



The Zero Carbon Railway Project

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The Project steps:

- ❑ Analysis of Renewable energy certificates market
- ❑ Questionnaires to UIC members
- ❑ Informal meetings with selected stakeholders
- ❑ SWOT analysis of possible methodological options
- ❑ Discussion/Workshops
- ❑ Final UIC Guidelines.



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Analysis of Renewable energy certificates market

The legal background

The REC/GO system is more than legal: it is supported by the latest EU Directives on renewable energy as a means of incentive to renewables and as a way to prove to final customers the quality of electricity.

The inclusion of RECs and Gos into the Corporate Reporting (single **company level**) is accepted by 2 main international standards for GHG reporting: Carbon Disclosure Project and GHG Protocol + by the specific standard for emission in transport services: CEN 16258



COMPANIES USING RENEWABLE ELECTRICITY CERTIFICATES



"The long term direction is for all IKEA Group buildings to be supplied with renewable energy."



"We have a clear interest in changing to renewable energy and reducing our energy usage"



"We use renewable energy ourselves and work with our industry partners to increase the use of responsibly managed renewables."



"Purchases renewable energy certificates to offset 5% of the energy consumed by its North America manufacturing locations."



"Purchasing electricity generated from renewable sources is an important component of Cisco's GHG reduction strategy."



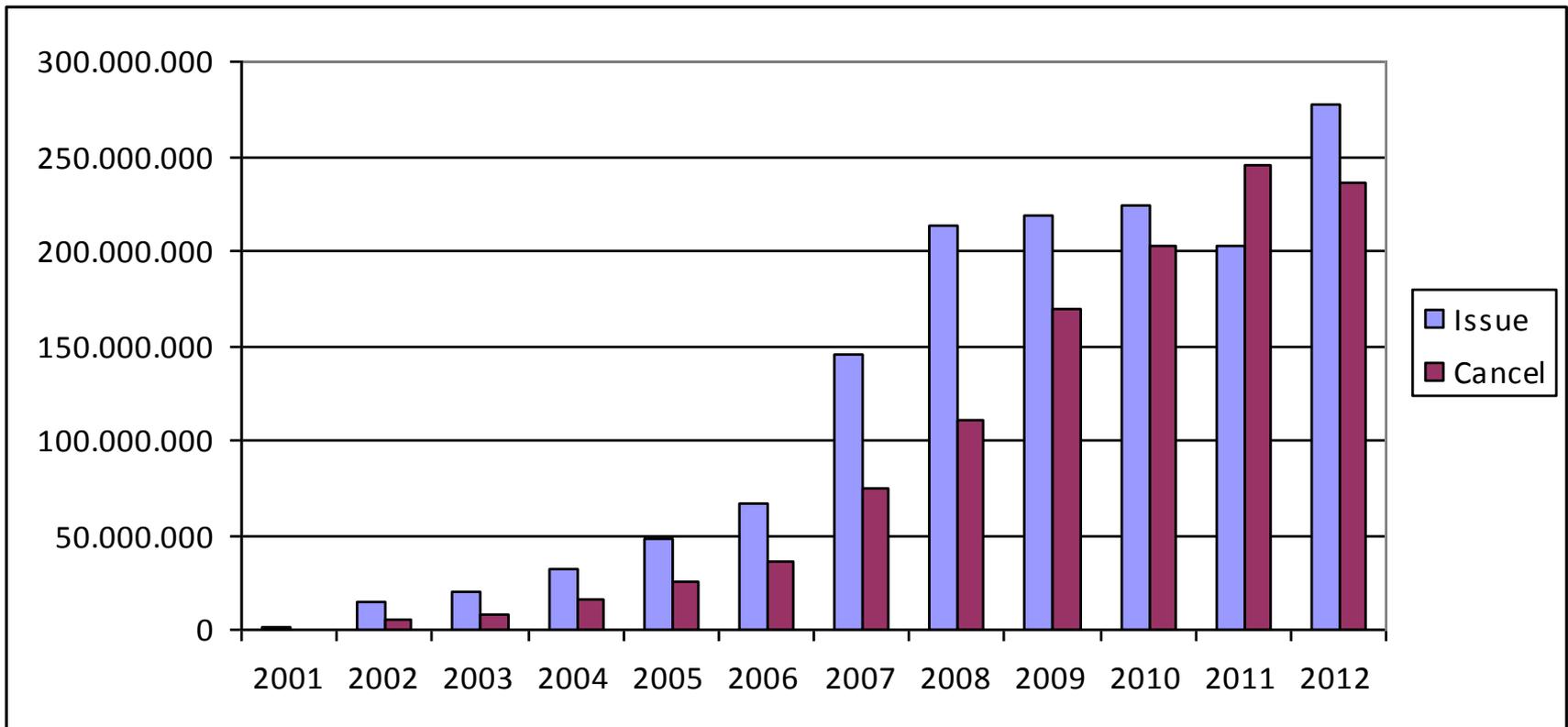
"We purchased renewable energy credits equal to 20 percent of the electricity for company-operated stores in the U.S. and Canada."



SGS signed a contract in December 2011 with ECOHZ, to purchase renewable energy certificates each year that correspond to 100% of our trend electricity consumption in European countries.

Transactions of EECS certificates during 2001 – 2012 (MWh)

Almost 30% of the electricity produced by renewable sources in Europe



Source: AIB

EUR 10 billion 100 TWh new RES

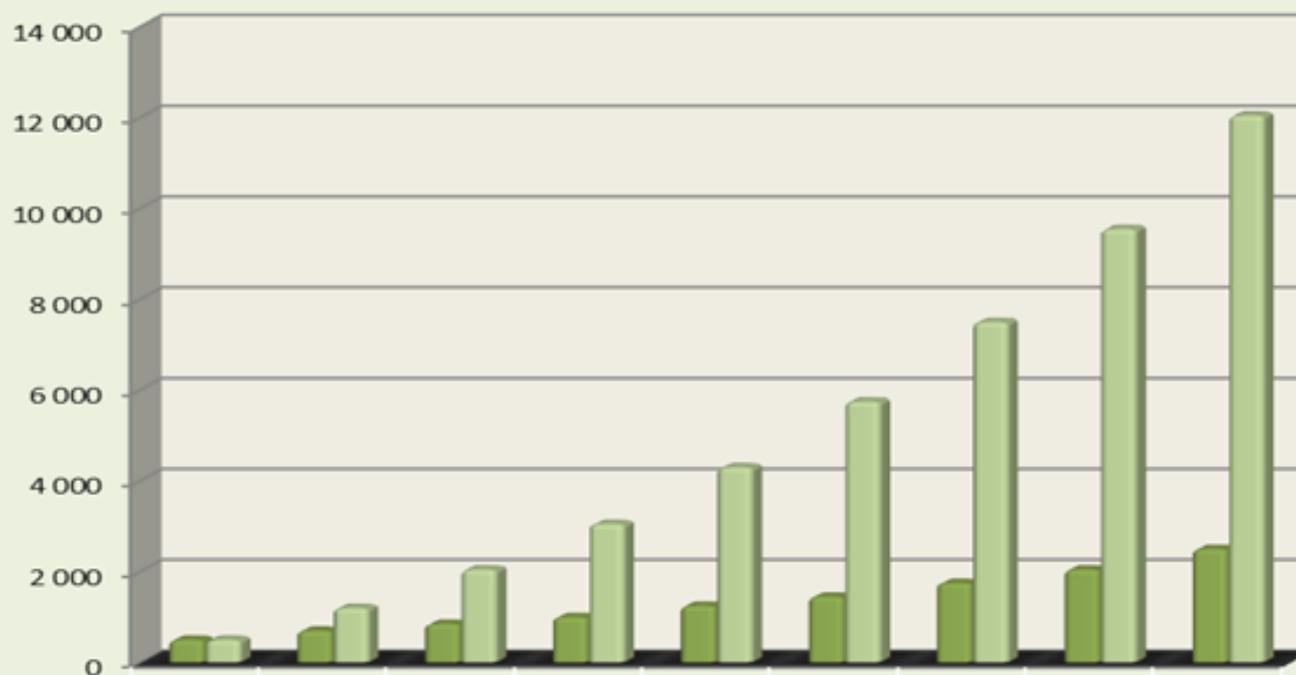
Key assumptions:

Price: eur 2,5

GO growth: 19% → 1000 TWh

Revenue allocation: 80%

Top financing: < 15%



Yearly revenue (MEUR)

2012

2013

2014

2015

2016

2017

2018

2019

2020

Aggregate revenue (MEUR)

