-demand balance

Preferred future

Use up optimal renewable energy sources that vary from town to town without waste

CO_2 reduction

Waste-free use of diverse renewable energy sources

Electricity with Built-in History

Year 2030 2040 2050

Technologies to be developed

Technology to embed historical data in electricity

Challenges

Inclusion of historical data from power generator to electricity user in electricity

Preferred future

Electricity with guaranteed authenticity of source of generation

CO_2 reduction

Truly use renewable energy, not nominally.

Power Electronics like Arduino

Year 2030 2040 2050

Technologies to be developed

- Modular architecture
- Software for automatic design
- Automated component selection

Challenges

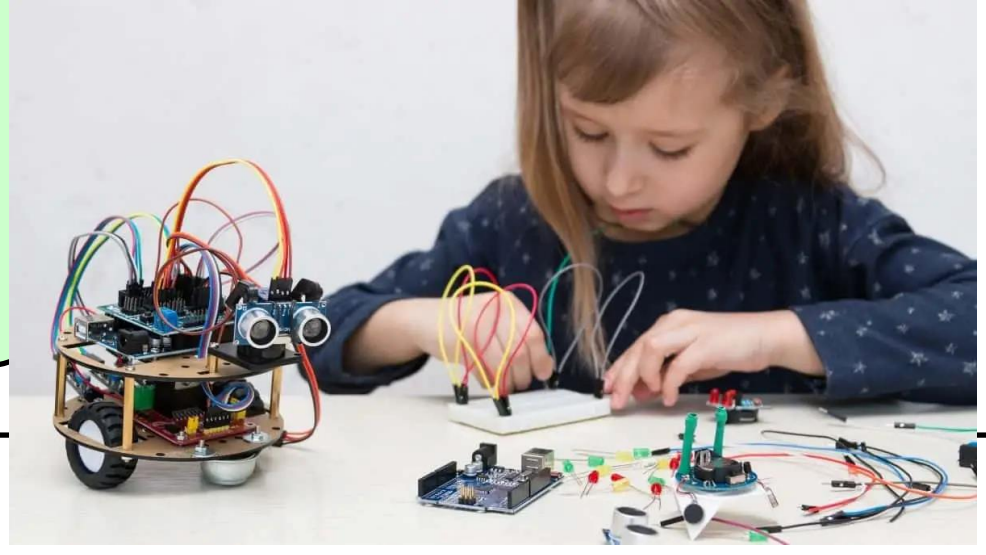
- Safety
- EMC
- Support for various specifications

Preferred future

Power electronics that can be used like Arduino

CO_2 reduction

Promoting electrification in developing countries



DC Power Supply in Home

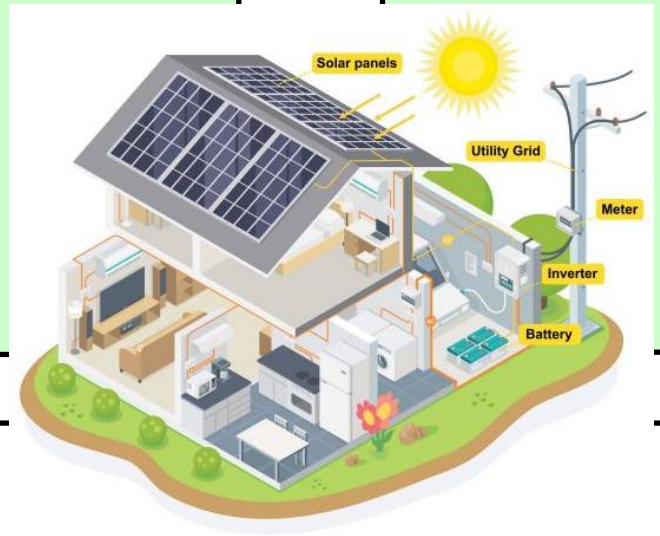
Year 2030 2040 2050

Technologies to be developed

- Standards development
- In-home DC distribution architecture

Challenges

- Global standardization
- All home appliances are converted to DC
- DC outlet



Preferred future

Power supply in home is unified in DC, because home's energy source is solar cells.

CO_2 reduction

Removing unnecessary conversions between DC and AC