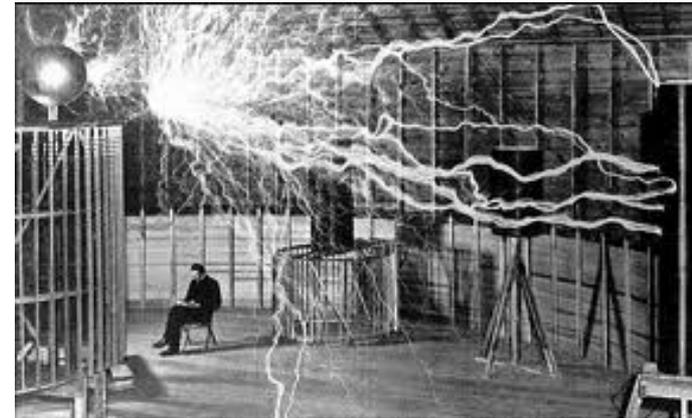


# La route et l'électricité

## Un coup de foudre qui peut durer

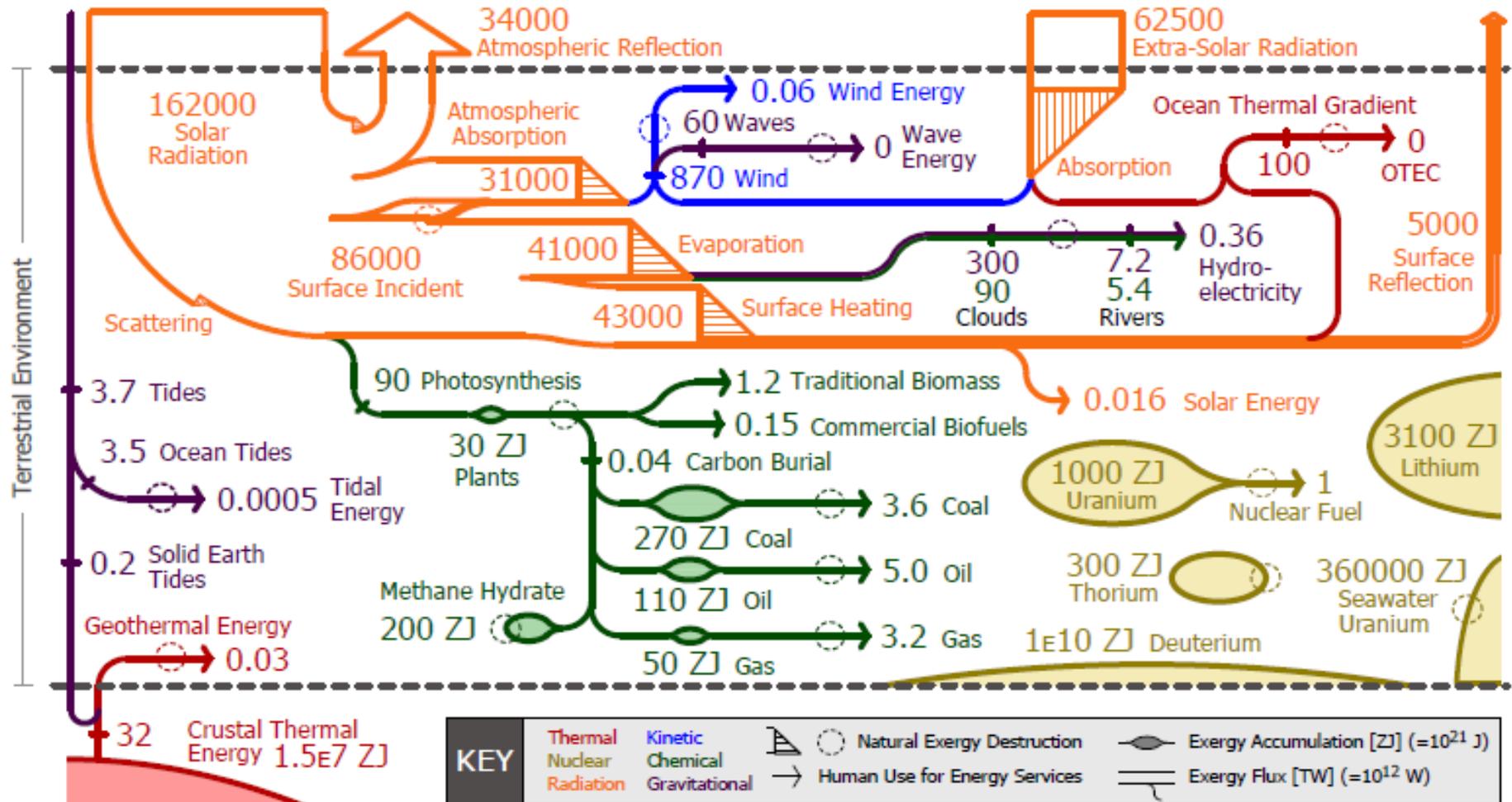
Henri Van Damme  
Ifsttar





15 TW

≈ Tectonique des plaques



Exergy is the useful portion of energy that allows us to do work and perform energy services. We gather exergy from energy-carrying substances in the natural world we call energy resources. While energy is conserved, the exergetic portion can be destroyed when it undergoes an energy conversion. This diagram summarizes the exergy reservoirs and flows in our sphere of influence including their interconnections, conversions, and eventual natural or anthropogenic destruction. Because the choice of energy resource and the method of resource utilization have environmental consequences, knowing the full range of energy options available to our growing world population and economy may assist in efforts to decouple energy use from environmental damage.

6 x 3,3 TW



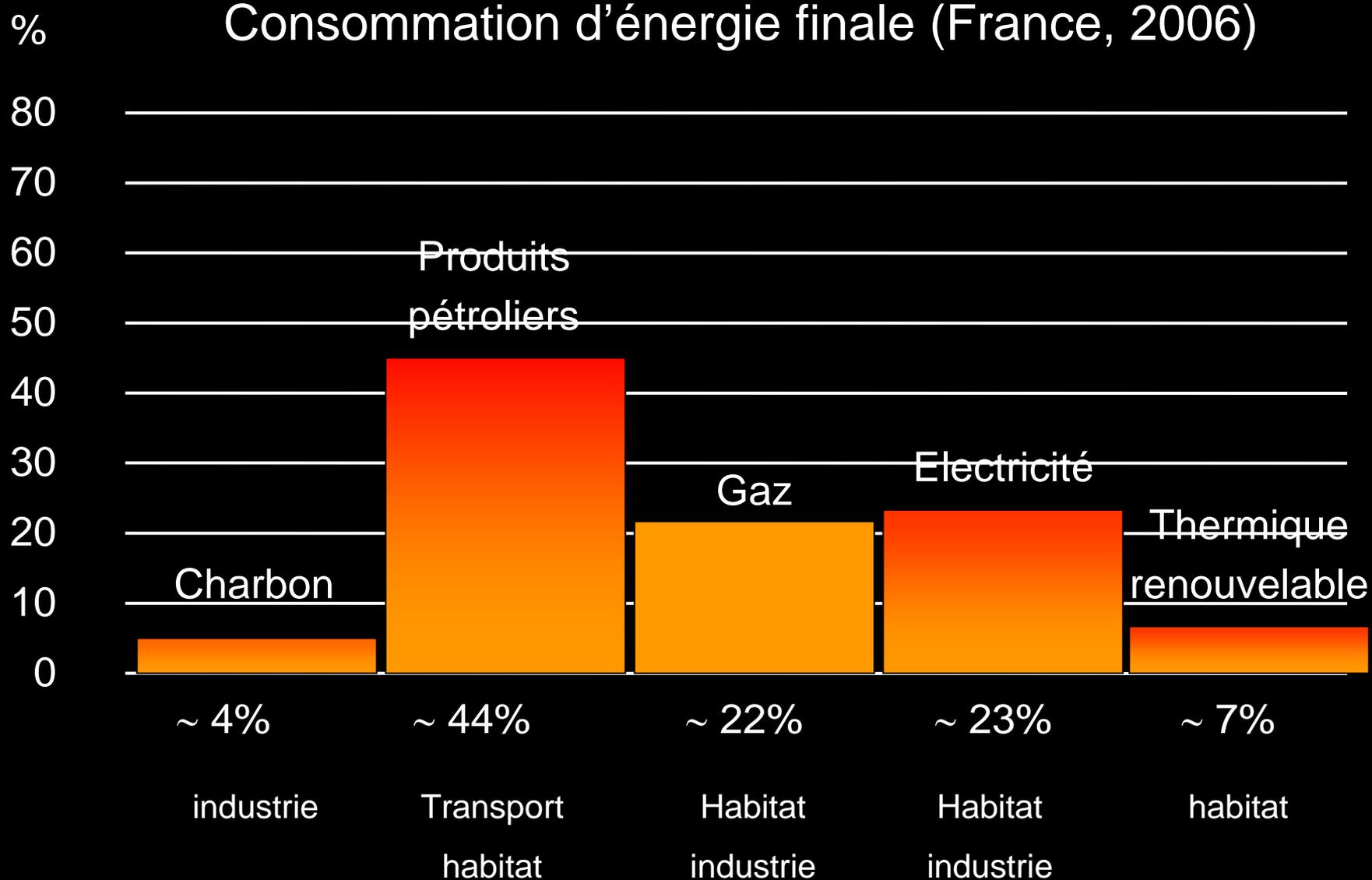
©1998, EB, Inc.

