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PROMET
ITS I LOGISTIKA
AERONAUTIKA

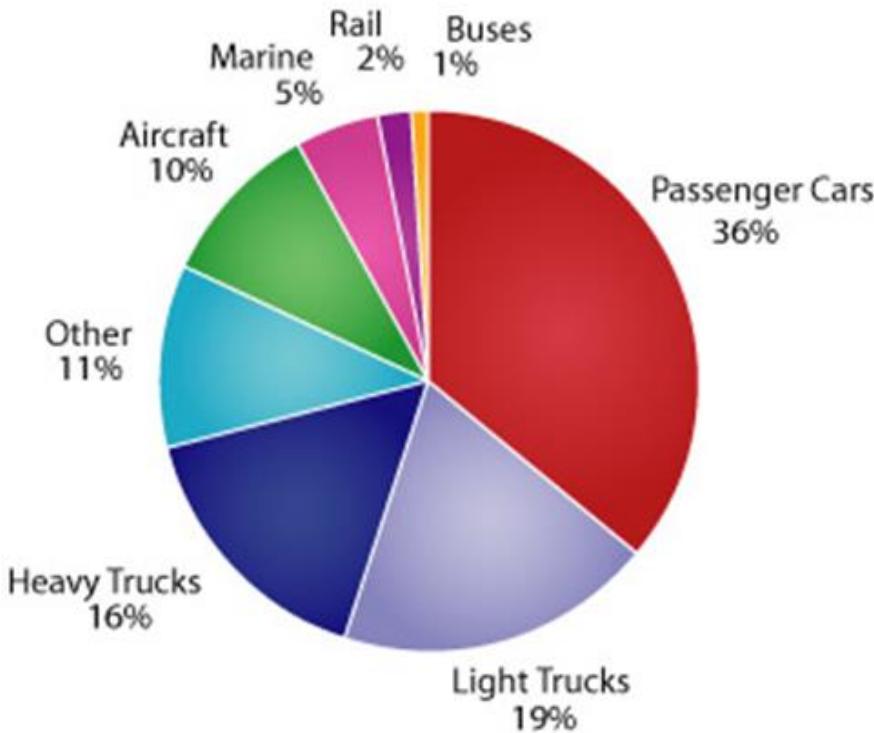
ŽELJEZNIČKA VUČNA VOZILA S HIBRIDNIM POGONOM I POGONOM NA ALTERNATIVNA GORIVA

prof.dr.sc. Mladen Nikšić



Emisija stakleničkih plinova

Transportation Greenhouse Gas Emissions



Alternative tradicionalnim pogonima

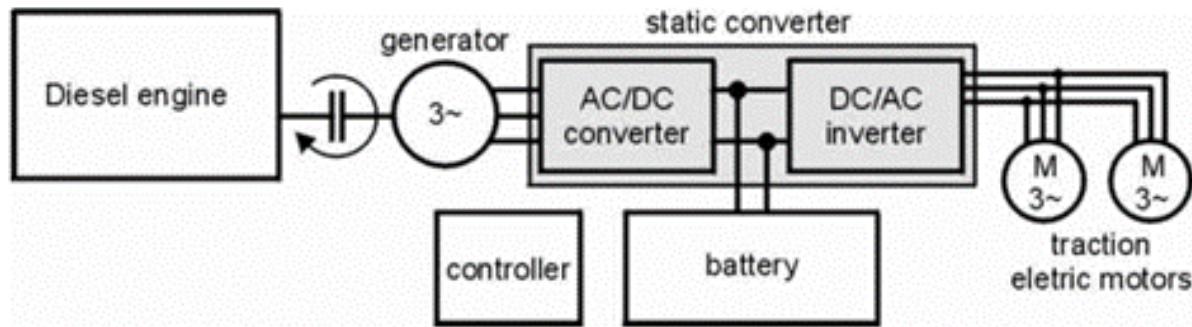
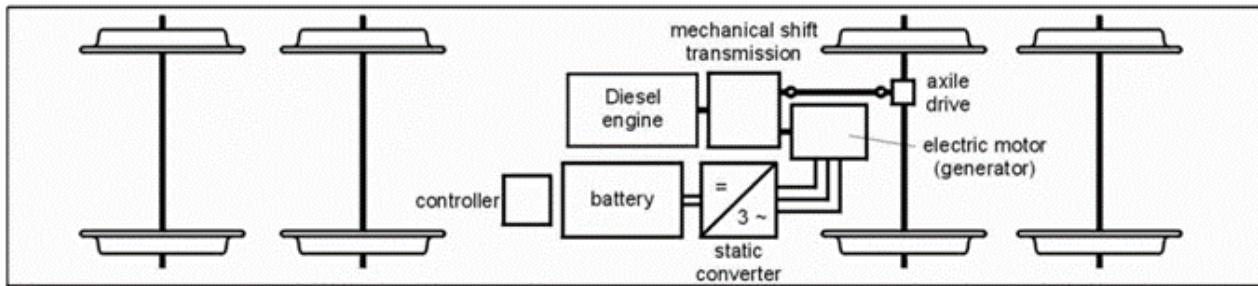
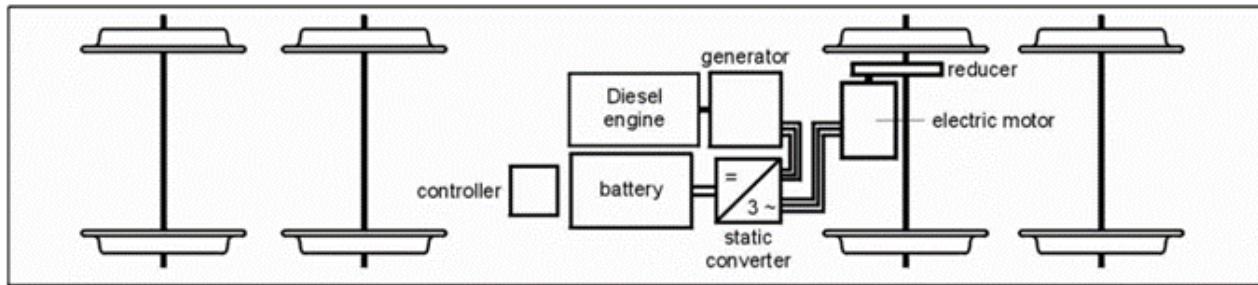
- hibridni pogon
- pogon na zemni plin
- pogon na vodik
- pogon na biodizel
- pogon na bioetanol



Hibridni pogon

- kombinacija dva pogona (dizelski motor + električni pogon)
- pogoni se mogu spojiti: serijski, paralelno, serijski-paralelno
- manja potrošnja goriva za 10%
- manje emisije NOx za 60%
- za 20 dB manja buka na kolodvorima/postajama i za 30 dB manja kod ubrzavanja iz stanja mirovanja
- gubitak energije pri radu







GE's Evolution® Hybrid Locomotive



How it works

In a conventional locomotive, energy generated by the traction motors **A** during braking is dissipated entirely as heat through resistor grids **B**.

