

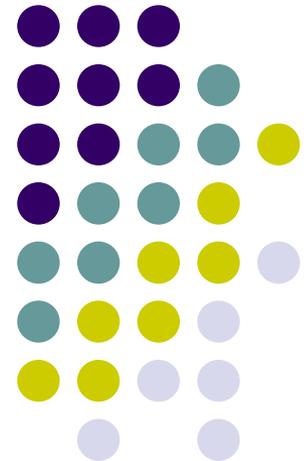
# Sustainable GoGreen logistics solutions for emerging metropolis

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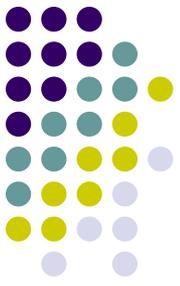
Andrei Angheluta  
Carmen Costea,  
ASE Bucharest

Research developed under  
COST MP0801  
CNCSIS PNII 774

With a start point in a proposed development DHL  
plan for Istanbul

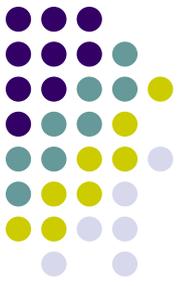


# Logistics impact on environment changes and degradation



- Innovative “green” logistics solutions can be applied at metropolis level, to get a pollution and traffic congestion decrease.
- The study focuses on a DHL Business Plan for Istanbul, a state of the art non polluting transportation mode implementation (by land/by sea) and an estimative cost calculation that will be incurred by this challenging task.
- Pioneering combinations of levers lead to six solutions, three of them qualify for further investigation:
  - **Trucks powered with compressed natural gas**
  - **Trucks powered with electricity and cargo ferries**
  - **Trucks powered with electricity and cargo trams**
  - **Underground transportation pipeline systems**
  - **Trucks powered with fuel cells**
  - **Air delivery**

## THE SELECTED GOGREEN ARE:



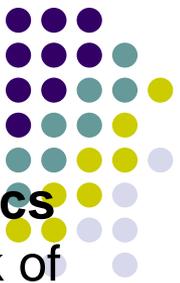
### **Logistic concept based on gas-powered trucks ensures high reliability and eco-friendliness**

- Cargo trams transport can deliver goods quietly to the city center, last mile by electric-powered trucks
- Cargo Ferries allow to avoid congested bridges, last mile by electric-powered trucks

The final result consists of a mathematical model that can be applied for environment conflicts.

The research reveals that, although we expect to have higher cost for such a non polluting challenge, on the long run the benefits of a durable go green policy has higher impact in terms of money savings, environment protection and next generation life standards. As the output is positive, these results can be successfully applied worldwide.

# Environment Technologies Barriers



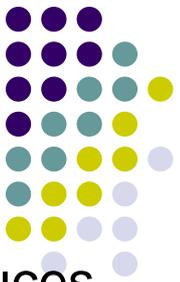
**NOT the technology itself but in production capacities and logistics**  
**BUT customers' reluctance** to buy these technologies caused by lack of conviction in its practicability and chance of survival and fear that these technologies might deprive them of flexibility.

- ♣ **Long investment periods:** the latest technology is not always implemented directly or existing technology is not adapted in short-enough intervals to facilitate inter - European compatibility.
- ♣ **Abating all emissions at the same time:** the lack of political framework and the sector-based political approaches towards all emission reduction SO<sub>x</sub>, NO<sub>x</sub> and CO<sub>2</sub> and noise at the same time. Alternative fuels are being tested but as for biofuels, the 2nd and 3rd generation still needs to be developed.
- ♣ **Administrative barriers.** resistance from the public administration, requirements, regulations and standards.



- ♣ **Costliness of environmental technologies:** fear of cost and price rises prevents firms (logistic firms and their customers) from taking up or demanding the take-up of environmental technologies.
- ♣ **Current availability of fuels - Infrastructure bottlenecks.**
  - Lack of perspective and availability, with regard to alternative fuels (biofuels, hydrogen, etc.) as general substitution of traditional fuels
  - High cost for modifications considered as alternative to the current fuel supply infrastructure is adapted to traditional fuels (gasoline and diesel).
  - Storage conditions for alternative fuels as they often cannot be stored for very long, require certain storage conditions, and cannot be mixed with other fuel types (e.g. the mixture of different blends of biofuels and traditional fuels).