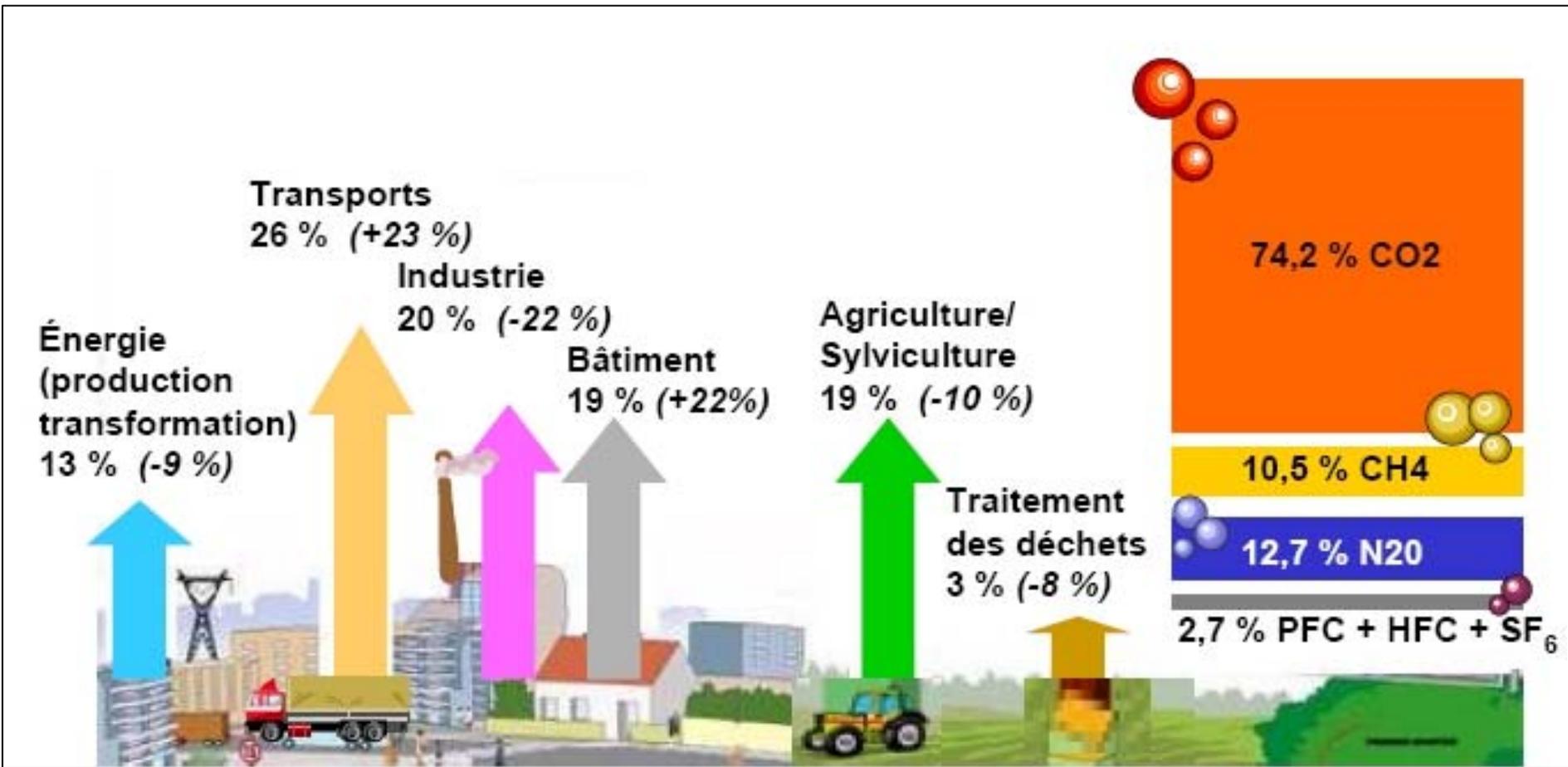
MTEp

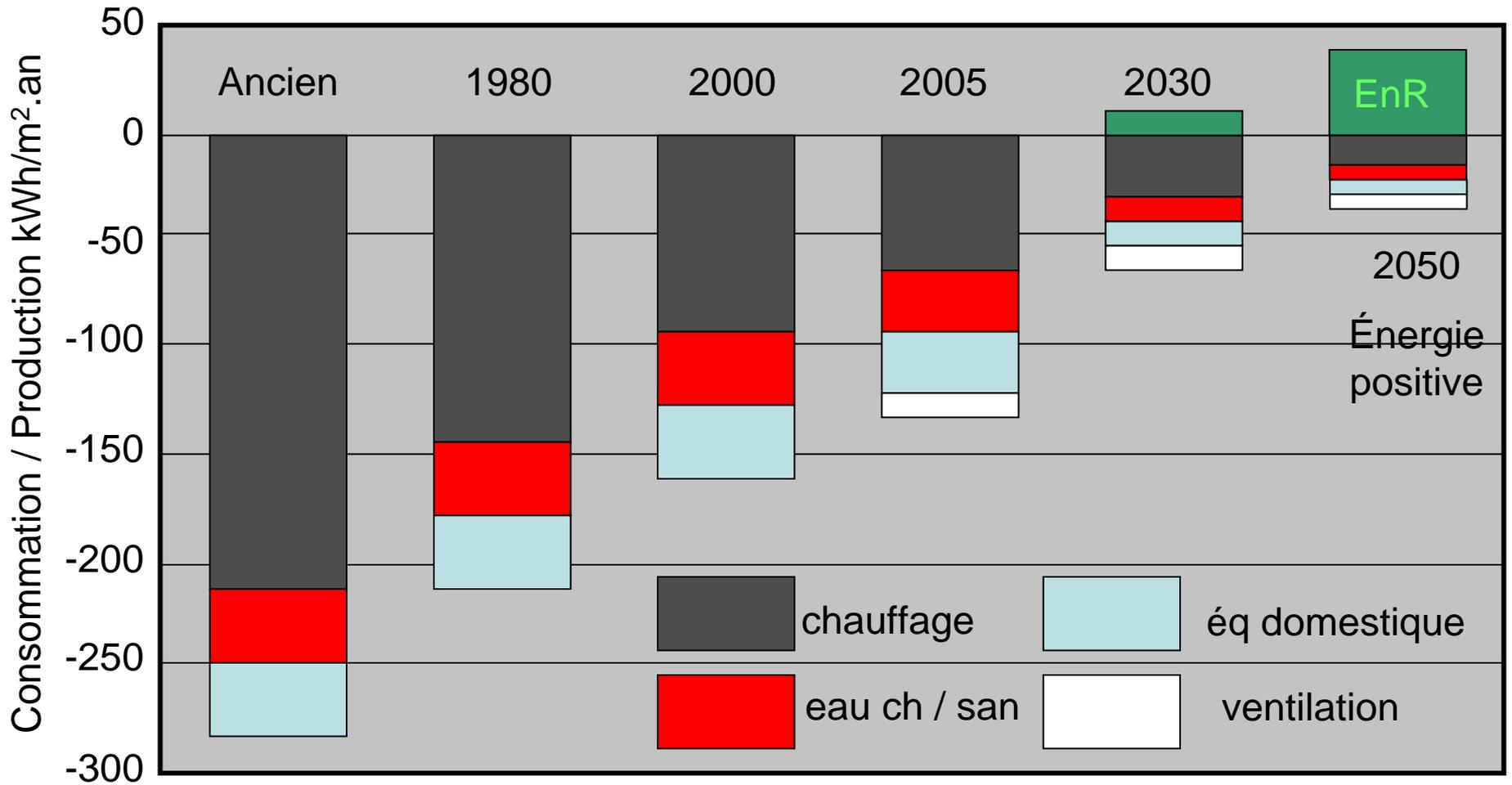
# Consommation d'énergie finale (France, 2006)