500

1 200

2 050

3 050

4 300

5 750

7 500

9 550

12 050

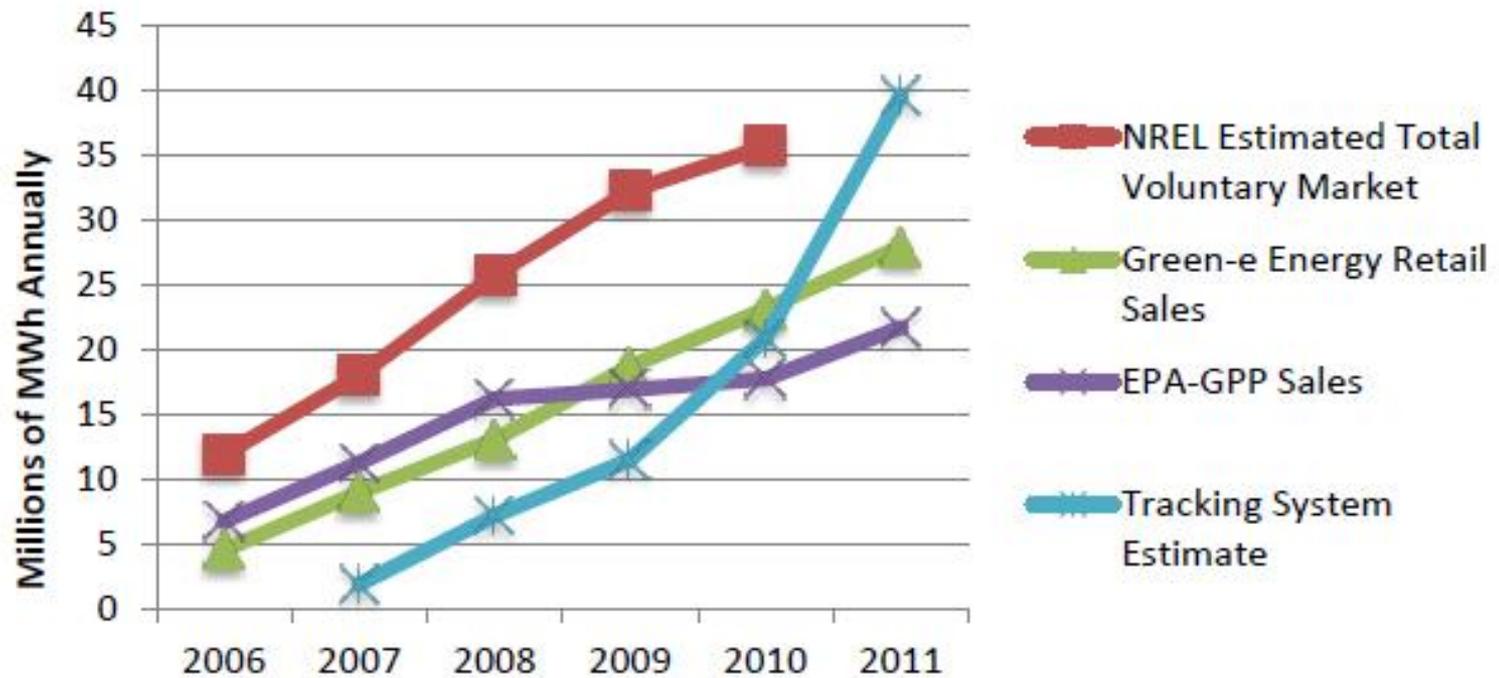
To give some examples (prices for 2013 in the wholesale market) in Euro per certificate (1 MWh):

- GO based on hydro installation older than 12 years without any further specification (commodity product): **0.16-0.20 €**
- GO based on hydro installation less than 6 years old: **1.8 €**
- GO from Norwegian wind power: **0.6-0.7 €**

Prices in the end customer market are significantly higher, **up to 4-6 Euro** for specific products/ecolabels with thorough documentation. There is in fact a tendency in the market to pay more attention to the “quality” of electric power, guaranteed by disclosure certificates.

As a comparison, the current average gross prices of electric power in Europe for non-household use (source: Eurostat, year 2012) are considerably higher: they go from a maximum of **227.9 Euro/MWh** (consumption up to 20 MWh) to a minimum of **103.7 Euro/MWh** (consumption between 70-150 GWh).