# SUSTAINABLE LOGISTICS SOLUTIONS FOR EMERGING METROPOLIS: ISTANBUL – A PARTICULAR CASE



Purpose: find a way to establish a logistic retailing concept that reduces emissions and congestion facing the following **key challenges**:

- High traffic congestion;
- Pollution;
- Increased pressure to reduce CO2 emissions;
- Water divides city into European and Asian sides.

● The key goals of the gogreen concept are summarized in:

Reliability

Cost-efficiency

Eco-friendliness

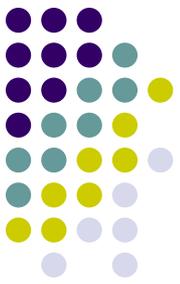
Performance

Openness, flexibility, communication

Competitive self-esteem

Efficiency

# General overview of gogreen solutions provided by DHL



## 1. Transportation mode

Means of delivery goods to the hypermarkets:

- Road
- Rail
- Air
- Maritime transportation

## 2. Location

Hypermarkets

- Access to delivery of goods
- Access to customers

Distribution centers

- Costs vs. location advantages

## 3. Connection

- Time of delivery goods
- Ways to connect districts and sides of the city

# Innovative green solutions for Istanbul

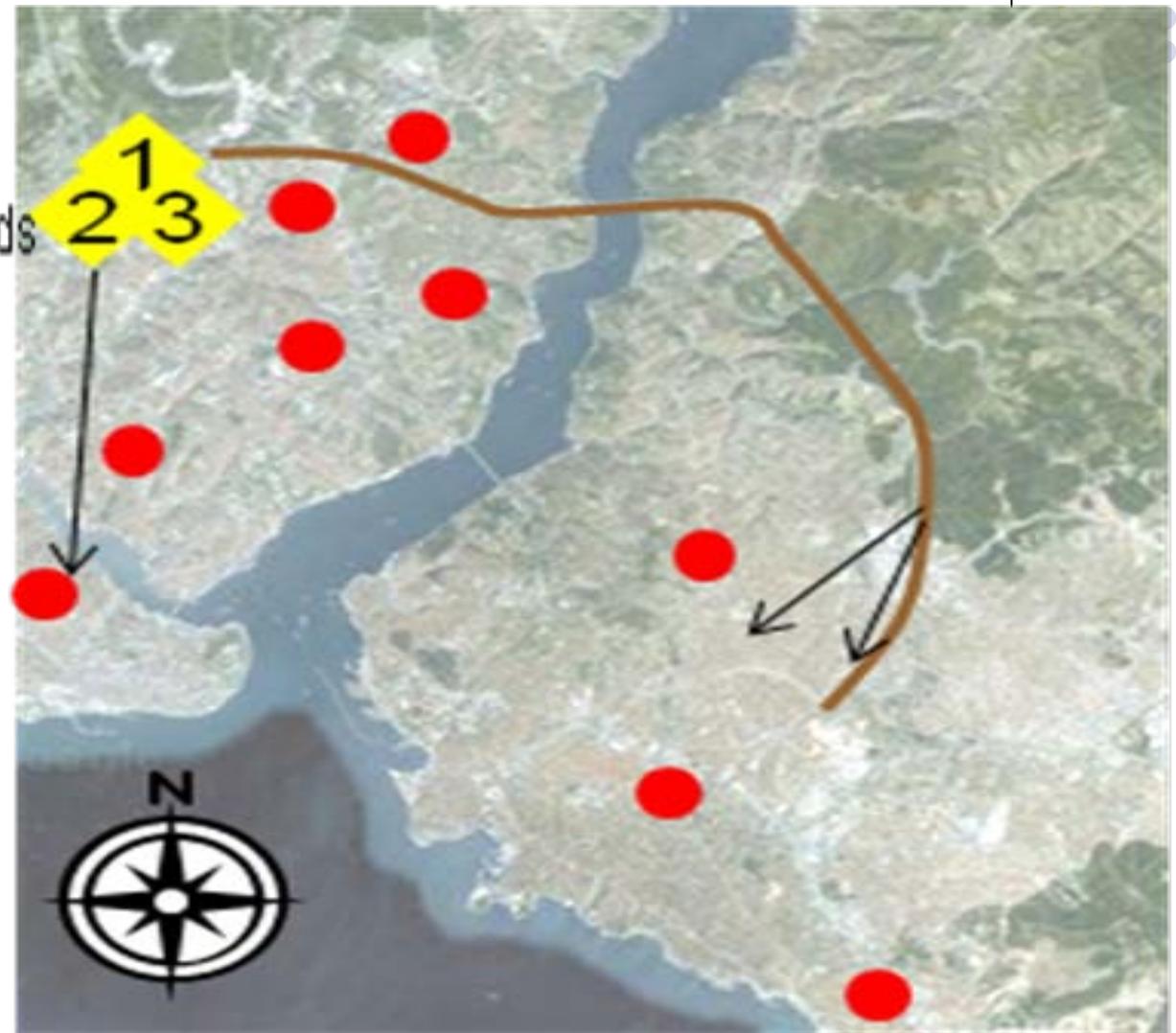


| Transportation mode                               | Location                                                                                            | Connection                                                                                    | Further investigation?                                                                           |
|---------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Trucks powered with compressed natural gas (CNG)  | Priority is close ness to highways<br>Customers may also reach hypermarkets via public transport    | All deliveries during nighttime<br>Use of Fatih Sultan Mehmet Bridge to connect East and West | Powerful ways to tackle CO <sub>2</sub> emissions<br>No positive influence on traffic congestion |