# Consommation d'énergie finale (France, 2006)



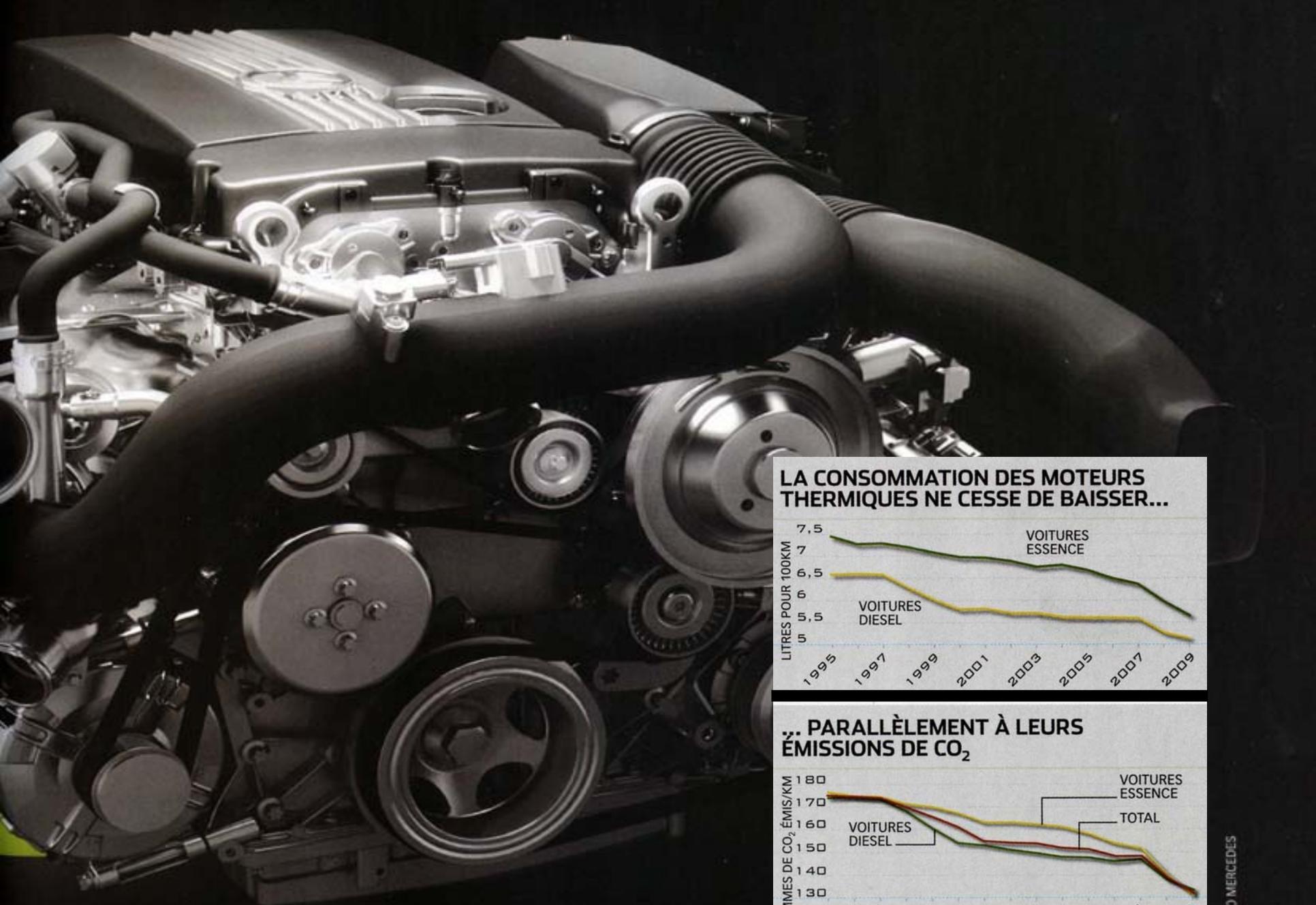




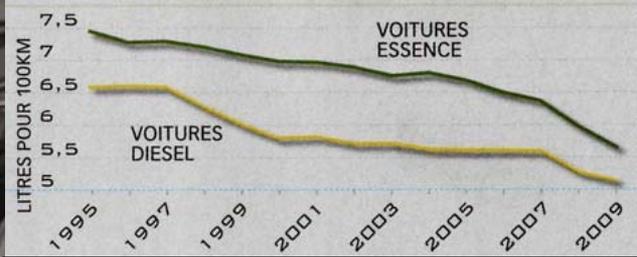


# Quels progrès ?

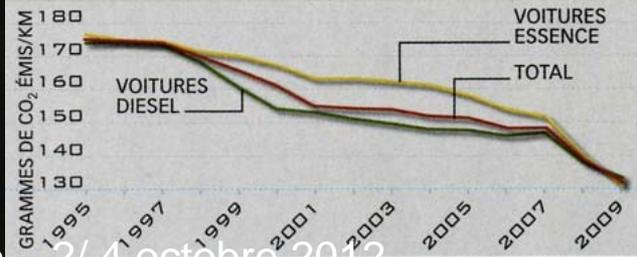




### LA CONSOMMATION DES MOTEURS THERMIQUES NE CESSE DE BAISSER...



### PARALLÈLEMENT À LEURS ÉMISSIONS DE CO<sub>2</sub>



# L'ECO-VEHICULE



Technologies hybrides

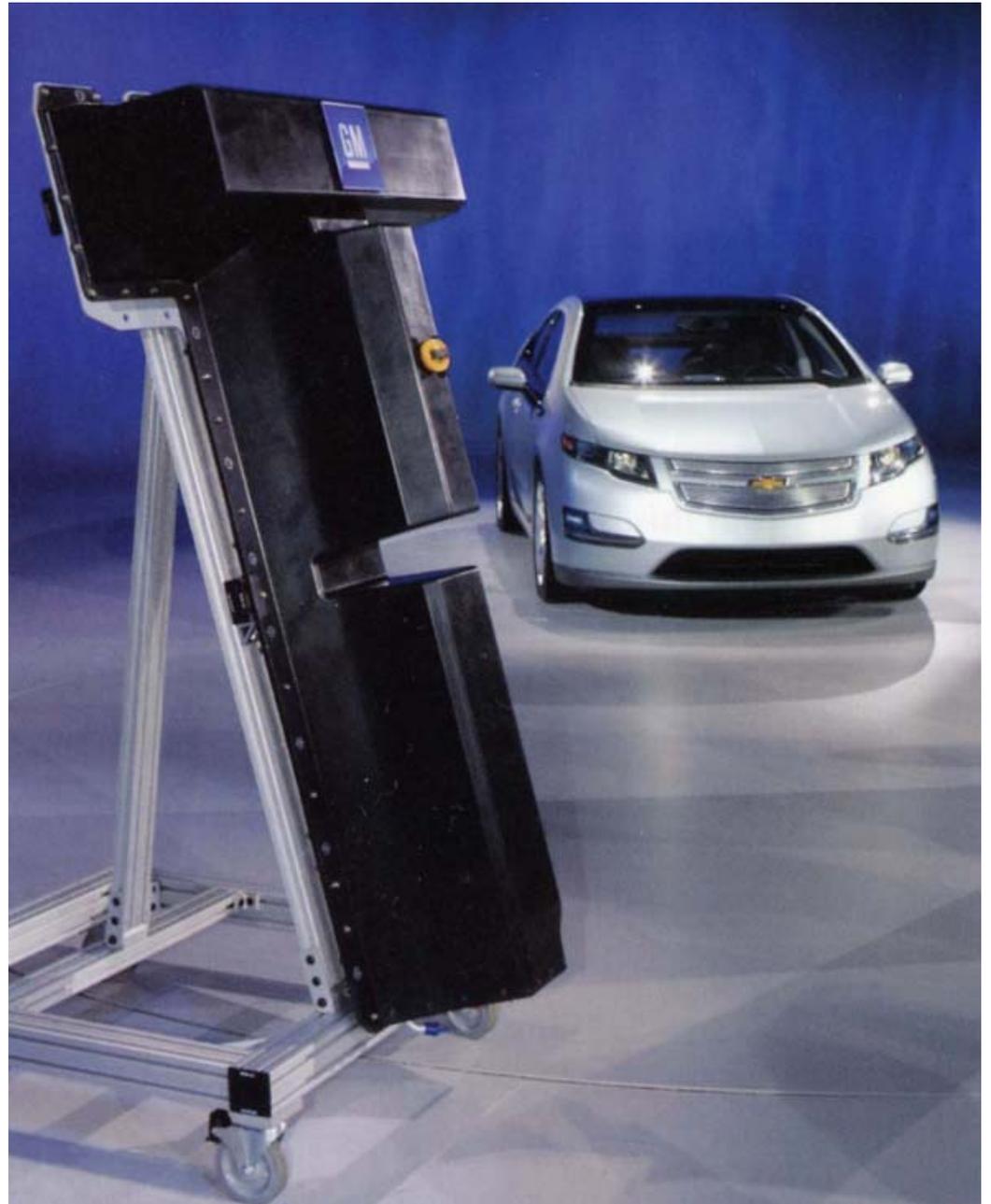
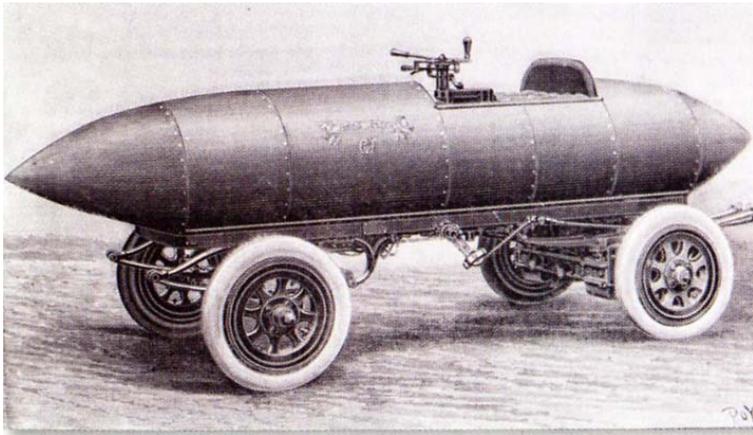


© Toyota



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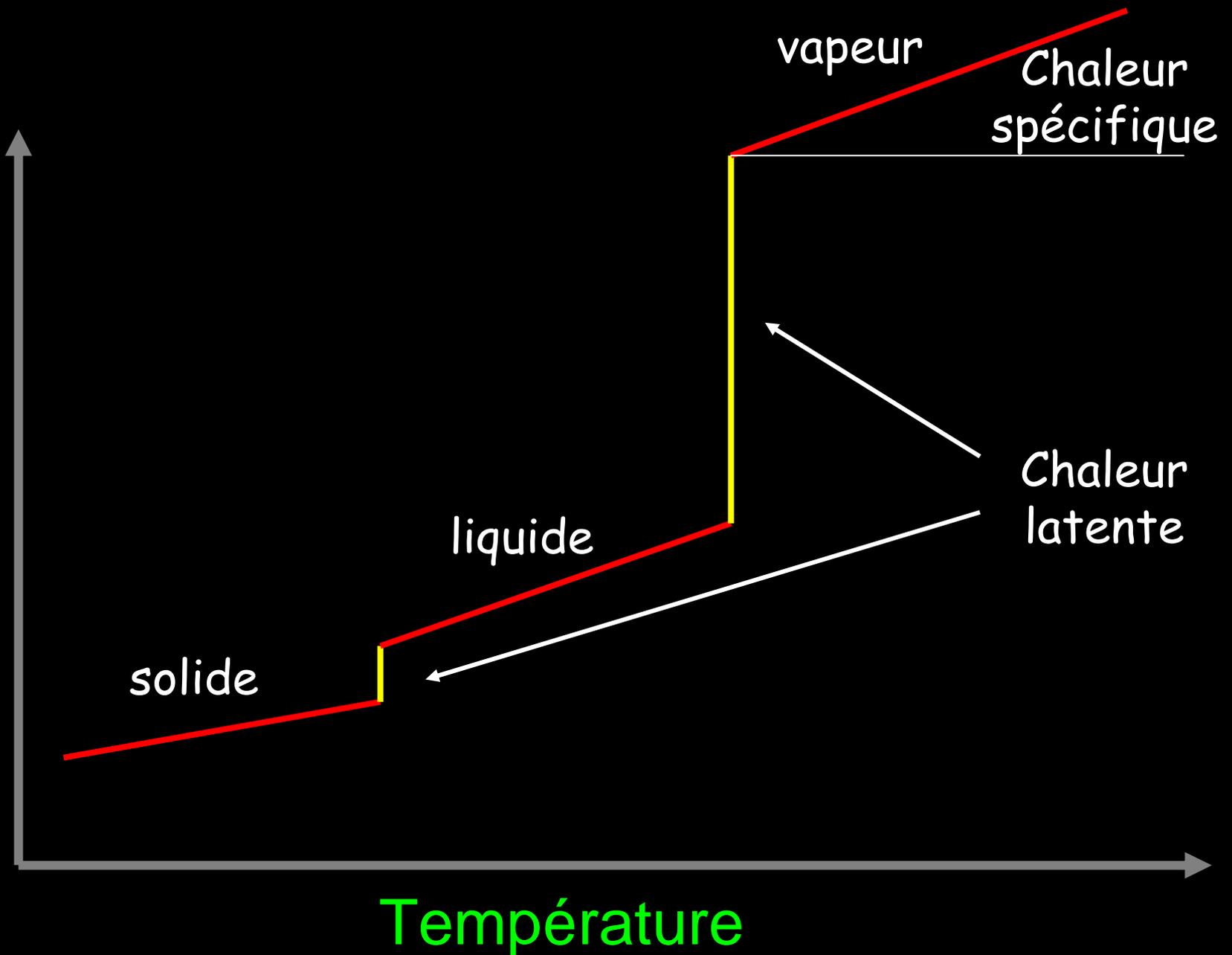






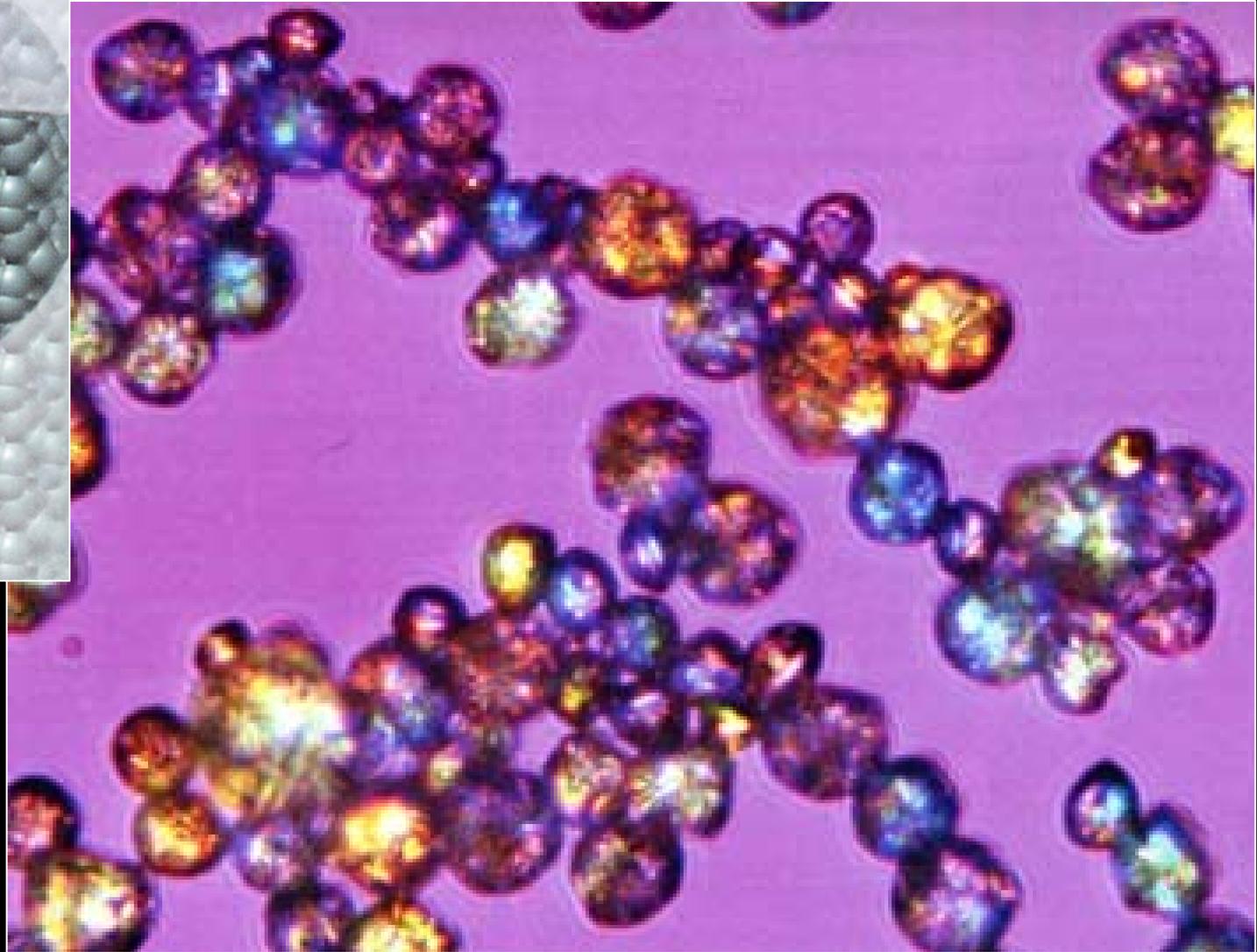
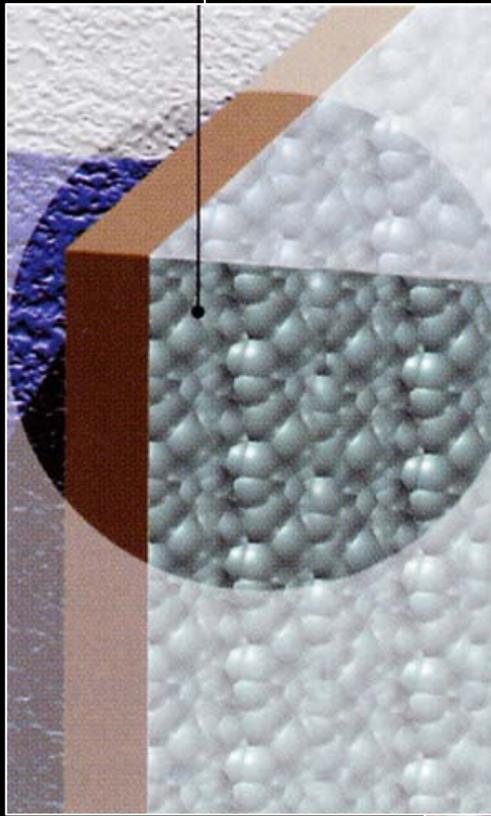
# Une route solaire thermique ?