ESTIMATED ANNUAL VOLUNTARY SALES IN U.S. BY MARKET SECTOR, 2006–2011



Source: U.S. Department of Energy

Figure 6.1 Energy attribute tracking certificate flows

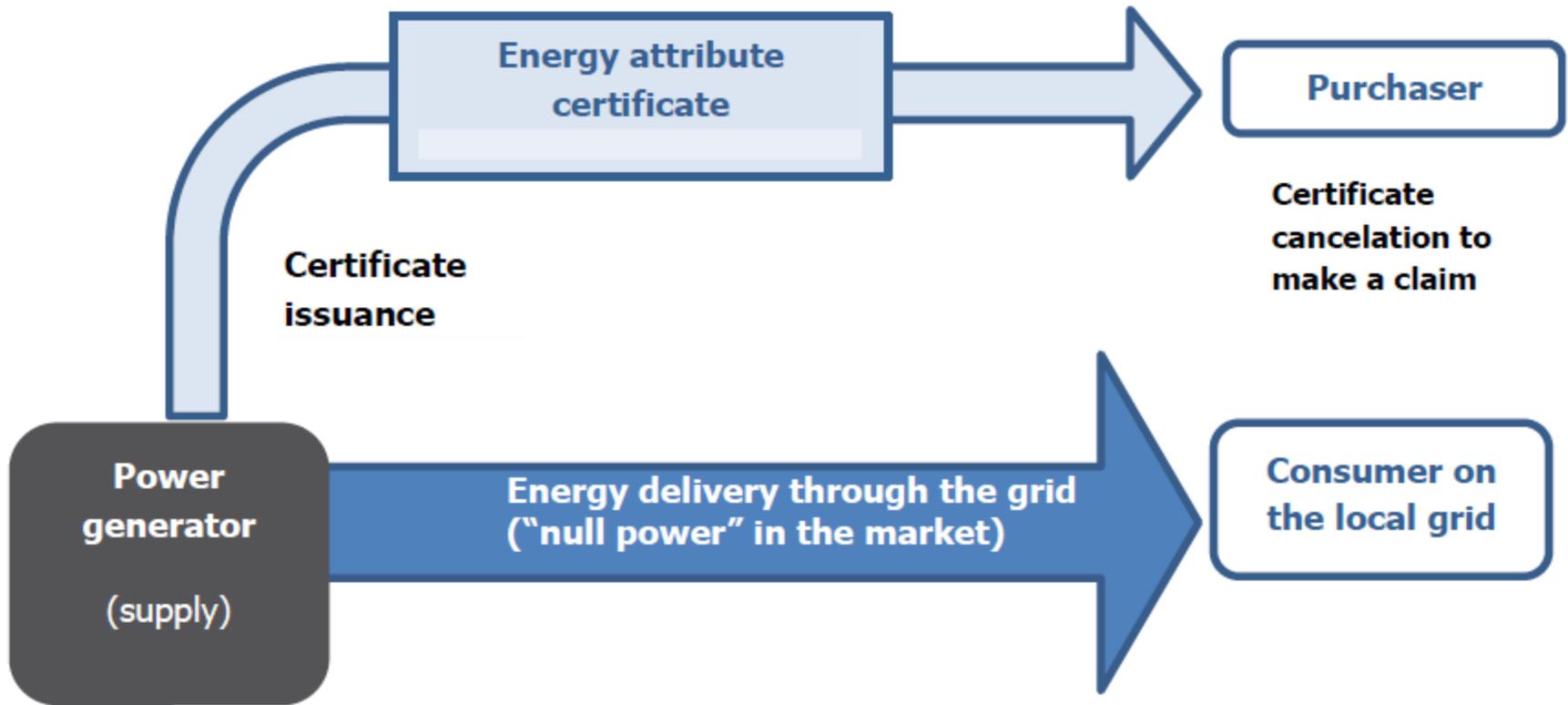
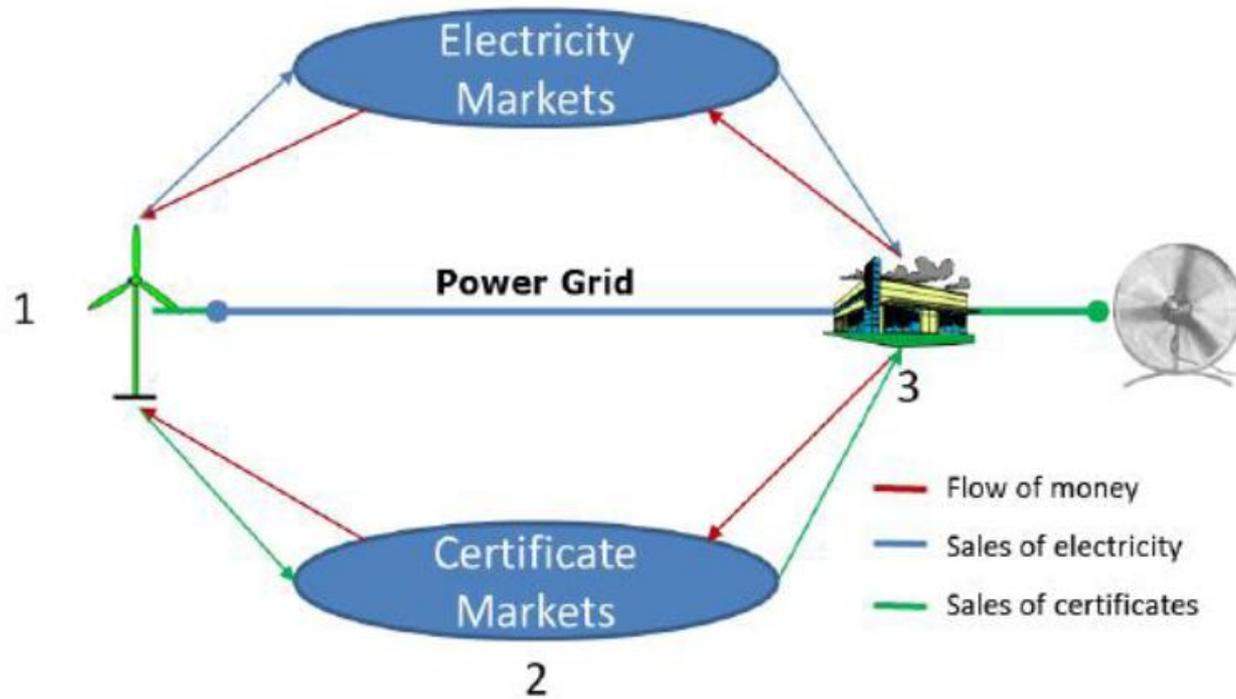
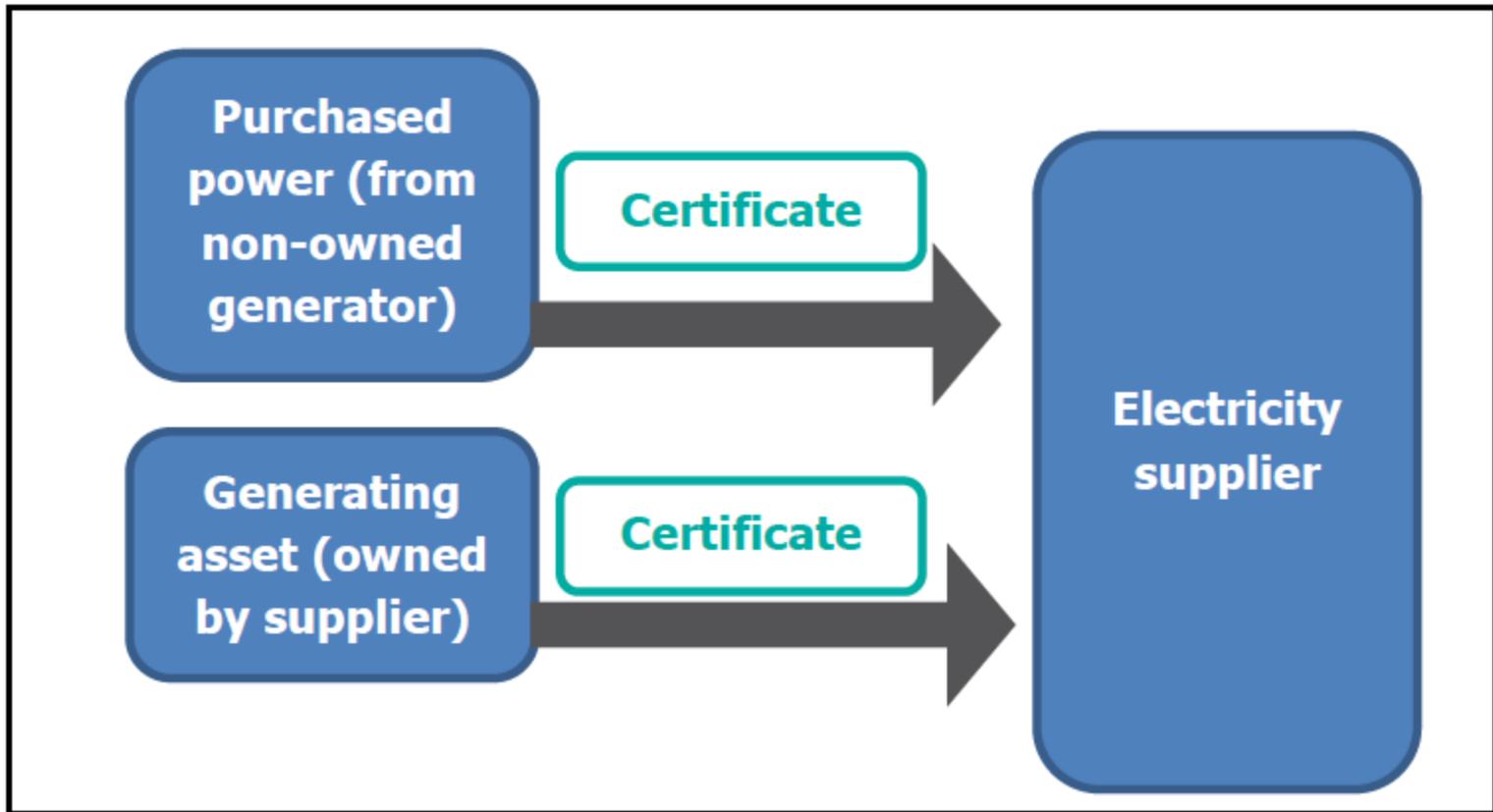


Fig. 3: Renewable producers gain extra revenue from selling energy certificates in the certificate markets



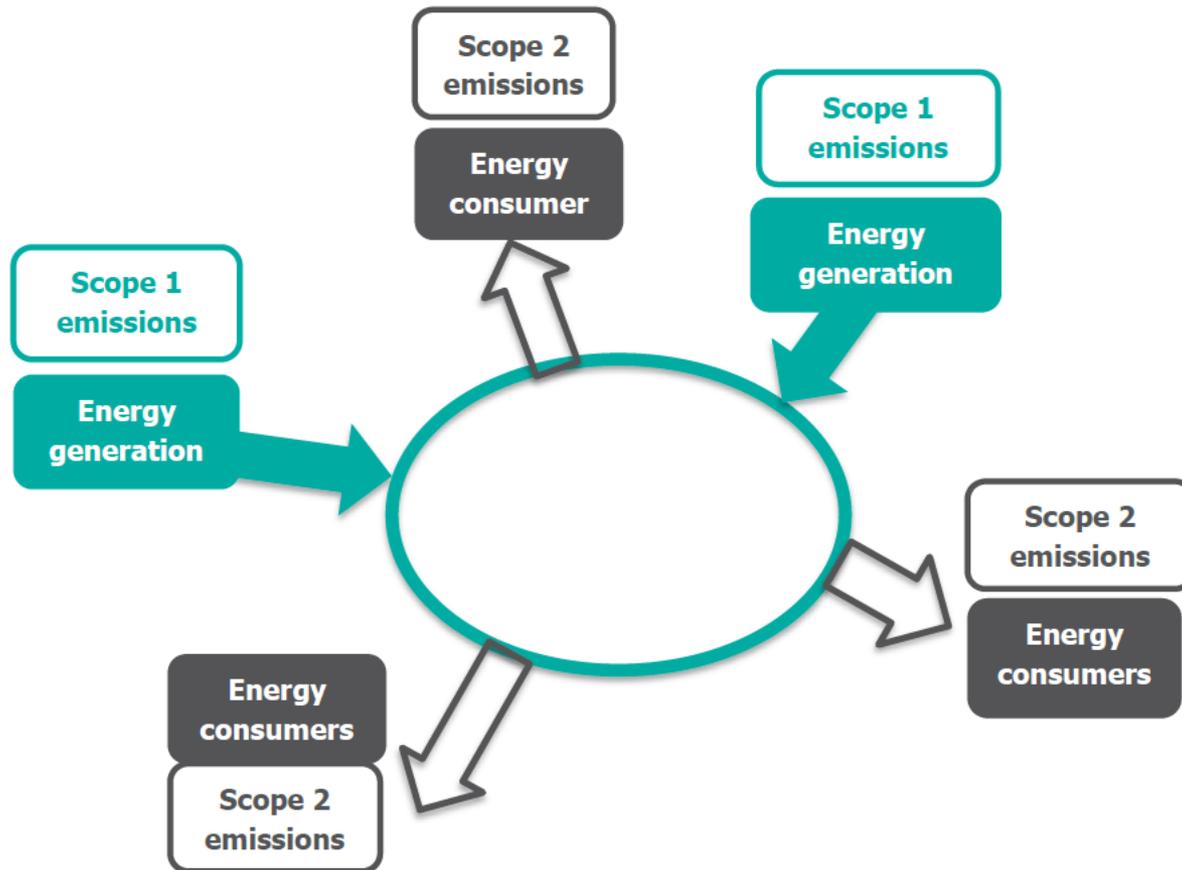
Source: Grexell

Figure 9.2 Electricity supplier purchasing and disclosure



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Figure 5.3 Grid-distributed energy, with multiple separate producers and consumers