| Trucks powered with electricity and cargo ferries | Priority is close ness to the river<br>Customers may also reach hypermarkets via public transport   | Use of Bosphorus Strait to connect East and West                                              | Reduction in CO <sub>2</sub> emissions<br>Reduction in congestion                                |
| Trucks powered with electricity and cargo trams   | Priority is close ness to tram tracks<br>Customers may also reach hypermarkets via public transport | Cargo trams used for main part of the route<br>Electric trucks used for last mile             | No CO <sub>2</sub> emissions<br>Reduction in congestion                                          |
| Underground transportation pipeline systems       | Customers may also reach hypermarkets via public transport                                          | Connection trough extensive network of underground pipes                                      | Reduction in congestion and CO <sub>2</sub> emissions<br>Too expensive to install                |
| Trucks powered with fuel cells                    | Priority is close ness to highways                                                                  | Use of Fatih Sultan Mehmet Bridge                                                             | Still in development<br>Too expensive                                                            |
| Air delivery                                      | Priority is close ness to airfields                                                                 | Helicopters are used to drop containers with self-navigation system                           | Reduction in congestion<br>Too expensive<br>Not developed yet                                    |

# Logistic concept based on gas-powered trucks ensures high reliability and eco-friendliness



-  Distribution Center (DC)
  - 1 Perishables & Frozen goods
  - 2 Non-chilled goods
  - 3 Medication
-  Hypermarket (HM)
-  Highway
-  Truck route