H  
Quantité de chaleur



*Billes de paraffine*

Un peu plus que l'isolation...



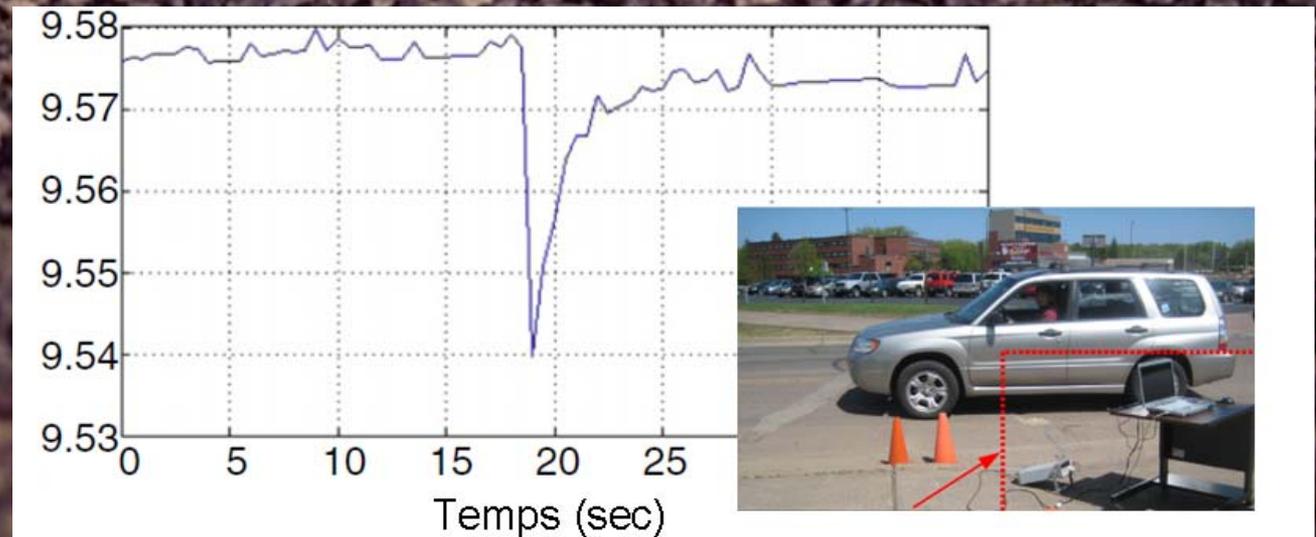
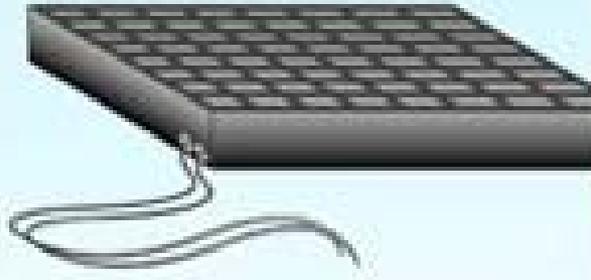
Senior citizen's apartments, Ebnat-Kappel, CH

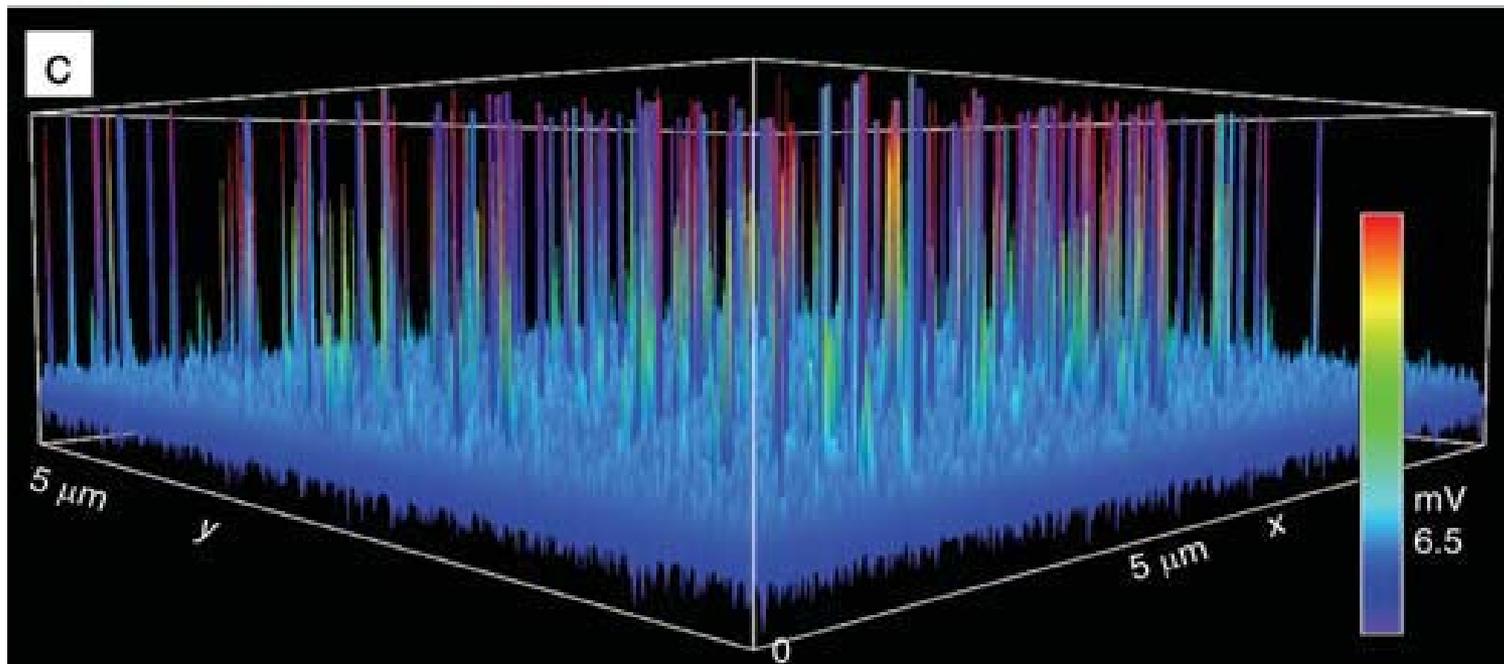
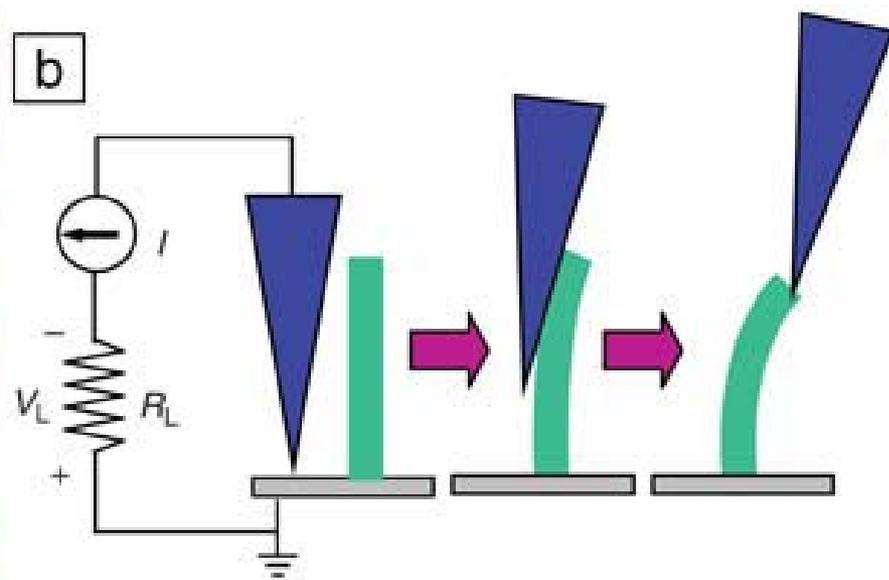
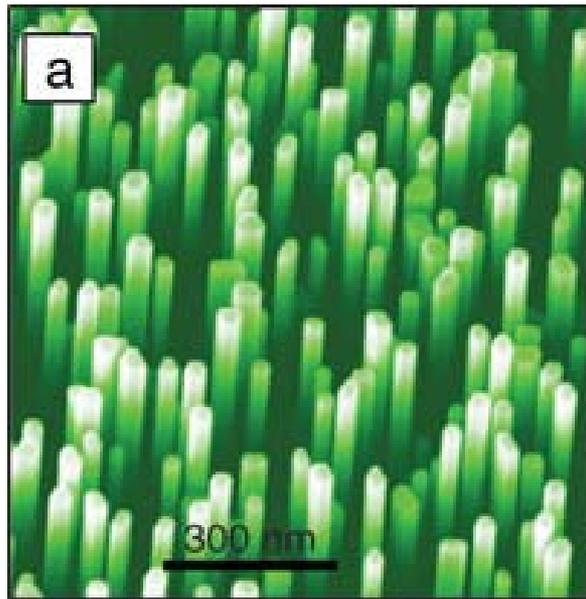