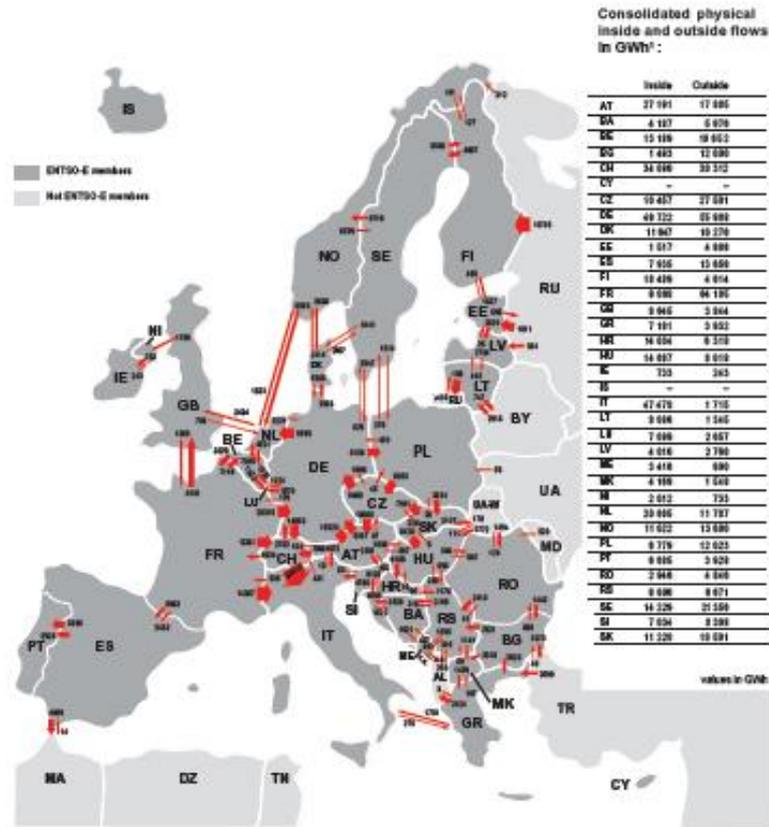


The main models for corporate use of renewable energy

- > **Direct investment:** a company directly invests in on-site renewable energy assets and consumes the energy generated. In order for the company to claim that the energy consumed is renewable, GO/RECs must be withdrawn by the company rather than sold..
- ❖ **Power purchase agreement (PPA):** The company purchases electricity from a specific renewable energy project and the associated GO/RECs are produced.
- ❖ **Green power procurement:** An energy supplier offers the purchasing company a guarantee with GO/RECs that its power has been produced using a certain percentage of renewable energy..
- ❖ **Renewable energy certificate (GO/REC) procurement**

Companies procuring credits from the voluntary market can claim, after certificates have been used (cancelled), that they have purchased a quantity of renewable energy corresponding to the number of GO/RECs. Traders may manage and withdraw the GO/RECs on the company's behalf, or the company may do this in-house.

Physical energy flows 2011 - graphical overview in GWh



Sum of physical energy flows between ENTSO-E countries = 370786 GWh²

Total physical energy flows = 411934 GWh²

¹ Consolidated yearly values might differ from detailed flow data from the ENTSO-E database due to ex-post consolidation taking into account national statistical resources.

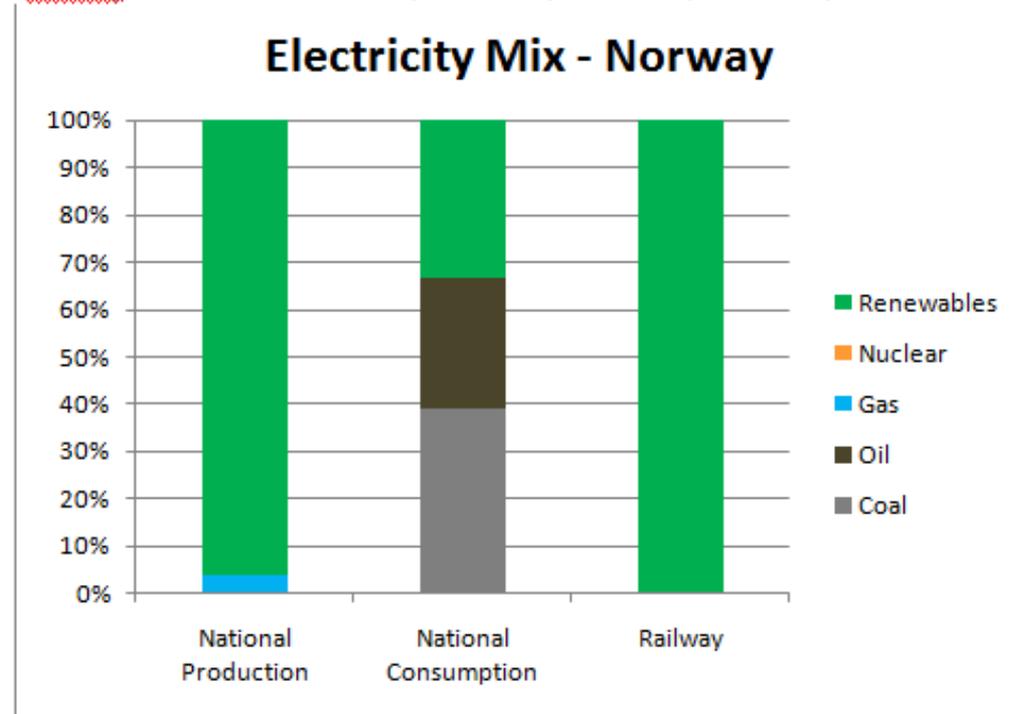
² Calculation based on the detailed physical energy flows in the table on page 16 without exchanges ME-AL.

Why do we need a European Attribute Mix?



Norway

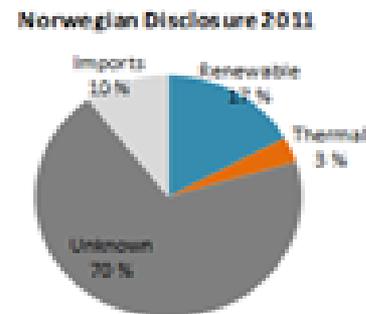
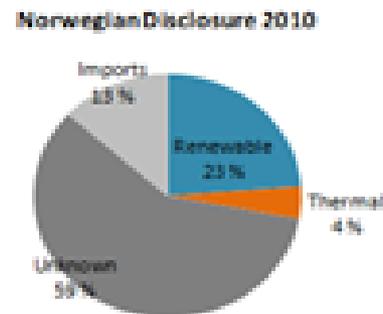
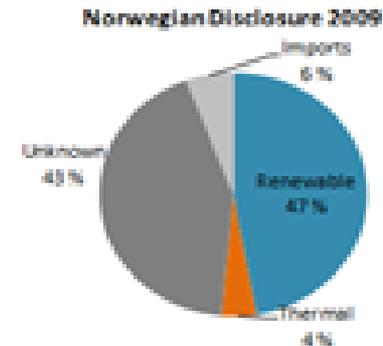
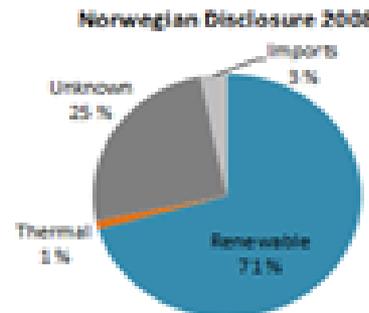
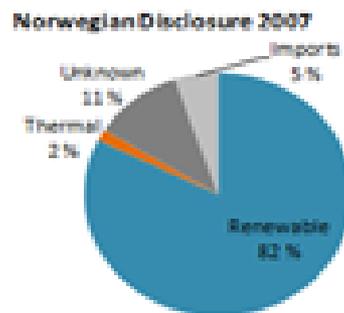
Norway	Coal	Oil	Gas	Nuclear	Renewables	REC/GF/GoO
National Production	0,1%	0,0%	3,9%	0,0%	95,9%	RECS
National Consumption	39,0%	28,0%	0,0%	0,0%	33,0%	98 Twh
Railway	0,0%	0,0%	0,0%	0,0%	100,0%	sold



Source : IEA (2012b), UIC (2012b) and UIC (2013b)

The Norwegian Disclosure

- The Norwegian Water Resources and Energy Directorate (NVE) is responsible for publishing the Electricity Disclosure





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Questionnaires to UIC members

SUSDEF Sent questionnaires in 2013 to 37 UIC/CER members: 21 railways replied.