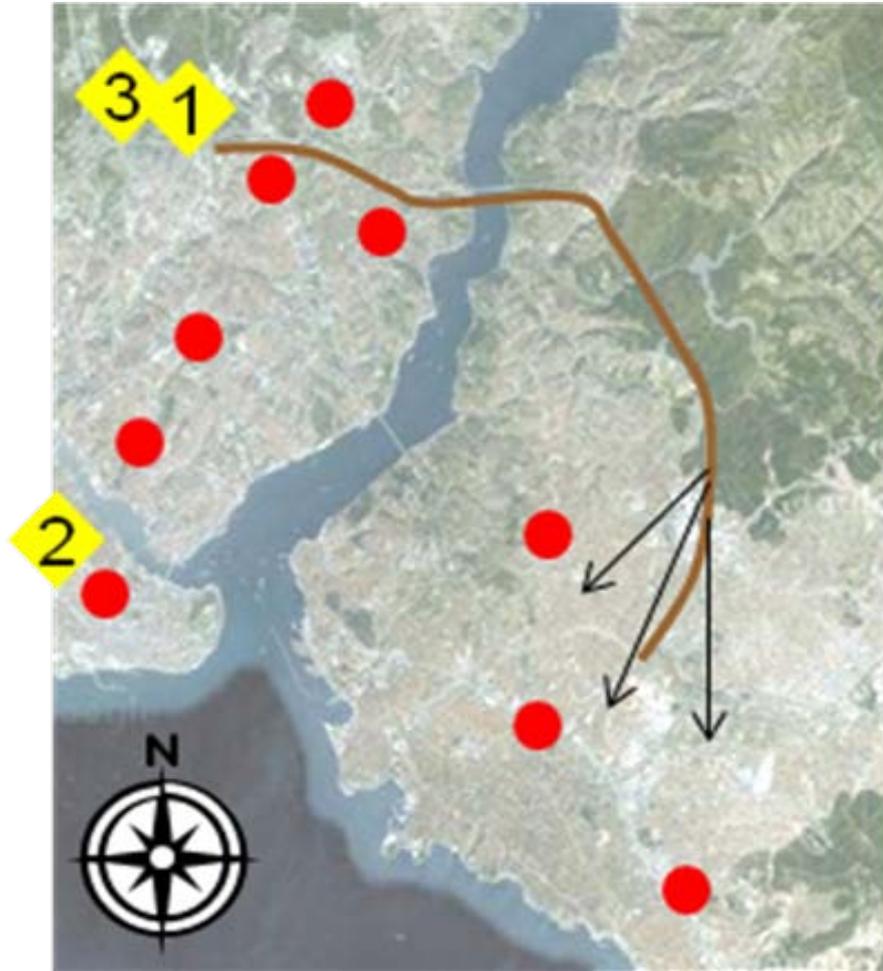
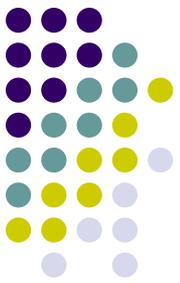


| <b>Initial Investment (Land, 3DC)</b>                             |                           |                          |                              |                   |
|-------------------------------------------------------------------|---------------------------|--------------------------|------------------------------|-------------------|
| Distribution Centre                                               | Warehouse size (sqm)      | DC location              | Euro/sqm                     | Total DC Cost (€) |
| <b>Non-Chilled DC</b>                                             | 15,000                    | Umraniye (Asia Side)     | 270                          | 4,044,000         |
| <b>Perishables DC</b>                                             | 25,000                    | Umraniye (Asia Side)     | 270                          | 6,740,000         |
| <b>Medication DC</b>                                              | 365                       | USKUDAR (Asia Side, D6)  | 430                          | 156,950           |
| <b>Total</b>                                                      | <b>40,365</b>             |                          |                              | <b>10,940,950</b> |
| <b>Initial Investment (99 Electric Trucks)</b>                    |                           |                          |                              |                   |
| Distribution Centre                                               | Total No. of Trucks (12T) | Cost (€)/Ele Truck (12T) | Total Truck Cost (€)         |                   |
| <b>Non-Chilled</b>                                                | 40                        | 95,403                   | 3,784,449                    |                   |
| <b>Perishables</b>                                                | 57                        | 95,403                   | 5,435,113                    |                   |
| <b>Medication</b>                                                 | 2                         | 95,403                   | 184,392                      |                   |
| <b>Total</b>                                                      | <b>99</b>                 |                          | <b>9,403,954</b>             |                   |
| <b>Initial Investment (6 Car Ferries)</b>                         |                           |                          |                              |                   |
| Each Car Ferry can hold 30 Electric Trucks (12t)                  |                           |                          |                              |                   |
| Cost (€)/Car Ferry                                                | Total No. of Trucks       | Total Costs (€)          |                              |                   |
| 1,752,400                                                         | 6                         | <b>10,514,400</b>        |                              |                   |
| <b>Estimated Profit from Metro Group Turkey</b>                   |                           |                          |                              |                   |
| <b>METRO Group Turkey Sales (€)<br/>in 36 Hypermarket in 2008</b> | <b>Sales in 9 HM</b>      | <b>5% Margin</b>         | <b>Estimated Profit/Year</b> |                   |
| 1,300,000,000                                                     | 325,000,000               |                          | <b>16,250,000</b>            |                   |