Dietrich Schwarz, architect



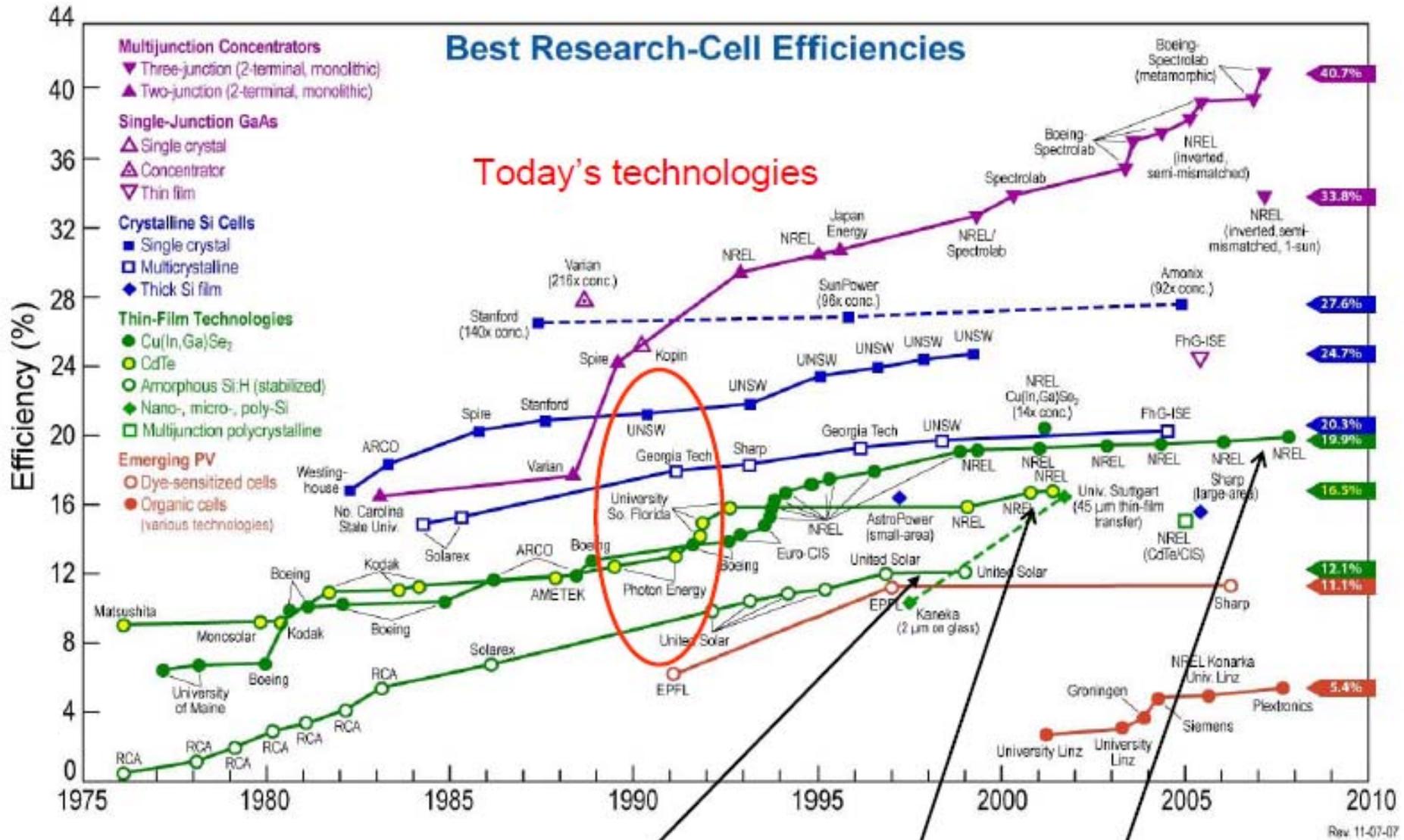
# Une route piézoélectrique ?





# Une route solaire photovoltaïque ?

# The Universe of PV Technologies



Rev. 11-07-07

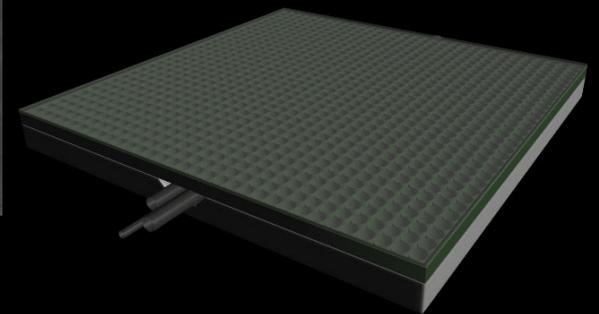
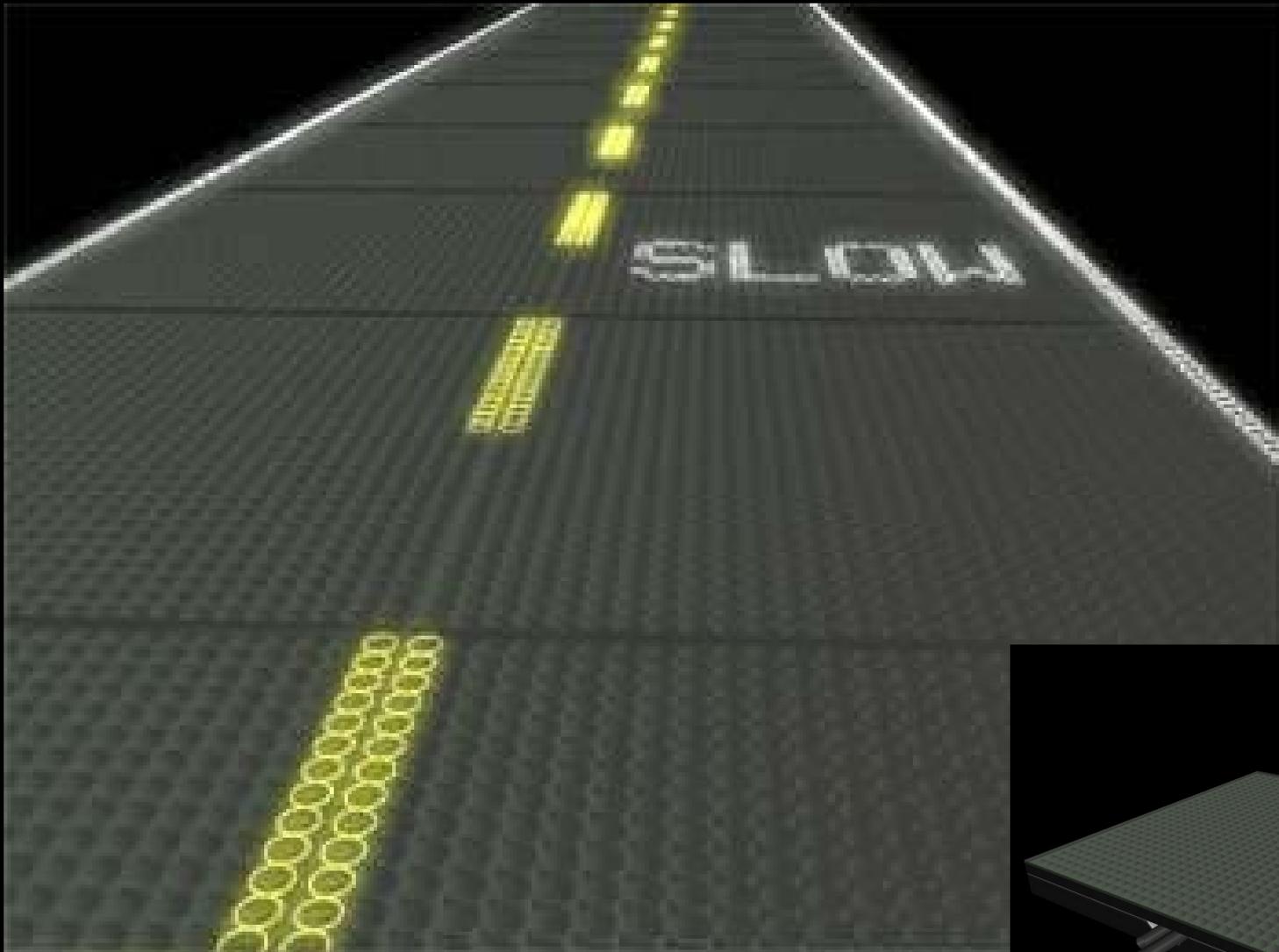
a-Si