The following railways already used RECs or GO certificates in 2013:

**VR, SJ, Greencargo, NSB, DSB,
PKP, OBB, NS, DB and RENFE.**

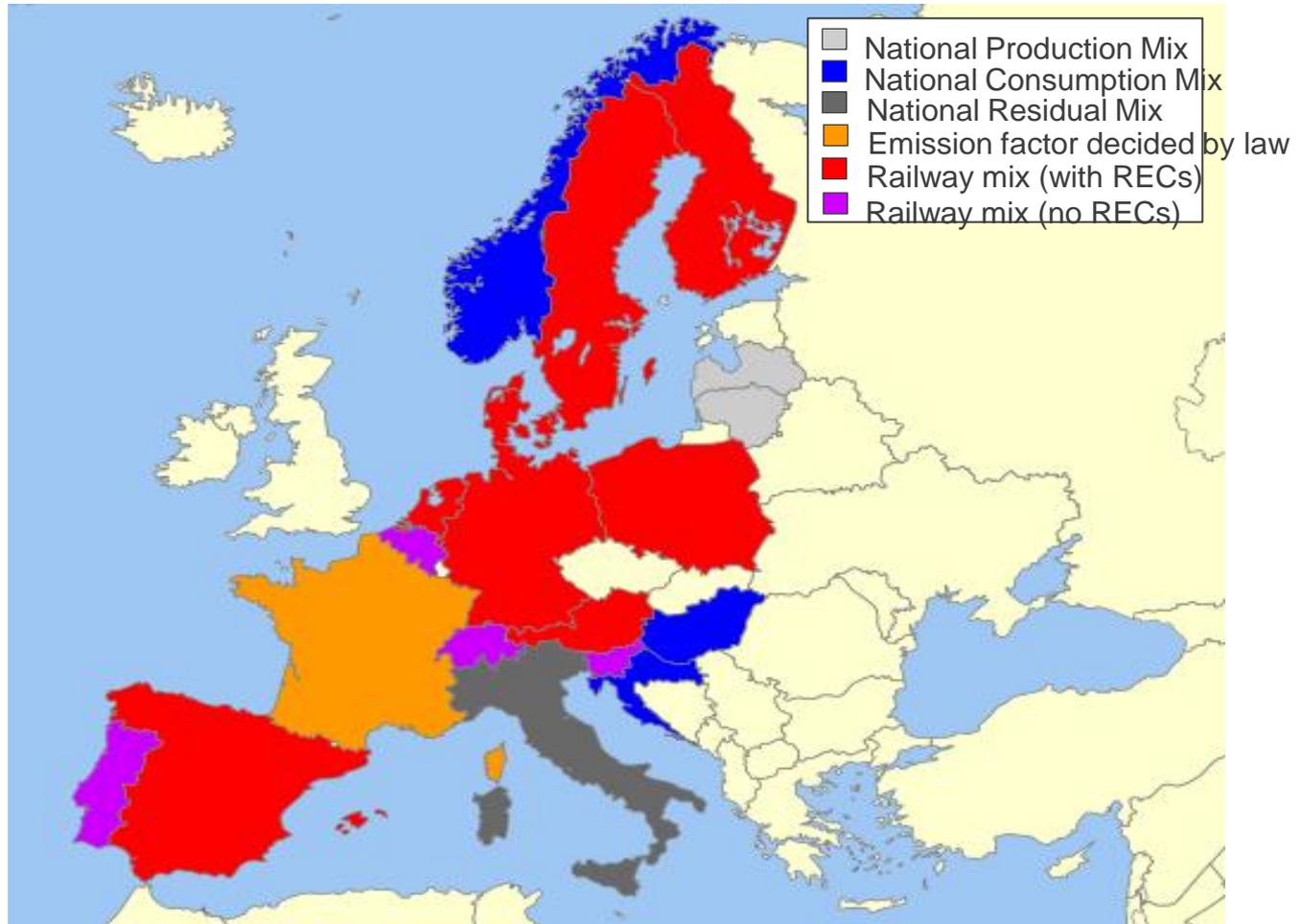
The Questionnaires gave also very useful information about the type of electricity mix considered in the national methodologies by UIC members

Table 1: Questionnaire report

Railway	National Production Mix	National Consumption Mix	Railway Mix	Use of RECs or Gos
ATOC				
CP			x	no
DB			x	yes
DSB				yes
FS		x		no
Greencargo			x	yes
HZ		x		no
LDZ	x			no
LG	x			no
MAV		x		no
NS			x	yes
NSB			x	yes
OBB			x	yes
PKP			x	yes
RENFE			x	yes
SBB			x	no
SJ			x	yes
SNCB			x	no
SNCF		x		no
SZ			x	no
Trafikverket			x	yes
VR			x	yes

source: SUSDEF

Electricity mix used by railways



The EES Strategy 2030 Targets and beyond

	Target	Baseline	Horizon
Climate Protection	• -30% pkm and tkm	1990	2020
	• -50% pkm and tkm • Not exceed total CO ₂ Emissions (1990)	1990	2030
	• Carbon-free train operation	-	2050
Energy Efficiency	• -30% pkm and tkm	1990	2030
	• -50% pkm and tkm	1990	2050
Exhaust Emissions	• -40% Total PM and NOx	2005	2030
	• Zero emissions of NOx and PM	-	2050
Noise and Vibrations	• No longer a problem for railways	-	2050



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Informal meetings with selected stakeholders

Informal meetings held (June 2013- January 2014):

- ✓ DB
- ✓ **IFEU**
- ✓ **ADEME** (French environment authority)
- ✓ National Authority Energy (Italy)
- ✓ NTM (Scandinavian transport calculator)
- ✓ **EEA** (European environment agency)
- ✓ **IEA** (International Energy Agency)
- ✓ EcoHz (provider of GO certificates)
- ✓ **EU commission (DG energy)**
- ✓ **Transport and environment** (NGO-Bruxelles)
- ✓ **Greenpeace Italy**

The meeting with EU Commission (DG Energy) and European Environmental Agency (EEA) has clarified that:

Gos should be used purely as an **instrument for the final customer** and:

- Shall have no role for the calculation of the Mandatory National Targets (EU 2020), where only the physical production is used,
- Shall not be used for the calculation of the **EU 2020 Transport Sector target** (10% use of renewables in transport at 2020).
- Shall not be used in the EEA official data for transport sector and Post-Kyoto evaluation
- Only the **physical approach** will be used.

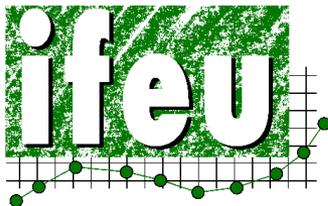


Some skeptic NGOs' view is that the green certificates system is purely a “mind game” potentially generating contradictory messages, **without creating “additionality”** (i.e. new renewable energy installations).

Doubts are also raised on the possibility of having a certificate exchange system which is strongly accurate, reliable and fraud-resistant (risk of **double-counting**)

Other bodies (like EEA): see the claim of zero emissions from inclusion of GO as a **“too little effort”** from railways side.

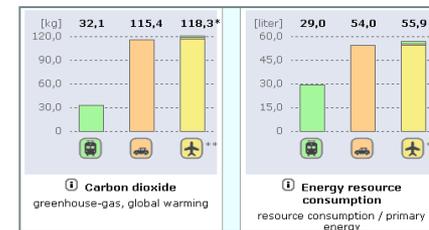
Some NGOs see as “wishful thinking” the possibility of extra revenue coming from certificate sales being invested in the installation of plants for renewable energy production.



Ecopassenger

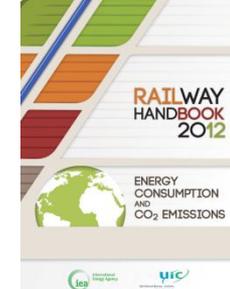
IFEU requests EcoPassenger calculations to use the official national electricity mix and consider that this would better highlight the rail sectors environmental advantage and prevent accusations of 'green washing'.

Ecotransit:

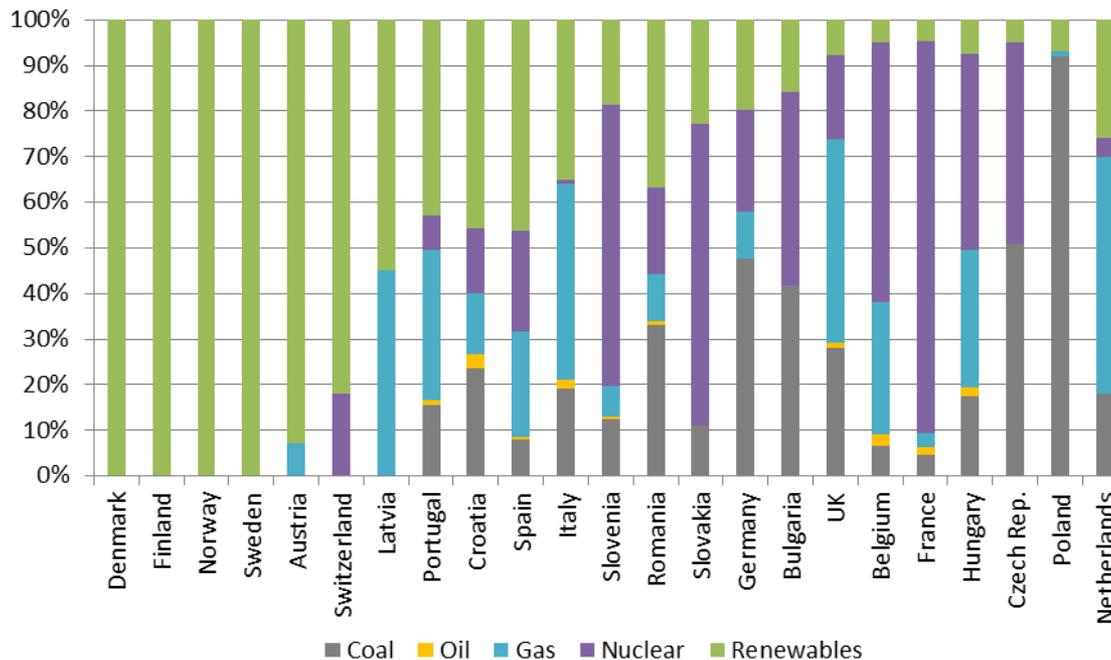


The Methodology Working Group of EcoTransit World, the CO2 emissions tool of which UIC, DB Schenker and other railway companies are members, decided in April 2014 that only the physical electricity mix will be used for calculations