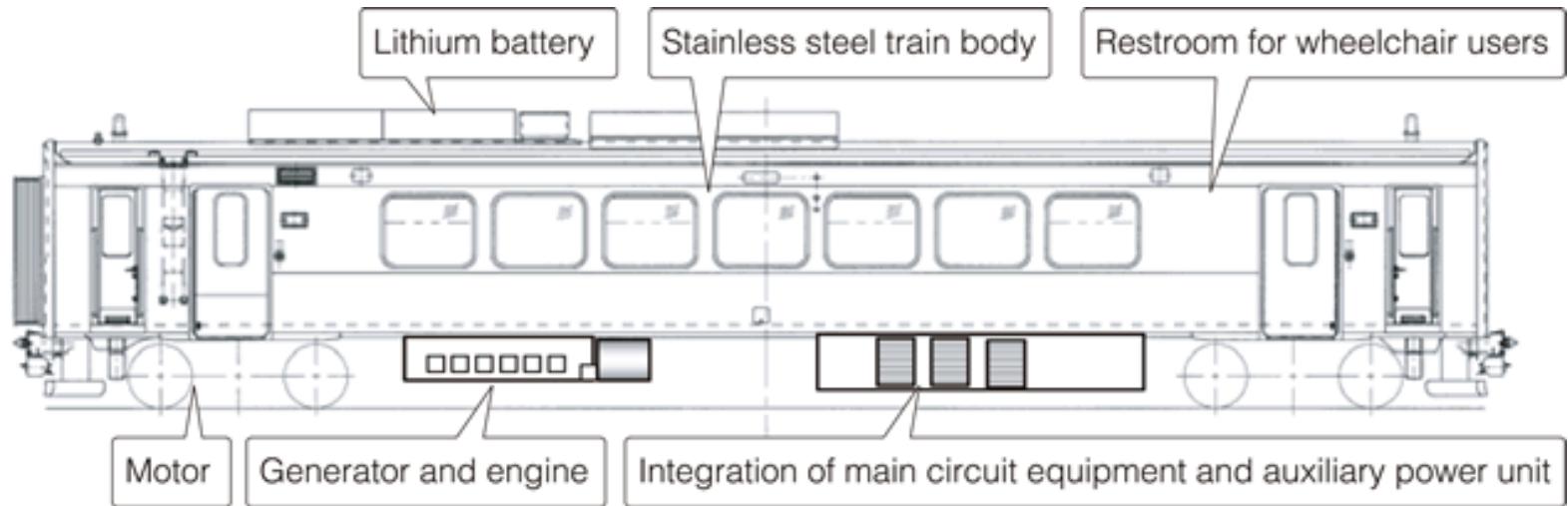
In contrast, in a hybrid locomotive, some of that energy is captured in a series of lead-free, rechargeable batteries **C**.

The captured energy can then be used to provide power in one of three ways:

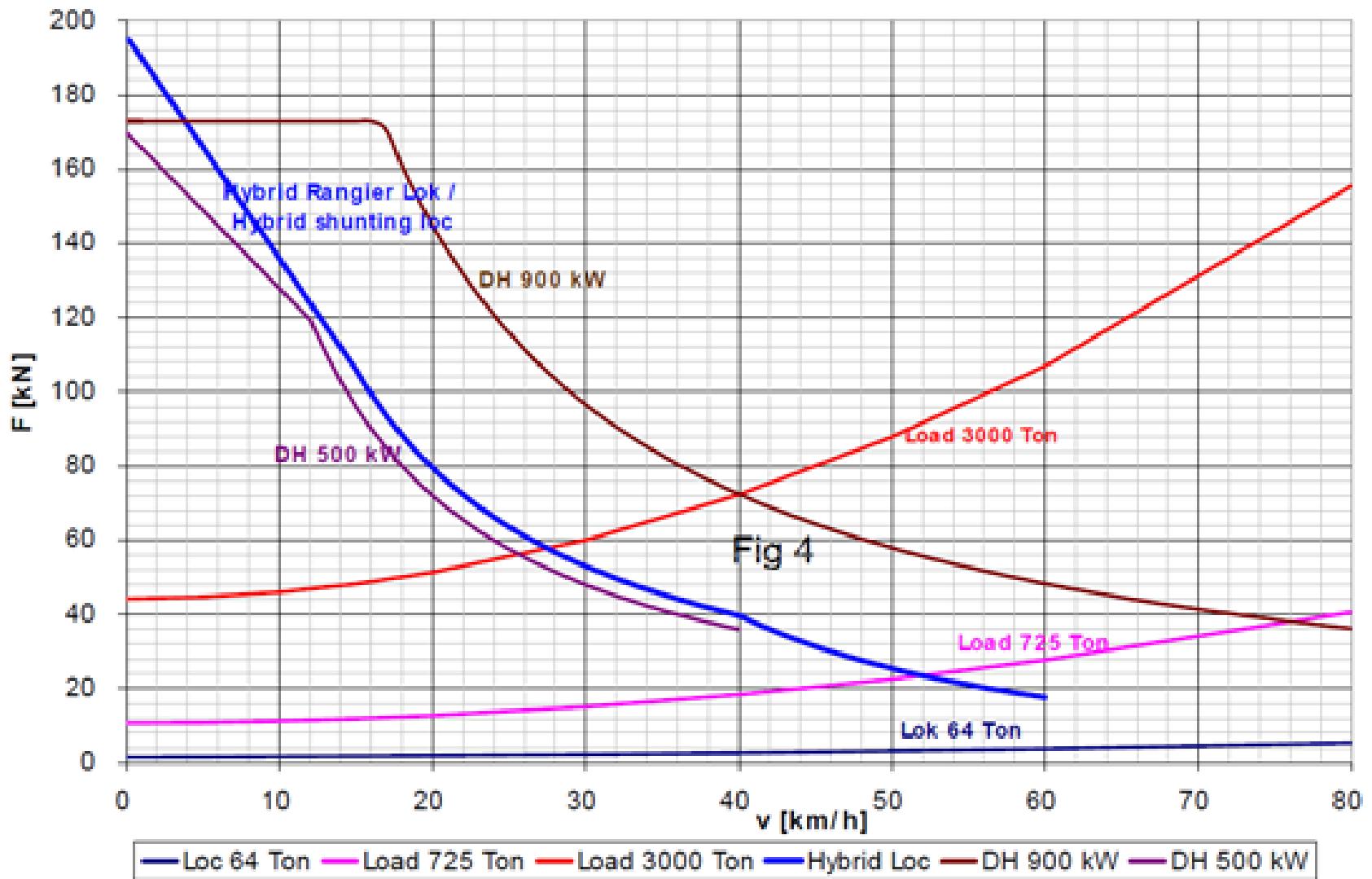
- In combination with diesel-electric power (provided by the engine **D** and the electrical system **E**) to consistently deliver the required horsepower.
- As an addition to full diesel-electric power for quick acceleration from a full stop.
- As the primary power source (full battery power).