CdTe

CIS

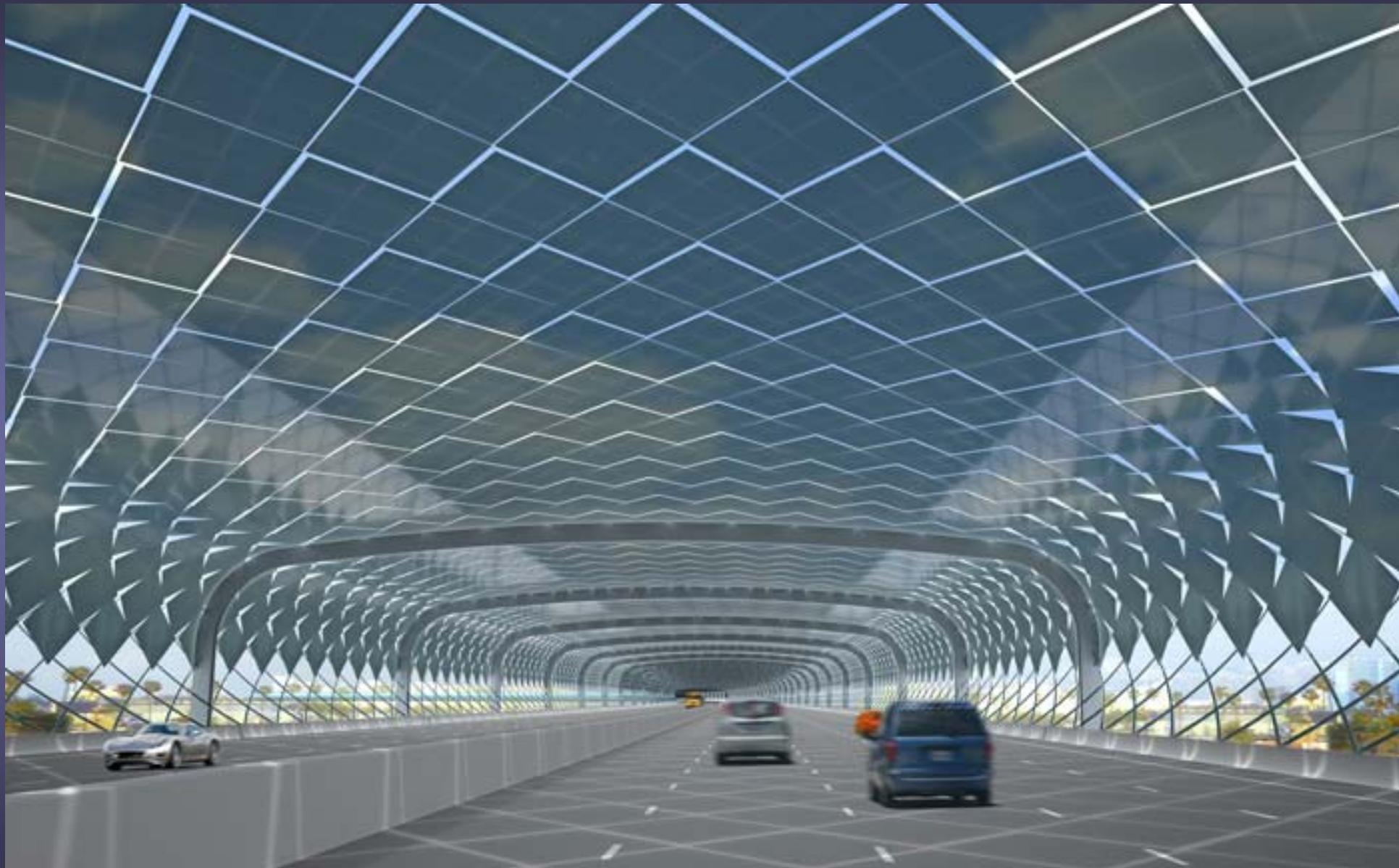






© Solar RoadWays





En couches (ultra)minces



© SHARP

# Cellules photoélectrochimiques





$RRN_{10\%} \cong 40 \text{ GW} \cong 2/3$  du parc nucléaire français

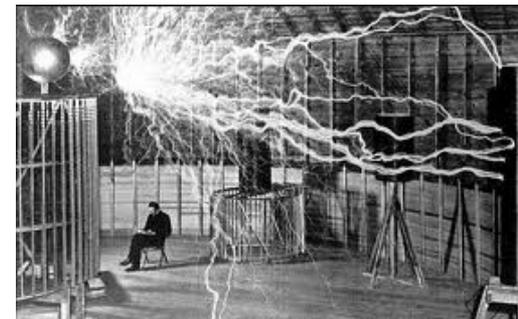
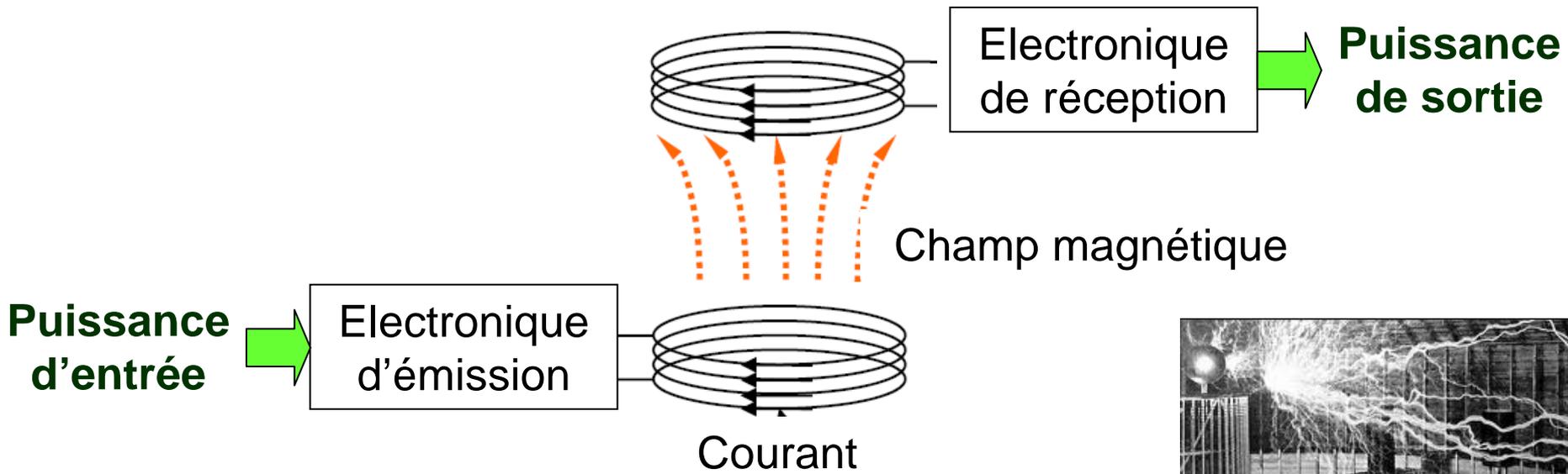
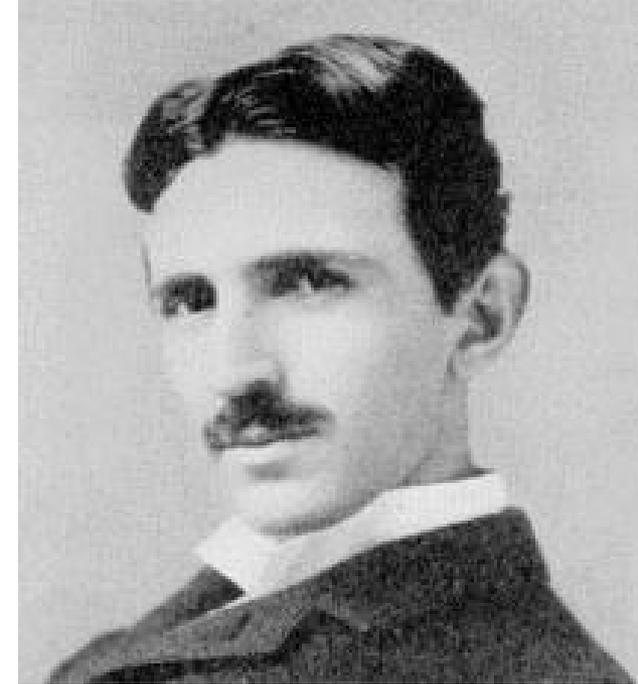


A close-up, low-angle shot of a dark asphalt road surface. A white dashed line runs vertically along the left side of the frame, receding into the distance. The texture of the asphalt is highly detailed, showing small stones and binder. The lighting is soft, creating subtle gradients of grey and black.

Une route à « énergie positive » ?

# Siège de Google, Mountain View, CA









**Wampfler: Charging- discontinuous power transfer**

# Automotive:

## BMW, Germany Floor Conveying System



- 15 vehicles
- 6.6 kW each
- Track length ~75 m



**Wampfler: Rail Applications**

©John T. Boys

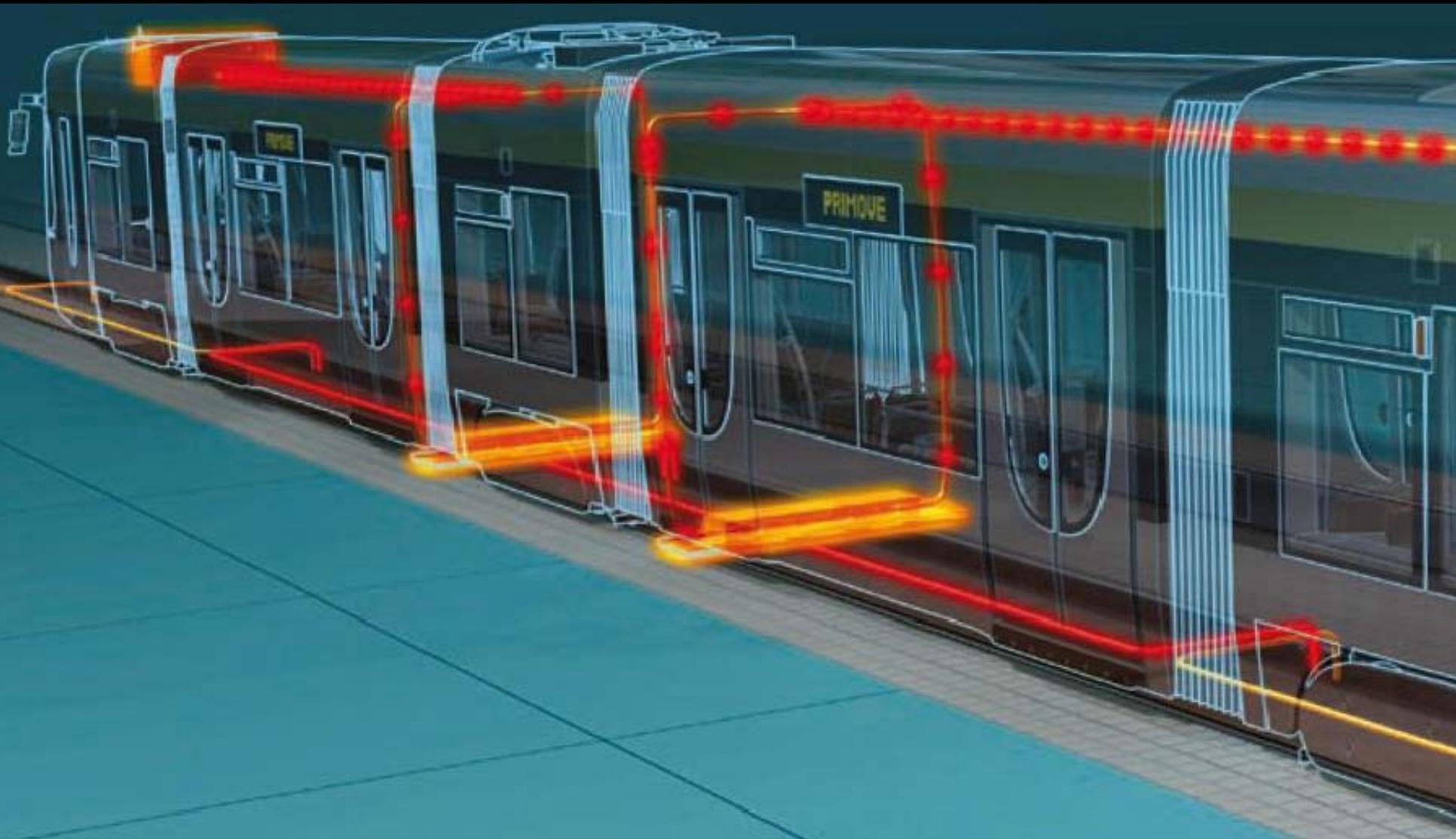


# Etat de l'art:

- ◆ Puissance transmise: 1 à 60 KW
- ◆ Rendement de transfer: 80 à 95%
- ◆ Distance de transfert: 5 à 25 cm