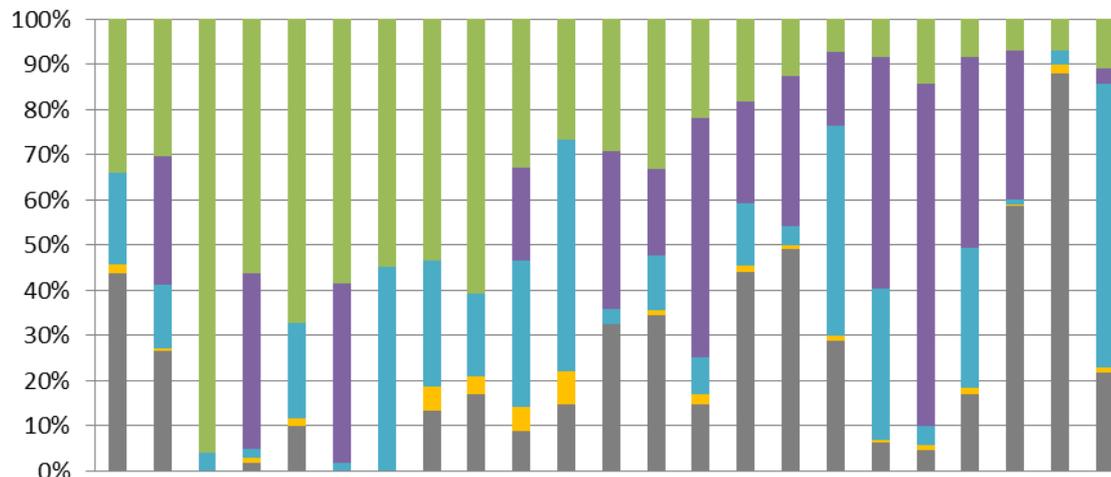
Warning from International Energy Agency



Railway operator mix



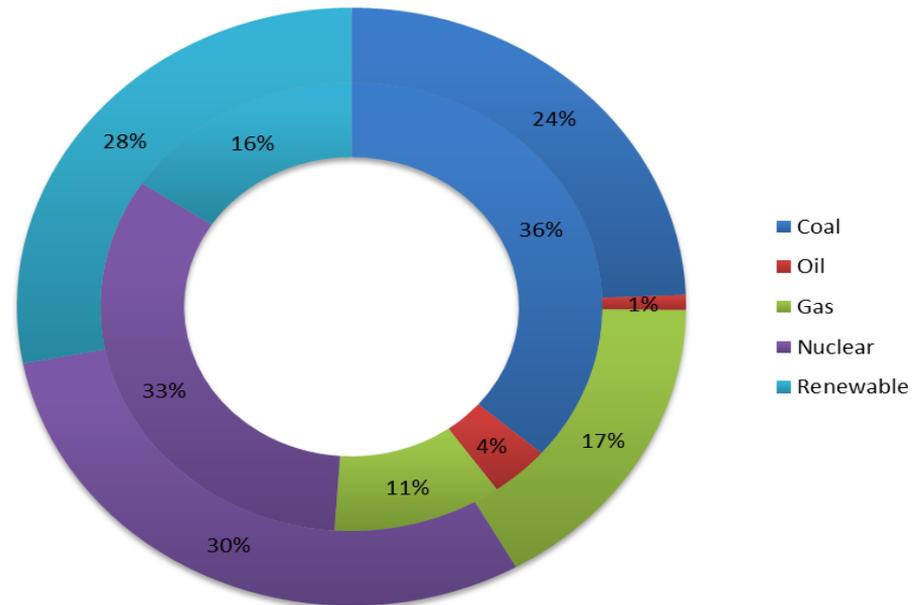
National production mix



(2010 data)

European Railways electricity mix

Europe Railway Electricity Mix
2005 (inside) - 2010 (outside)



European railways use **almost 30% of renewable electricity**, with a tremendous increase in the last 5 years



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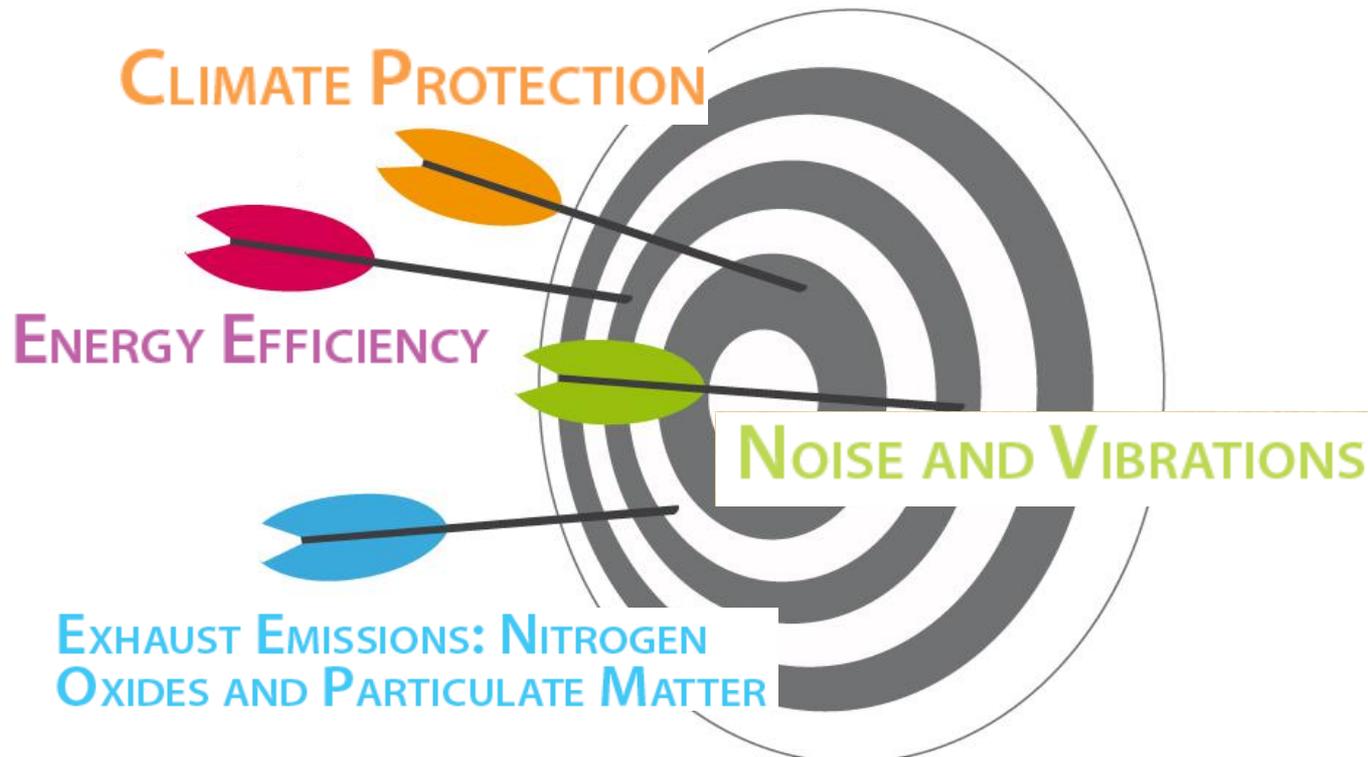
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SWOT analysis of possible methodological options

STRATEGY

Moving towards sustainable mobility: The EES Strategy for 2030 and beyond

(voted by UIC and CER at UIC General Assembly in December 2010)