Kiha E200 - Japan







Spremnici energije

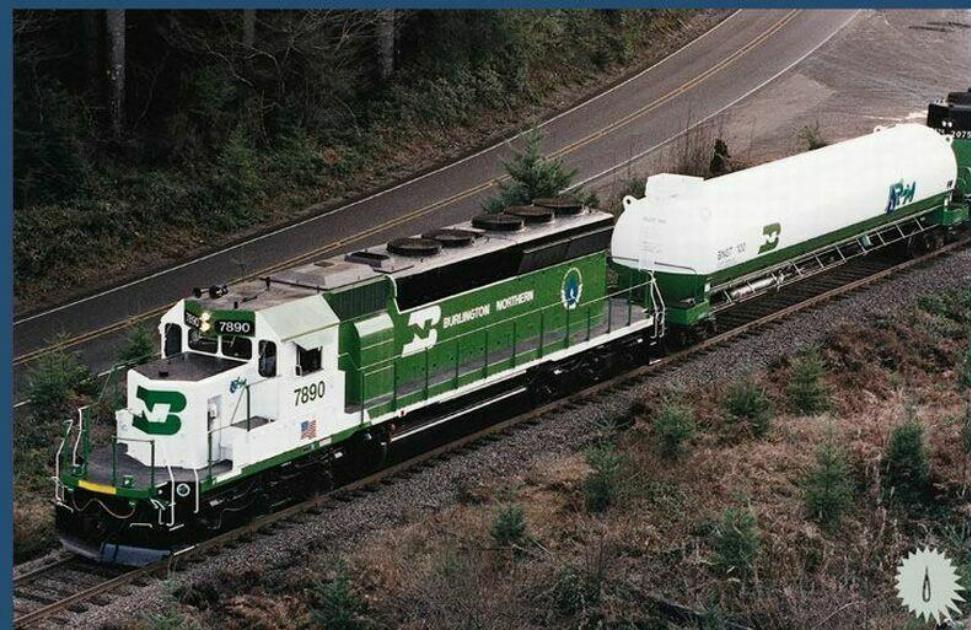
- baterije: olovno-kiselinske, nikal-kadmijeve, nikal-metalhidridne, litijsko-ionske
- kondenzatori velikog učinka
- zamašnjaci



Zemni plin

- dolazi u dva oblika (CNG i LNG)
- kratkoročno rješenje
- znatno manja emisija štetnih plinova
- zahtijeva veći volumen i masu spremnika
- skupa i komplicirana potrebna infrastruktura





The BN 7890: The first demonstration of a direct injected natural gas locomotive. ECI designed and developed the dual fuel system which included new pistons and cylinder heads, gas injectors, electronic control system, and a modified cooling system.