# 2010: Bombardier Primove 270 KW Triphasé



Augsburg, Germany

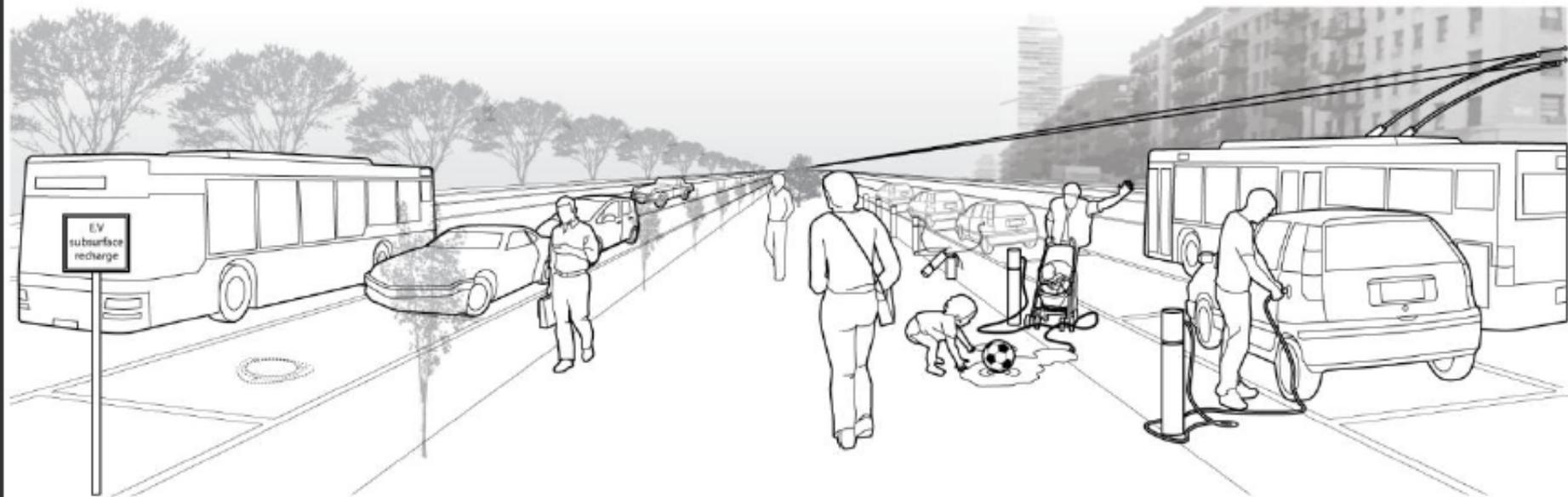
<http://www.primovecity.bombardier.com>





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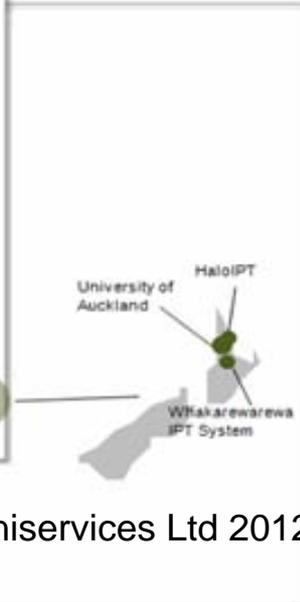
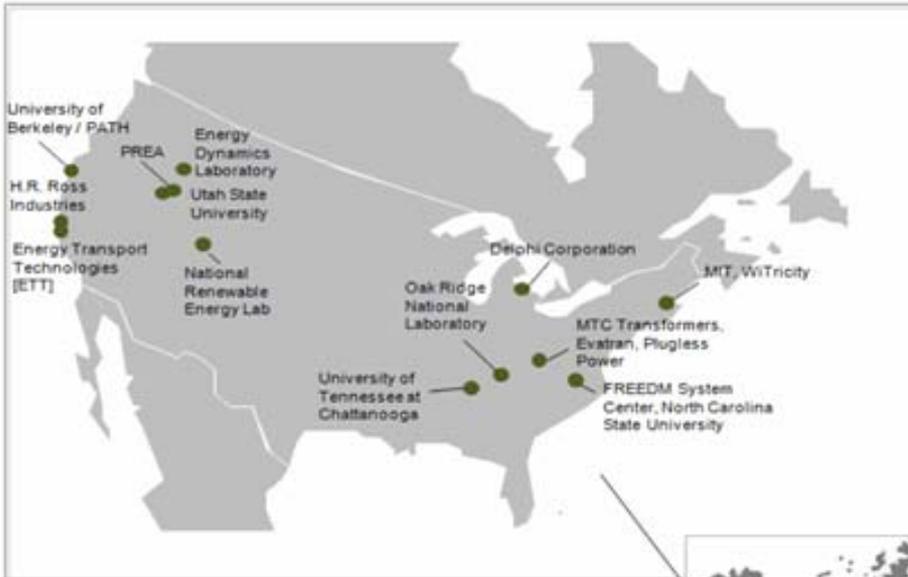
© Auckland Uniservices Ltd 2012

- ◆ Pas de risque d'électrocution
- ◆ Laisse la surface de chaussée libre pour tous les modes
- ◆ Peu sujet au vandalisme
- ◆ Aucune installation visible en surface
- ◆ Pas besoin de sortir du véhicule
- ◆ Gain de ~80% sur la batterie

# Inductive power transfer projects emerge globally and focus different fields of application.



© Auckland Uniservices Ltd 2012



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<http://www.primovecity.bombardier.com>



Lommel, Belgique

Bombardier / VanHool / Volvo

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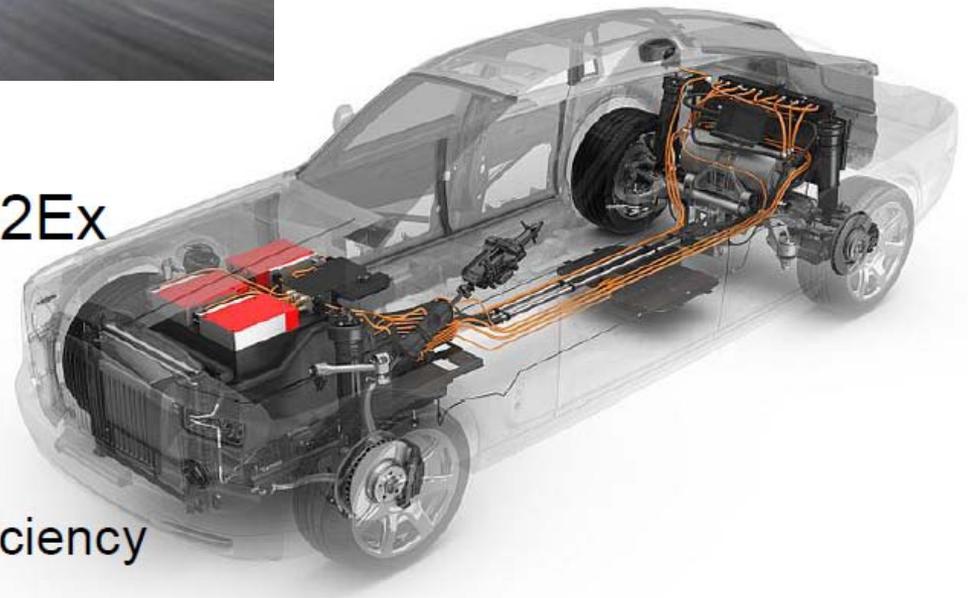
# OLEV (OnLine Electric Vehicle)



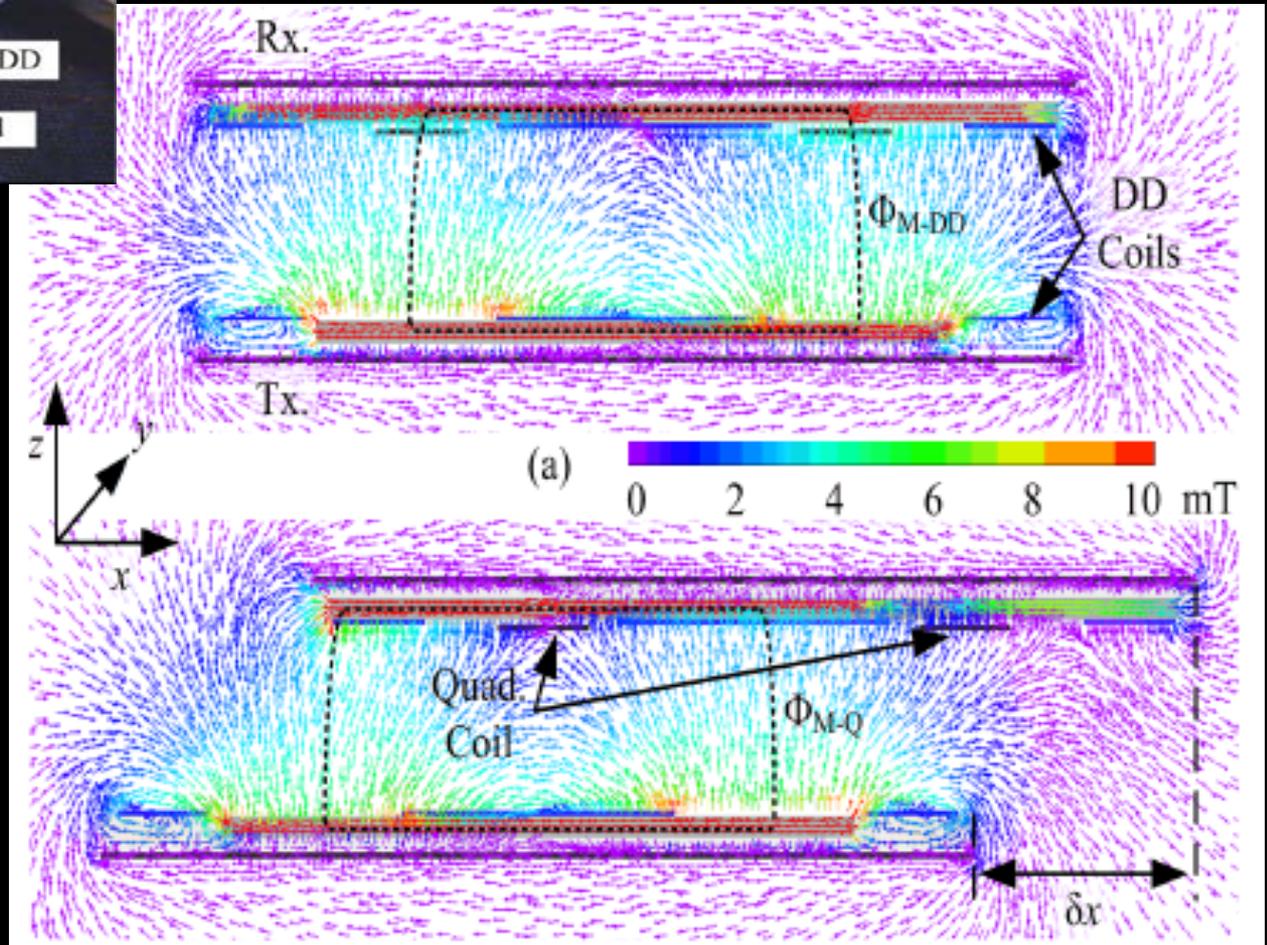
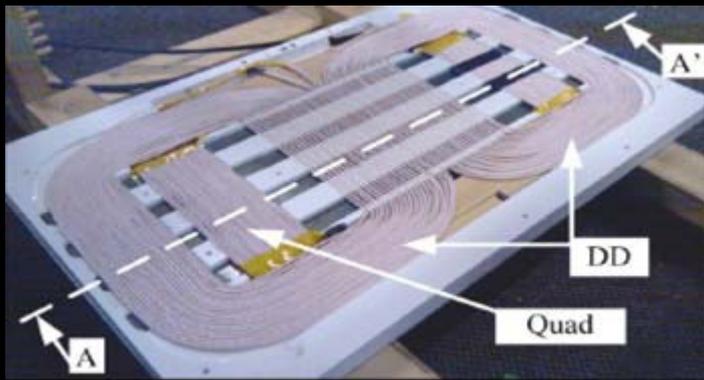
KAIST (Korea Advanced Institute of Science and Technology)