The EES Strategy 2030 Targets and beyond

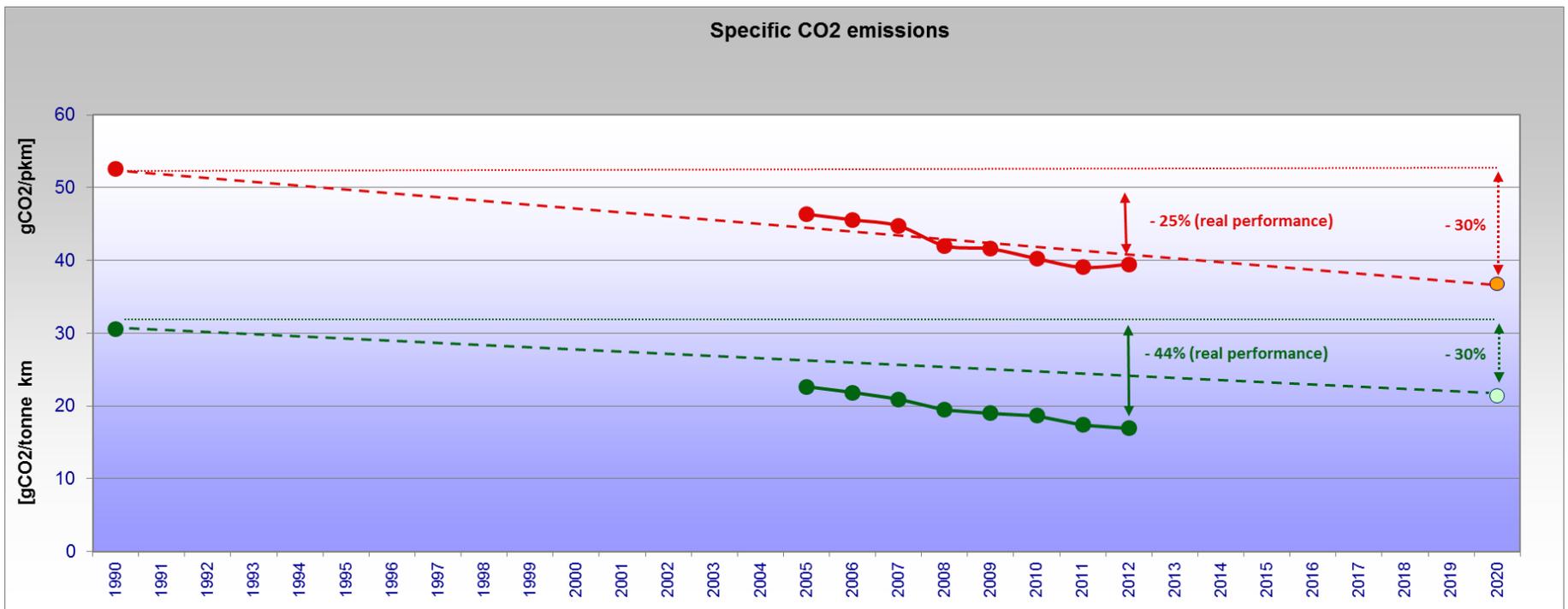
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Exhaust Emissions	• -40% Total PM and NOx	2005	2030
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Noise and Vibrations	• No longer a problem for railways	-	2050

PROGRESS TOWARDS TARGETS: SPECIFIC EMISSIONS RECALCULATED

Specific CO₂ emissions 1990-2012 trend:

Passengers: 39.5 g/pkm (-25%) Freight:17 g/tkm (- 44%)

(vs. -22% expected linear tendency to 2020)



Input for UIC/CER Methodology
on 2020-2030 European Railway Sector
CO₂ reduction target calculation :

Possible Options :

- 1) Physical approach (grid-based)
- 2) Virtual Approach (market-based)

- ❖ **Physical Approach, option 1:** Calculation using the European production mix
- ❖ **Physical Approach 2, option 2 :** Calculation using the “National consumption mix” (including physical import/export)
- ❖ **Virtual Approach, option 1:** Calculation using the electricity providers’ mix (allowing green electricity procurement and Renewable energy certificate procurement/GOs), and establishing some “minimum requirements” for quality of certificates
- ❖ **Virtual Approach, option 2:** Calculation using all forms of certificates, provided they are compliant to the EU directive

Calculation using the European production mix

Fig. 10: Physical Approach SWOT analysis– Option 1

STRENGTHS

- Low impact on database management
- No input needed from railway operators on electricity mix
- Official and authoritative
- Data available since 1990

WEAKNESSES

- Allows an easy comparison between different modes of transport only at European average and not at national level

OPPORTUNITIES

- No double accounting
- Avoids potential criticism for ambiguous and counterproductive messages
- European mix will naturally be greener in 2020 and 2030: railways would benefit directly

THREATS

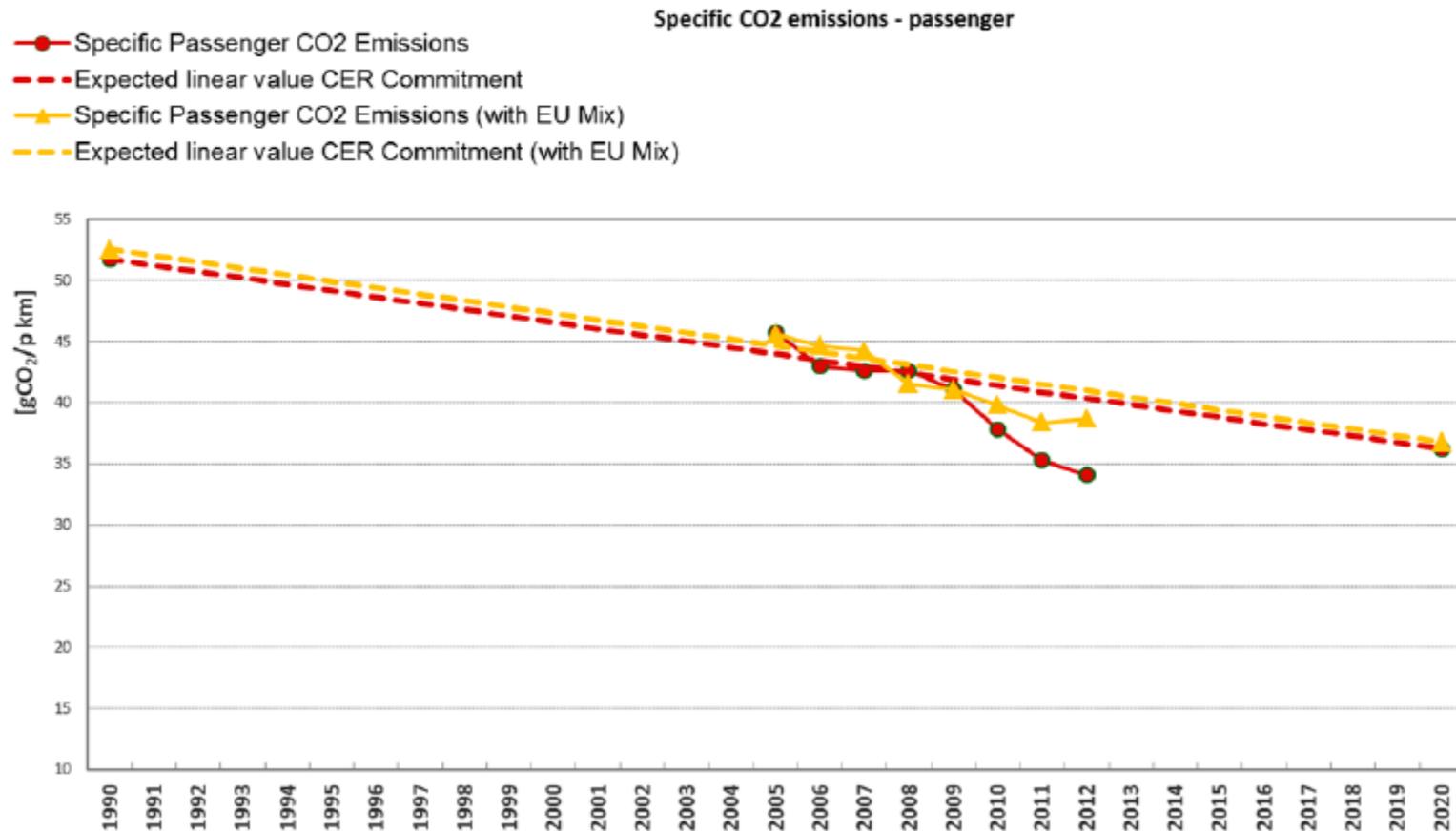
- Doesn't support the market for renewables
- Doesn't allow railway companies to use an emission reduction strategy commonly accepted in other sectors
- Doesn't follow the EC formulation on RES incentives and establishment of a single market

SPECIFIC EMISSIONS RECALCULATED WITH EU PRODUCTION MIX: DIFFERENCE WITH TRADITIONAL METHOD (PASSENGER)

Traditional method: 34.1 g/pkm (-34%)

Recalculated: 38.7 g/pkm (-26%)

(vs. -22% expected linear tendency to 2020)