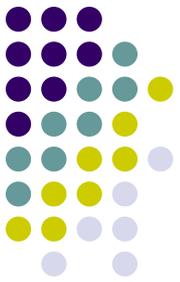
- **Analysis:** All DCs are located in the European part in the district with the lowest land price. Deliveries are made by trucks using a highway, bridge, and main roads.
- **Reliability:** No effect on traffic congestion, put additional pressure on existing roads and bridges → High dependency on traffic situation (less time control of deliveries).
- **Eco-friendliness:** Reduction of CO<sub>2</sub> and overall pollution up to 40% in comparison with conventional vehicles; Medium reduction of noise.
- **Cost-efficiency:** Initial investment: 30% higher than for conventional trucks; Low fuel costs (but need fuel stations).
- **Evaluation:** Reduced CO<sub>2</sub> emission; Noise-reduction; Concept already tested; Widespread availability of natural gas stations; Does not overcome challenge of congestion; Additional pressure on roads and bridges; Higher initial investment than for conventional trucks.

Mixed quiet cargo trams transport delivering goods to city center, by electric powered trucks for the last mile

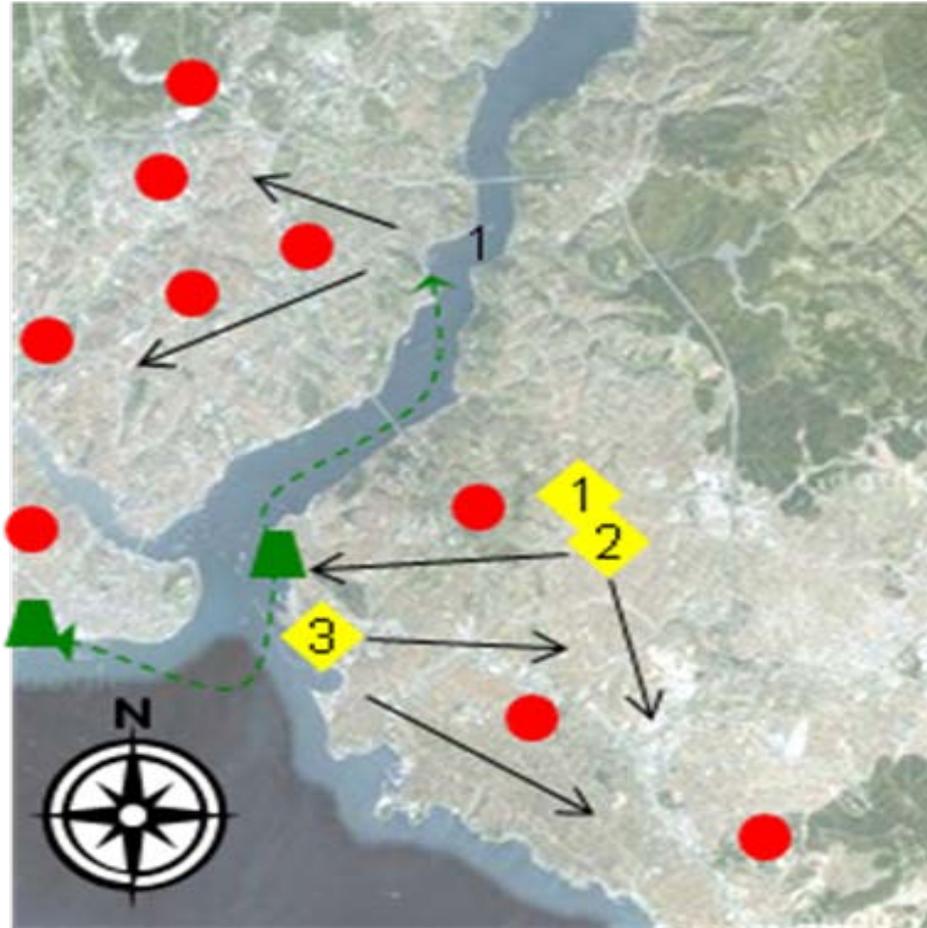


-  Distribution Center (DC)
  - 1 Perishables & Frozen goods
  - 2 Non-chilled goods
  - 3 Medication
-  Hypermarket (HM)
-  Tram Terminal (TT)
-  Tram line existing
-  Tram line to be built
-  Highway

