

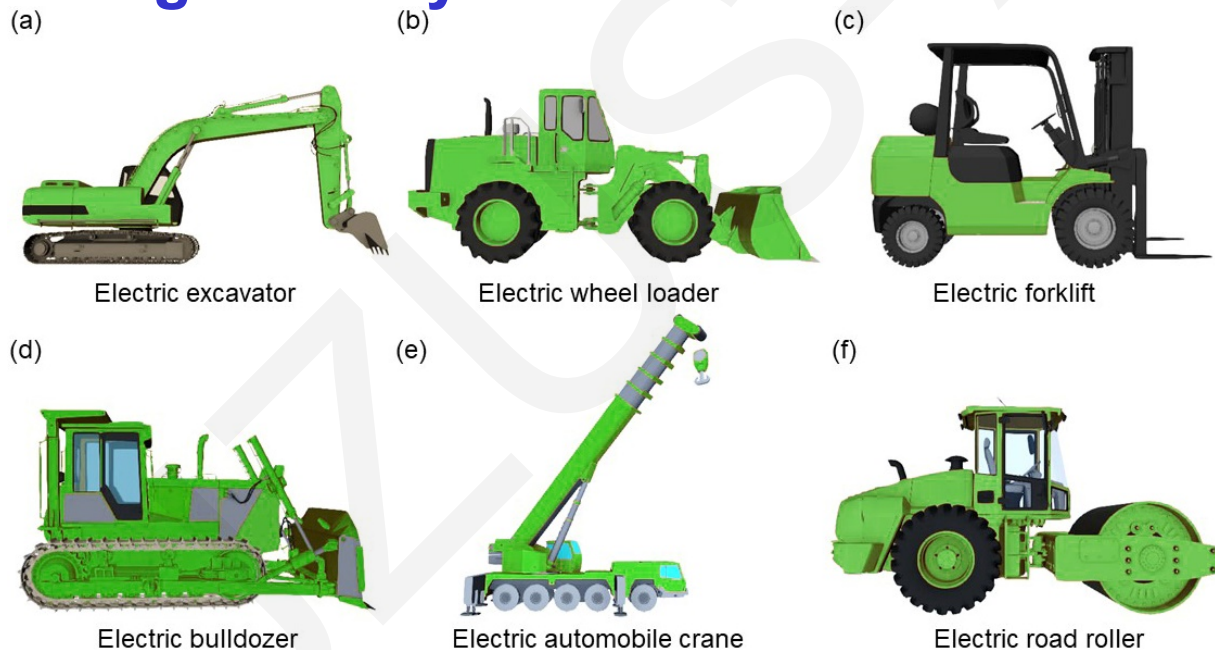
# Development of electric construction machinery in China: a review of key technologies and future directions

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# Electric construction machinery

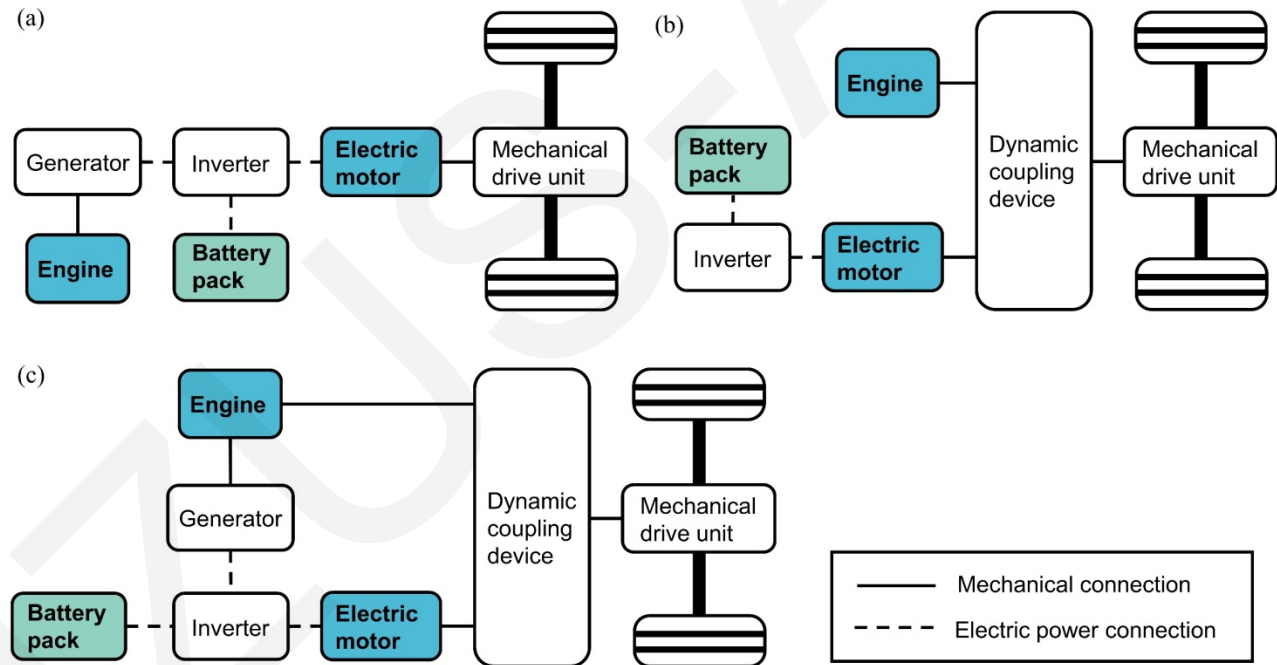
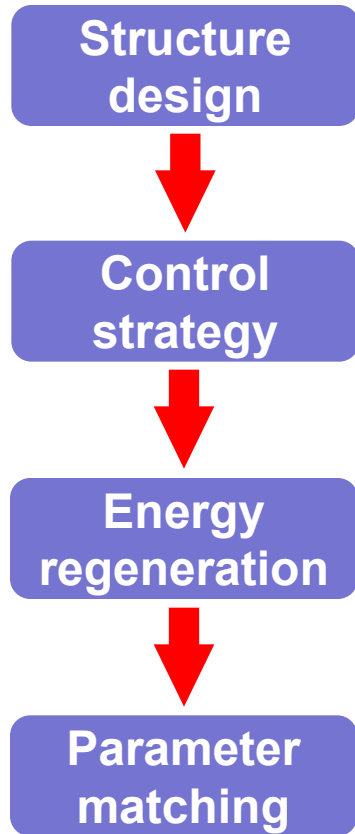
■ **Electric construction machineries (ECMs) are widely operated in various engineering applications and are critical for infrastructure development and manufacturing industry.**