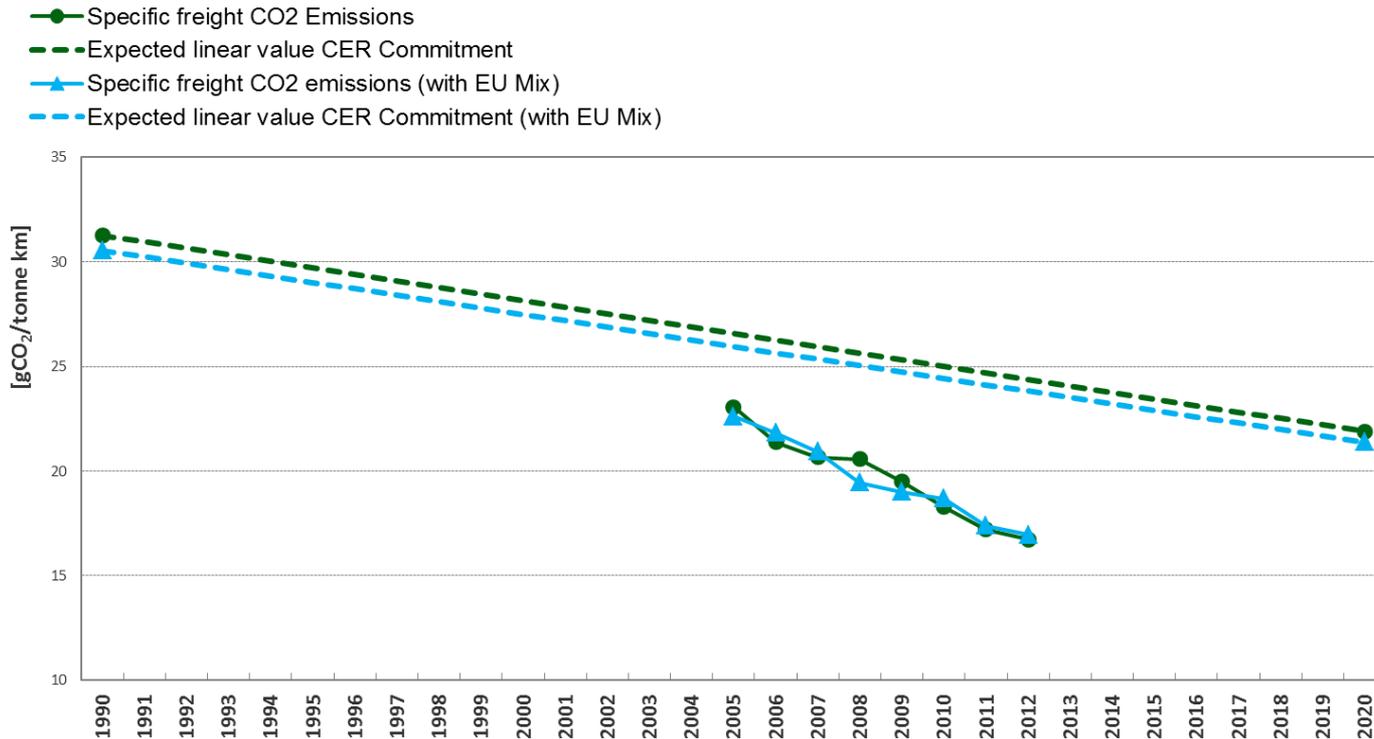
SPECIFIC EMISSIONS RECALCULATED: DIFFERENCE WITH TRADITIONAL METHOD (FREIGHT)

Traditional method: 16.7 g/tkm (-47%)

Recalculated: 17 g/tkm (-44%)

(vs. -22% expected linear tendency to 2020)

Specific CO₂ emissions - freight



Calculation using the “National consumption mix”

Fig. 12: Physical Approach SWOT Analysis – Option 2

STRENGTHS

- Low impact on database management
- No input needed from railway operators on electricity mix
- Data available since 1990
- Takes import and export into account

WEAKNESSES

- Not official
- A specific methodology has to be created to calculate the electricity mix

OPPORTUNITIES

- Allows an easy comparison between different modes of transport
- Avoids potentially ambiguous and counterproductive messages
- No double accounting

THREATS

- Doesn't support the market for renewables
- Doesn't allow railway companies to use an emission reduction strategy commonly accepted in other sectors
- Doesn't follow the EC formulation on RES incentives and establishment of a single market
- Not compliant with practices already adopted by several railway undertakings

Virtual approach, option 1 : establishing minimum requirements

- Define a threshold limit to the **age** of the electricity plant ?
- Define a required quantity of investment actually going to **additional** green electricity?
- Define a maximum **limit of use** by a single railway (ex. 30% of the total energy consumption) ?
- Any other ?????



Calculation using recs with minimum requirements

Fig. 13: Virtual Approach SWOT ANALYSIS- Option 1

STRENGTHS

- Low impact on database management
- Takes import and export into account
- When the EECS system is up and running, there are no risks of double accounting
- In line with art. 15 of EU 2009/28 directive

WEAKNESSES

- The database needs special input from RUs
- Inhomogeneity of input data between RU that use GO/RECs and those who do not use them
- Inhomogeneity of input data from 2012 onward
- Residual mixes will always get “dirtier”

OPPORTUNITIES

- Goes hand in hand with the current process of using green electricity contracts already in place in several railway companies

THREATS

- Virtually eliminates the possibility of a comparison with other transport modes
- Is exposed to the fluctuations of the GO/REC market – «one-way strategy»
- Potentially ambiguous and counterproductive message towards customers and NGOs
- Double accounting, currently estimated at 20%
- Discrepancy between railway statistics and official sources

Calculation using all kinds of existing recs

Fig. 14: Virtual approach SWOT ANALYSIS -Option 2

STRENGTHS

- Low impact on database management
- Takes import and export into account
- When the EECs system is up and running, there are no risks of double accounting
- In line with art. 15 of EU 2009/28 directive

WEAKNESSES

- The common principles should be drafted and accepted by UIC/CER
- The database needs special input from RUs
- Inhomogeneity of input data between RU that use GO/RECs and those who do not use them
- Inhomogeneity of input data from 2012 onward
- Residual mixes will always get “dirtier”

OPPORTUNITIES

- Stimulates RES and single market
- Shows that the railway sector is proactive
- Can be easily harmonized with current process of using green electricity contracts already in place in several railway companies

THREATS

- Virtually eliminates the possibility of a comparison with other transport modes
- Is exposed to the fluctuations of the GO/REC market – «one-way strategy»
- Potentially ambiguous and counterproductive message towards customers and NGOs
- Double accounting, currently estimated at 20%
- Discrepancy between railway statistics and official sources



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Discussion

Virtual approach could be less applicable for European Sector Target calculation

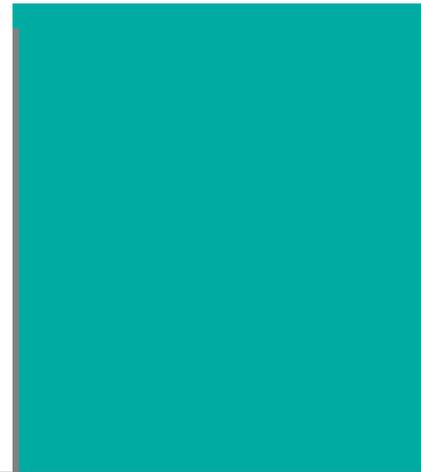


Calculation and Reporting would lack consistency and reliability:

1. Some national data would be calculated with GO/RECS
2. Other data (SNCF) would be calculated with national law approach (ADEME)
3. Other data (FS) would be calculated with National «Residual mix»
4. Other data with National Production mix



GHG Protocol Scope 2 Guidance



A supplement to the GHG
Protocol Corporate Standard

March 2014

For companies with operations in markets *with choice in electricity product or supplier*: (see chapter 6, 9)

- Companies **shall** report scope 2 in two ways: one total based on the location-based method, and one total based on the market-based method where applicable and Quality Criteria are met.
- Companies **shall** ensure that contractual instruments used in the market-based method meet the Quality Criteria outlined in this Guidance. A statement shall be made by a 3rd party ensuring that these Criteria have been met, or a reference given to the certification program which has verified conformance with the Quality Criteria
- Companies **shall** disclose the relationship between energy attribute certificates used in the market-based method and compliance instruments present in the same market.
- Companies **shall** identify which scope 2 total – location-based method or market-based method – serves as the basis for goal setting and for scope 3 data uses.
- Companies **should** disclose key features about their contractual instruments for added transparency about the context of the procurement choices
- Companies **may** report avoided emissions from projects or actions separately from the scopes using project-level methodology.

Environment Report 2010
2009 CO₂ Data Result and Analysis

Issued in March 2011



Evolution of Target

Following the PostEurop recalculation on historical data, it shows that members are on the right track to reach the reduction target in 2012.

From 2007 to 2009, a reduction by 465 thousand of tonnes of CO₂ was accounted for, meaning a collective reduction of 15%. However, green electricity with a low emission factor was major contribution in achieving this result. Consequently, without considering the reduction obtained thanks to green electricity, the result will be a lower reduction, that will require further alternative efforts in order to reach the target in 2012.



Evolution of Target (SCOPE 1 and 2 only)