|                                                                   | Total No. of Perishables Goods pallets/month | Total No. of Non-Chilled Goods pallets/month | Total No. of Medication Goods pallets/month |                    |                                                                             |                            |              |
|-------------------------------------------------------------------|----------------------------------------------|----------------------------------------------|---------------------------------------------|--------------------|-----------------------------------------------------------------------------|----------------------------|--------------|
| European side                                                     | 33,130                                       | 23,068                                       | 562                                         |                    |                                                                             |                            |              |
| Asian side                                                        | 30,448                                       | 21,201                                       | 516                                         |                    |                                                                             |                            |              |
| TOTAL                                                             | 63,578                                       | 44,269                                       | 1,078                                       |                    |                                                                             |                            |              |
|                                                                   |                                              |                                              |                                             |                    |                                                                             |                            |              |
|                                                                   |                                              |                                              |                                             |                    |                                                                             |                            |              |
| <b>Pallets PER DAY</b>                                            |                                              |                                              |                                             |                    |                                                                             |                            |              |
|                                                                   | <b>European side</b>                         | <b>Asian side</b>                            | <b>Total</b>                                |                    |                                                                             |                            |              |
| Perishables                                                       | 1,069                                        | 982                                          | 2,051                                       |                    |                                                                             |                            |              |
| Non-Chilled                                                       | 744                                          | 684                                          | 1,428                                       |                    |                                                                             |                            |              |
| Medication                                                        | 18                                           | 17                                           | 35                                          |                    |                                                                             |                            |              |
|                                                                   |                                              |                                              |                                             |                    |                                                                             |                            |              |
|                                                                   |                                              |                                              |                                             |                    |                                                                             |                            |              |
| <b>No. of Trucks Deliveries PER DAY</b>                           |                                              |                                              |                                             |                    | <b>Total No. of Trucks Need/day</b>                                         |                            |              |
| We take 12-tons truck, 18 pallets per truck, so EVERY DAY we need |                                              |                                              |                                             |                    | <b>Assume each truck would transport 2 times a day within 8 hours shift</b> |                            |              |
|                                                                   |                                              |                                              |                                             |                    |                                                                             |                            |              |
|                                                                   | <b>European side</b>                         | <b>Asian side</b>                            | <b>Total</b>                                |                    | <b>European side</b>                                                        | <b>Asian side</b>          | <b>Total</b> |
| Perishables                                                       | 59                                           | 55                                           | 114                                         | <b>Perishables</b> | 30                                                                          | 27                         | 57           |
| Non-Chilled                                                       | 41                                           | 38                                           | 79                                          | <b>Non-Chilled</b> | 21                                                                          | 19                         | 40           |
| Medication                                                        | 1                                            | 1                                            | 2                                           | <b>Medication</b>  | 1                                                                           | 1                          | 2            |
|                                                                   |                                              |                                              |                                             |                    |                                                                             |                            |              |
|                                                                   |                                              |                                              |                                             |                    |                                                                             | <b>Total No. of Trucks</b> | <b>99</b>    |



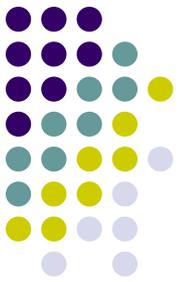
Cargo Ferries allow to avoid congested bridges, last mile by electric-powered trucks



-  Distribution Center (DC)
  - 1 Perishables & Frozen goods
  - 2 Non-chilled goods
  - 3 Medication
-  Hypermarket (HM)
-  Ferry Terminal (FT)
-  Ferry route
-  Truck route



- **Analysis:** \* All Distribution Centers are located in the Asian side, where Ferry Terminal-2 is located; \* FT-2 holds a central position for making all the deliveries by water.
- **Reliability:** \* Effect on congestion: Traffic situation greatly improved – do not utilize bridges, the main chokepoints of Istanbul .
- **Eco-friendliness:** \* CO2: No emission from electric trucks and small amounts from ferries; \* Effect on other emissions: Sufficient noise-reduction from electric trucks; no road pollution from ferries;
- **Cost-efficiency:** \* Initial investment: high, price for electric truck is around £90 000 per truck.
- **Evaluation:** \* High reduction of congestion; \* High reduction of CO2 emissions and noise \* Low maintenance and fuel costs; \* Feasibility of using solar/wind technologies for ferries in the long-run; \* Weather dependency for ferry transport; \* High initial investment for buying/leasing electric trucks and ferry.