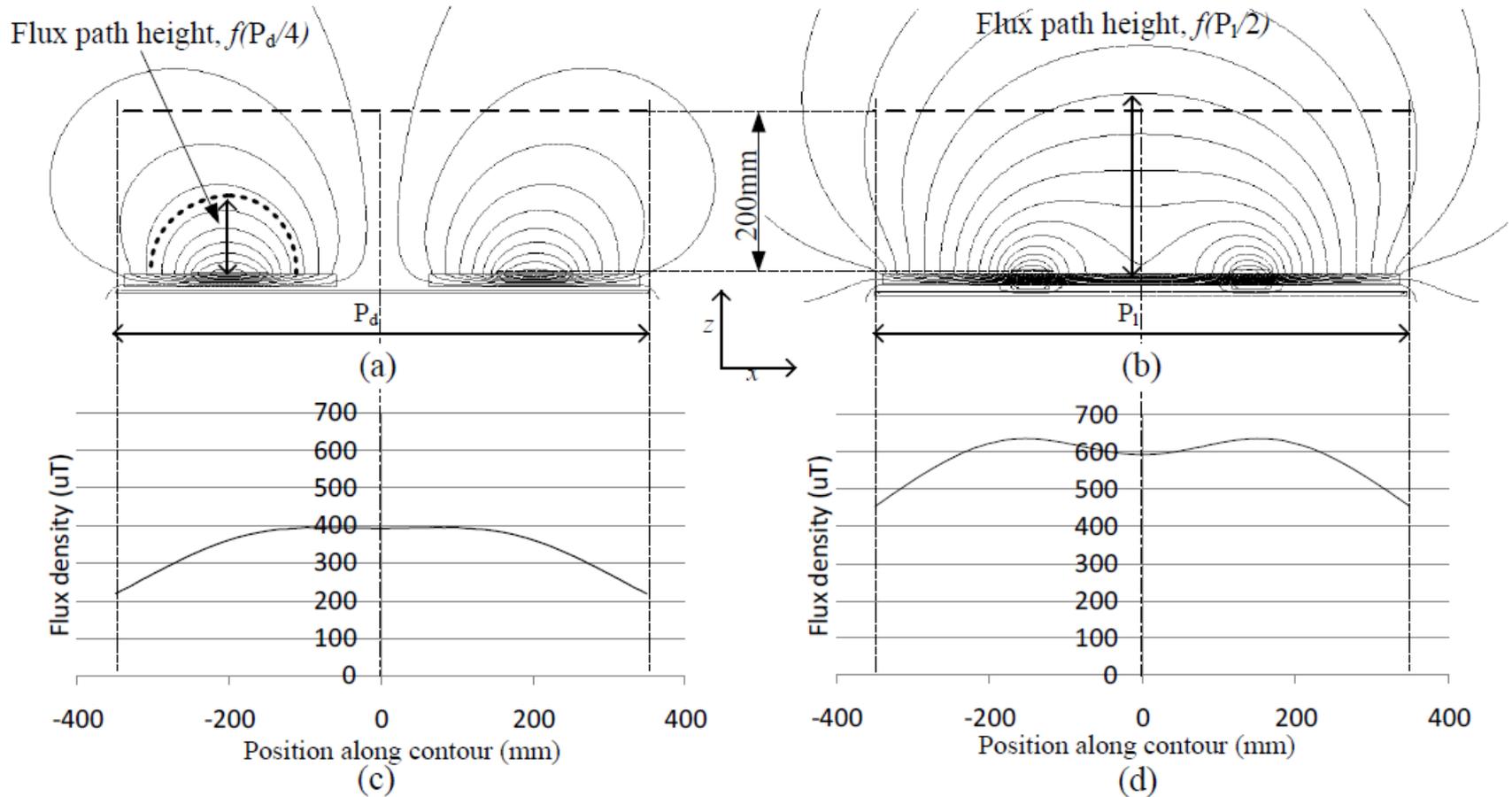
## Rolls Royce Phantom 102Ex



7kW charge system > 90% Efficiency

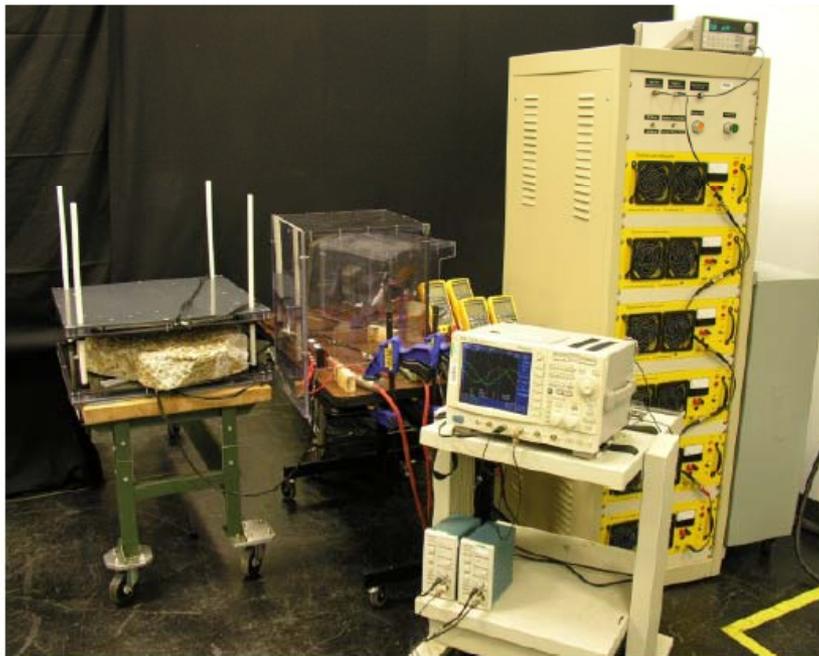


# Optimiser les flux magnétiques

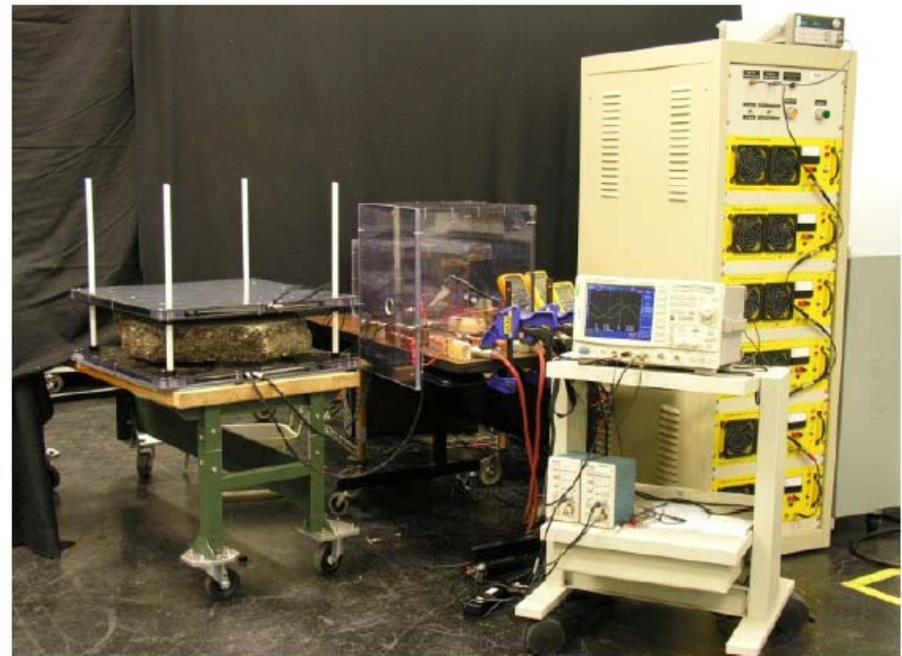


# WPT and roadway surfacing materials

- ORNL investigated the influence of conventional roadway surfacing materials on WPT coupling performance and loss.
  - Sections of in-highway aged concrete and asphalt were tested



Concrete section (110mm)



Asphalt section (~110mm) thick under test

# Couplage avec la conduite automatisée

D'après Tom M. Gasser (BAST) / Jacques Ehrlich (Ifsttar / LIVIC)

Possible aujourd'hui

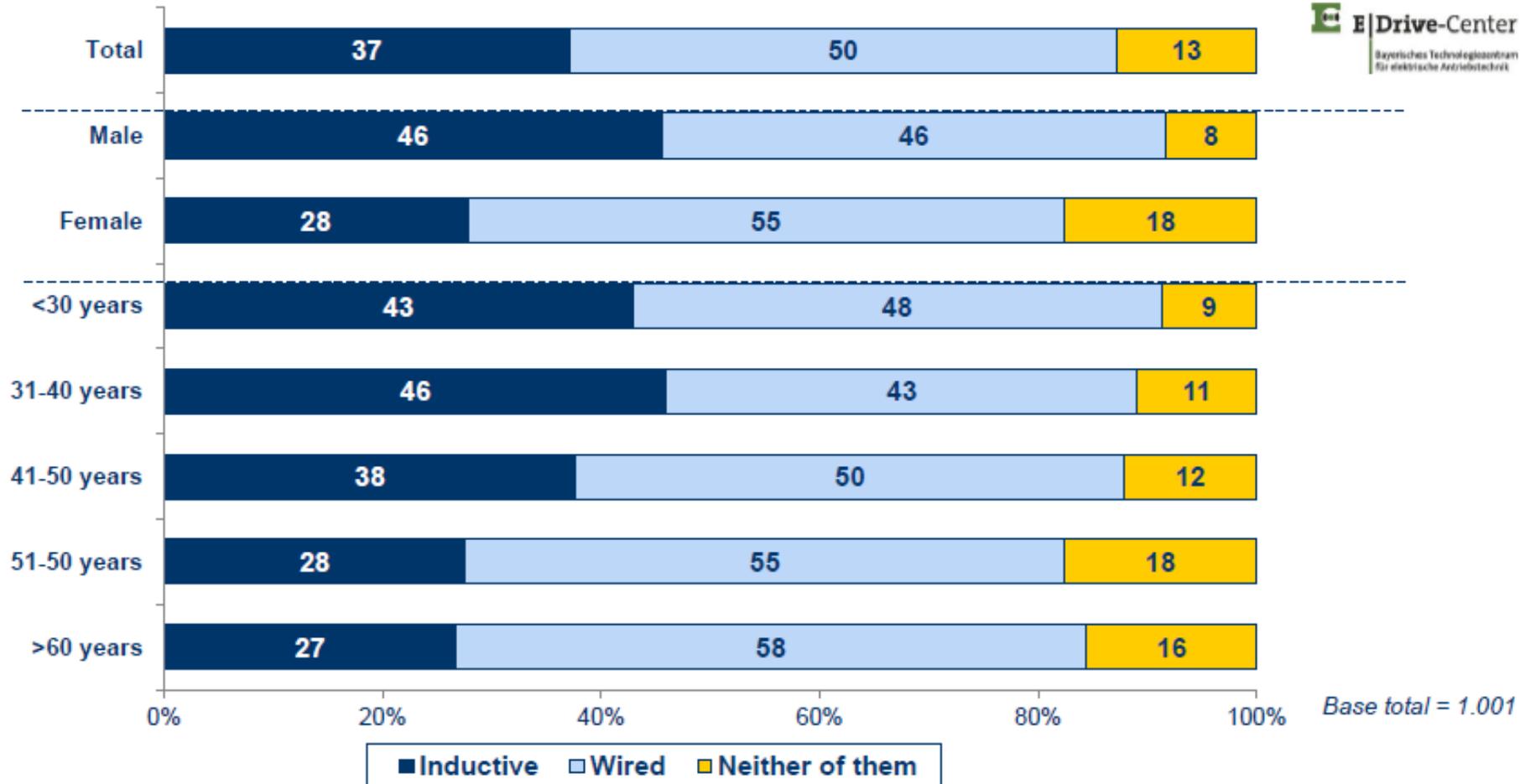
Dans le futur

- **Driver Only:**
  - Le conducteur exécute manuellement la tâche de conduite
- **Driver Assistance:**
  - Le conducteur contrôle en permanence la trajectoire (en latéral et longitudinal). Des aides pallient les défaillances (ABS, ESC, LDW, FU)
- **Partial automation:**
  - Le véhicule contrôle la trajectoire en latéral et/ou en longitudinal, le conducteur doit rester constamment prêt à reprendre le contrôle (SL, CC, ACC, LK)
- **High automation:**
  - Le véhicule contrôle la trajectoire en latéral et en longitudinal, le conducteur doit reprendre le contrôle sur requête du système après un certain délai (ABV)
- **Full automation: “hands-off, feet-off, brain-off”**
  - Le système contrôle la trajectoire en longitudinal et latéral en permanence. En cas de demande de reprise de contrôle par le conducteur et si celui-ci ne réagit pas le véhicule exécute une “manœuvre à risque minimal”



## Preferred charging technology

- Question 3b : Which of the two charging possibilities would you prefer?





IFSTTAR

Merci de votre attention



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