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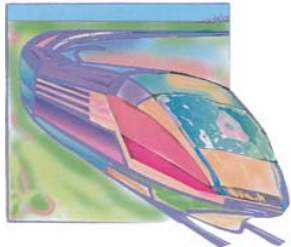
Centre for Research
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in Railway Engineering



Gröna Tåget

(Eng: Green Train)

**Energy consumption -
vital for environmental performance and
sustainable transportation**



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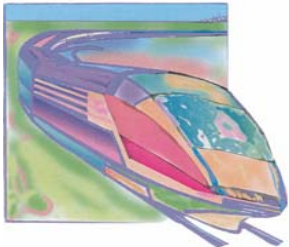
Further improved environmental performance

Required

- Low **energy consumption** – and related **air pollution** of greenhouse gases (CO₂, NO_x etc).
- Low **external noise** level.
- Low **particle emissions**.

Most important ...

- The train is **attractive to passengers**, with respect to short **travel time**, **interiors** (functionality and visual appearance), a **smooth and silent ride**, **boarding** (also for people with reduced mobility) and **ticket price**;
... for using the train instead of other means of transport.





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Reductions of energy consumption

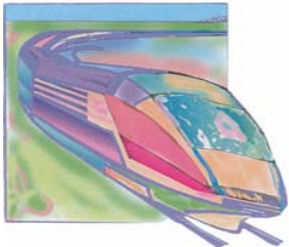
Energy consumption (per seat-km) to be reduced by approx 20 – 30 % (compared with *X 2000*).

Preliminary studies indicate

a 15 - 20 % reduction to be achieved with a continental width of the train (~2.95 m);

or 30 % reduction with a wide carbody train (~3.5 m; having almost 25 % more seats per car).

This is despite a **higher top speed** (250 km/h instead of 200 km/h).





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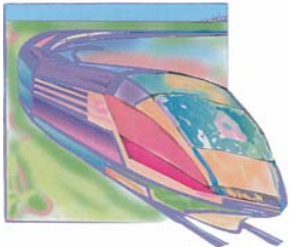
How is energy consumption reduced?

Reasons:

- **Motor coaches** (Electric Multiple Unit) instead of loco-hauled train + efficient **space utilization** (4 – 5 cars instead of loco + 6 cars).

This results in 35 – 40 % less weight per seat (with wide body).

- **Braking** will be mainly electric and **feeds back electric energy to other trains.**
- Improved **aerodynamics** (less air drag).
- Improved **energy efficiency** in electric drives.





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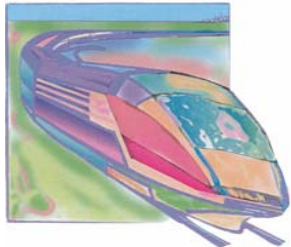
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Energy consumption Comparison

Example: Stockholm – Gothenburg line (455 km)

	Per seat-km (Wh)	Per pass-km (Wh)
Old loco-hauled train (1980 onwards, 160 km/h)	48 ¹	108 ¹
X 2000 (1990 onwards, 200 km/h)	43 ¹	77 ¹
Airplane (Boeing 737-800)	330 ²	510 ²
Green Train (250 km/h) (preliminary)	31 ¹	52 ¹



1) Electric energy from public grid; 2) Energy content in fuel



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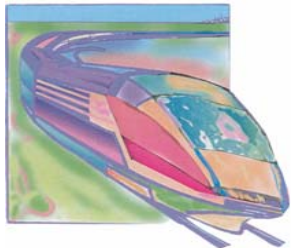
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Emissions of CO₂ Comparison

Example: Stockholm – Gothenburg line (455 km)

	Per seat-km (Wh)	Per pass-km (Wh)
Old loco-hauled train (1980 onwards, 160 km/h)	4 ¹	10 ¹
X 2000 (1990 onwards, 200 km/h)	4 ¹	7 ¹
Airplane (Boeing 737-800)	85 ²	130 ²
Green Train (250 km/h) (preliminary)	3 ¹	5 ¹



1) Average electric power on common Nordic market (2000 – 2004)

2) According to NTM (Network for Transport and Environment)



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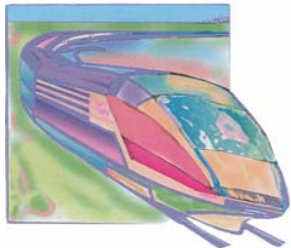
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How will particle emissions be reduced?

Reasons:

- **Radially steered bogies** (passive and still more mechatronic) will produce less wear of metallic particles from wheels and rails.
- **Braking will be mainly electric** (by means of electric drives), thus few particles are worn from brake pads and brake disks.





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Conclusion

**Environmental performance will be improved
in parallel with higher speed.**