| <b>Items</b>                   | <b>Number</b> | <b>Cost (EUR)</b>        |
|--------------------------------|---------------|--------------------------|
| Land for DC                    | 3             | 10.940.950               |
| Electric trucks<br>(12 tonnes) | 99            | 9.403.954                |
| Car ferries<br>(30 trucks)     | 6             | 10.514.400               |
|                                |               | <b>Total -30.859.304</b> |

**The winning solution is a system based on cargo ferries.**

**Profit per year: 16.250.000 EUR <sup>1)</sup>**

**ROI = 1,9 years**

The ROI was calculated based on demand structure, total number of pallets (inbounded & outbounded) related to this demand, and initial investment/costs (Appendix 1-4).

- 
- **Analysis:** DC-2 is near the starting point of the tram line; DC-1 and DC-3 are near the end of projected tram line and close to highway in order to deliver goods to the Asian side by electric trucks;
  - **Reliability:** Effect on congestion: helps to reduce congestion in the European part, but does not solve the main problem – the chokepoint in Fatih Sultan Mehmet Bridge.
  - **Eco-friendliness:** No CO2 emissions (use of electrical vehicles only); Reduction of overall pollution, medium noise-reduction.
  - **Cost-efficiency:** High initial investments: building of new tram line, buying cargo trams (about 3 million euro per tram) and electric trucks; Additional equipment for loading/unloading of goods; Low fuel and maintenance costs.
  - **Evaluation:** Reduced traffic congestion, accidents, injuries and fatalities; Reduced traffic exhaustion and noise; Reduced petroleum fuel consumption; Increased control over delivery schedules; High initial investment; Does not help with the main chokepoint; Main part of the transport still on the road.

# Durable gogreen solutions overview



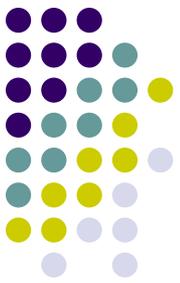
There is no universally applicable solution; each company still needs to try to identify their own possibilities. **Small scale projects adapted to the local infrastructure and the transport mode.** Projects also have to be adapted to the respective transport mode.

Environmentally friendly technical solutions are more abundantly available for city transports than for long-haul transports where reliable technical alternatives still need to be identified and extensively tested.

- An *environmentally friendly* solution does not need to concern only alternative fuels or vehicle design.
- *Commercial CO2* recovered from existing industrial processes is also an environmentally beneficial product. Non-purified CO2, is still out of question.
- Another possibility is the Flexiwaggon for fast loading and unloading of trucks and facilitates the moving of large numbers of trucks over large distances by rail. The low position of the wagon makes it possible to load and unload on graveled areas so that no specific terminal is needed.

## Policy-based solutions. **Obligatory performance-related targets for car/truck manufacturers**

- Performance-related, legally binding targets for manufacturers of freight vehicles.
- Manufacturers of vehicles should be able to choose among different technologies for the construction of vehicles, etc.
- Such obligatory requirements would also thwart the economic strategy of competitors in freight transport, which consists of adopting the cheapest (and thus often the most environmentally unfriendly technology) to lower the transport price.
- *Emissions Trading Scheme (ETS)* as additional measure to command-and-control measures a programmed reduction of emissions based on market mechanisms.
- For NO<sub>x</sub>, charges may be a viable alternative to ETS. These charges can be dedicated to a fund to provide capital for specific NO<sub>x</sub>-reducing projects/technologies, This system is implemented today for Norway.



# Home message



- Each company and the individual responsible for the purchase/development of technologies, public procurement, etc. should and could develop solutions and consider concrete steps to take up environmental transport technologies which fit into the company's portfolio.
- Small steps are important as they may lead to knowledge and experience that can stimulate new projects and approaches.
- More contacts should be set up between companies and institutions having a stake in the development, use and spread of environmental technologies, such as companies buying and selling transports, universities, technology developers/sellers, and policy makers.
- A good reason to sustain the FuturICT Project development & implementation.