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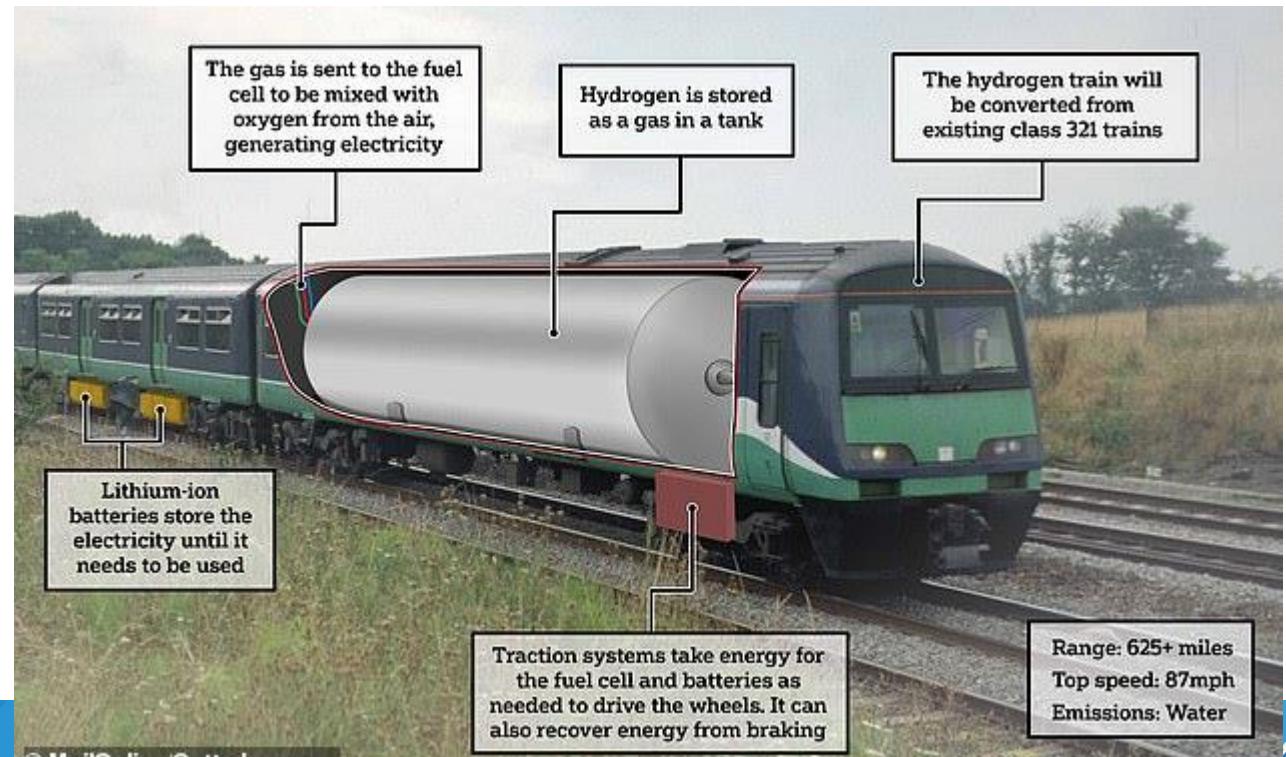
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25 godina

Vodik

- dugoročno rješenje
- zanemarive emisije
- u kombinaciji s helijem ili kisikom



Biodizel

- proizvodi se iz: algi, životinjskih masti, suncokreta, repice i soje
- manja emisija štetnih plinova
- kraći vijek trajanja motora
- nepogodan za teške vlakove



Bioetanol

- početak korištenja 70-ih godina XX. stoljeća
- dobiva se procesima: fermentiranja, destilacije, dehidracije, hidrolize i saharifikacije
- potrebna veće količina goriva zbog manje ogrjevne sposobnosti i potrebne preinake
- veća iskorištenost i kompresija motora
- manja razina stakleničkih plinova
- laka proizvodnja



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La Navata 31/07/13, Powell**



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Hvala na pozornosti!