**Fig. 2. Typical ECM types: (a) electric excavator; (b) electric wheel loader; (c) electric forklift truck; (d) electric bulldozer; (e) electric automobile crane; (f) electric road roller.**

# Electric construction machinery

## ■ Hybrid and pure electric drive system



**Fig. 9. Structure of mainstream hybrid power system: (a) series structure; (b) parallel structure; (c) hybrid structure.**

# Battery management system (BMS)

- The battery has gradually replaced other kinds of energy sources and been applied to construction machinery. However, the health of the battery needs to be monitored for reliable energy supply, and timely maintenance.

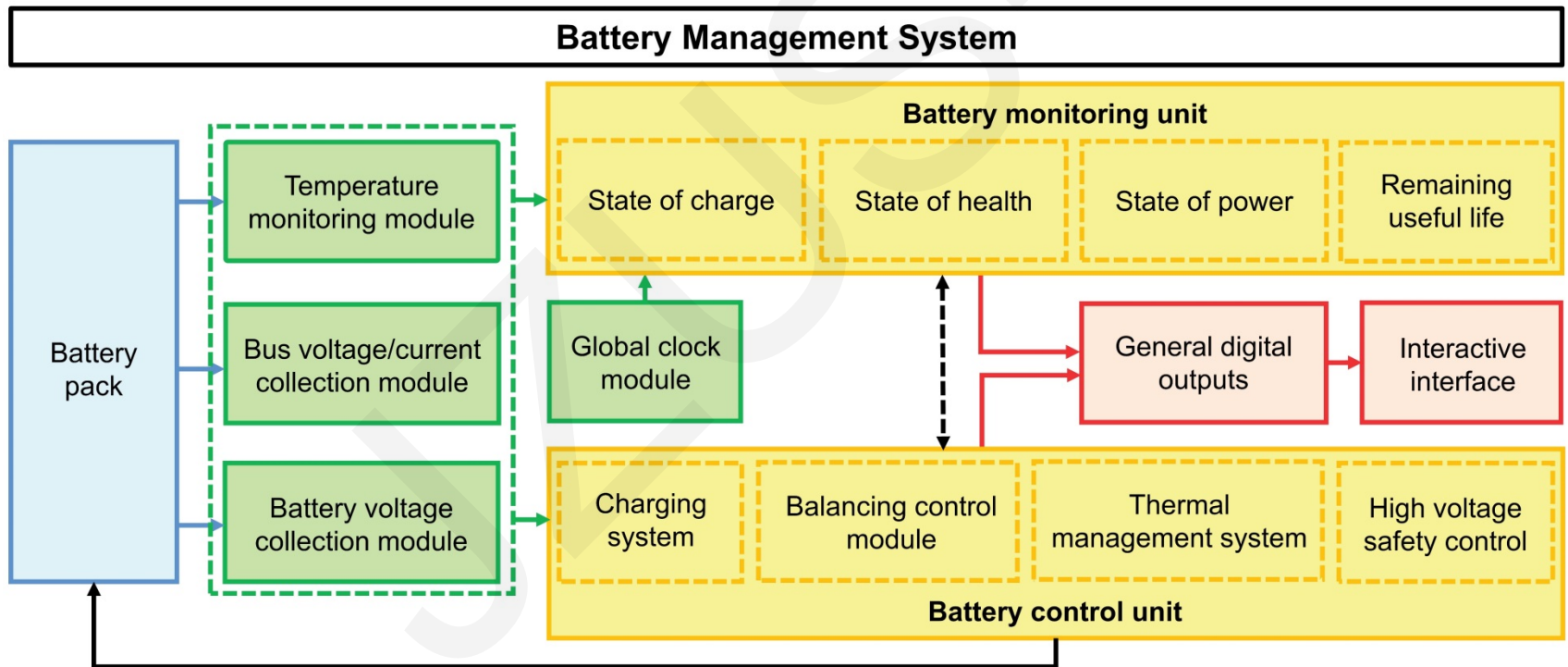
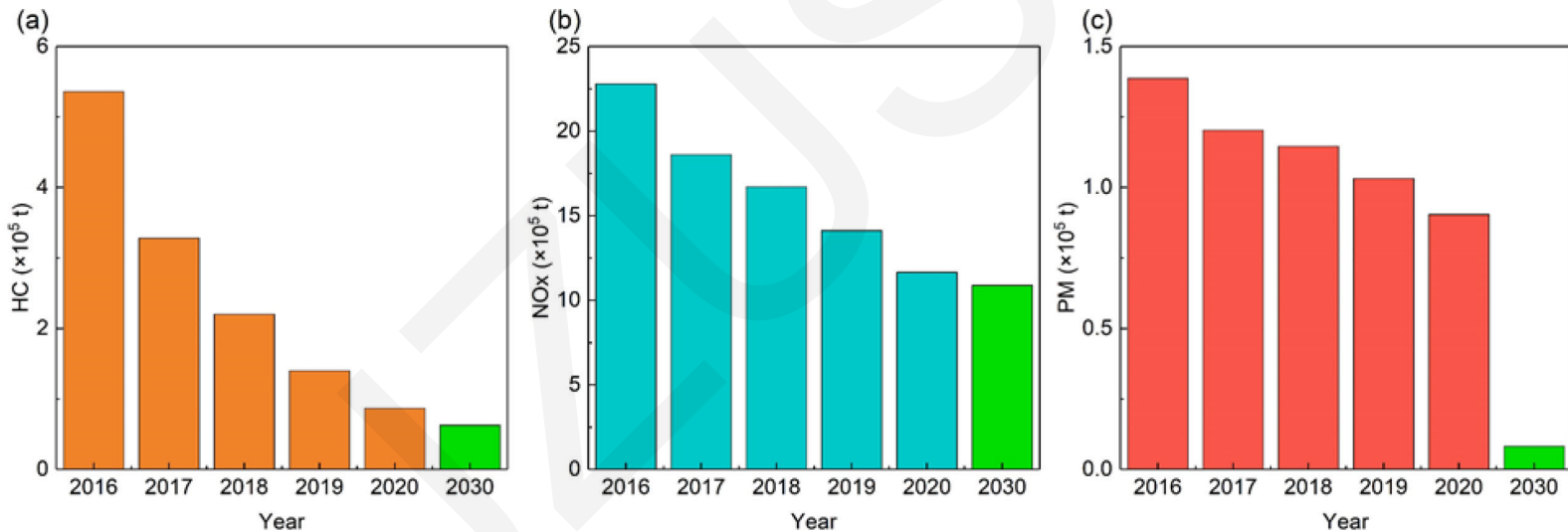


Fig. 12. Structure and functions of a typical BMS.

# Environmental benefits

■ The implementation of ECM in China shows considerable environmental benefits, and more government incentives are encouraged to further motivate CM manufacturers in developing more ECM models for the Chinese market.



**Fig. 15. Estimated national total CM emissions in China (2016-2020 and 2030): (a) HC; (b) NOx; (c) PM.**

# Conclusions & future developments

- Traditional construction machinery no longer satisfies the demand for energy saving and environmental protection.
- The development of ECM that utilizes clean and renew-able energy is of great importance in the construction industry.
- Due to harsh operation conditions, ECMs, such as the mining truck and excavator, demand high battery performance with long cycle-life, fast-charging speed, and stable current output.
- The rapid development of information technology, e.g., Artificial Intelligence, Internet of Things, and 5G are transforming the CM industry.