e-Highway2050 WP3/Demand

Elaborated from multiple sources (see main document)

Technofi, 6 December 2013

Legend for selection

Step 1	*Step 2*
end use selected	technology selected
end use selected	technology not selected
end use not selected	N/A

	Step 1 analysis							*Step 1 analysis*	*Step 2 analysis*
RESIDENTIAL	**Volume effect**			**Energy efficiency effect**	**Load controllability potential**		**Impact on Energy demand (TWh)**	**Impact on load profile Power (GW)**	**End use segment**	**Technologies**
Segments	***Today (Ms 1.1 Eurelectric based on 2006 data); EUROSTAT 2013 (in blue color)***	***EURELECTRIC report "role of electricity"***	***Trends to 2050***	***Trends to 2050***	***Potential to 2050***					
TOTAL residential	EUROSTAT: 818 TWh of electricity consumption in residential sector in EU27 in 2009; 841 TWh in 2010; 803 TWh in 2011. It should be noted that the reference taken for the breakdown below assumed an electricity demand for EU27 at 843 TWh in 2009 (such forecast exceeds the actual consumption by less than 3%).	In the report "Role of electricity" the annual electricity consumption is provided for both residential and commercial sectors at 1532 TWh in 2005.	Estimated at 1300 TWh in 2050 (about 1050 TWh expected in 2030)	*Detailed per end use: see below*	*Detailed per end use: see below*					
D1 - White goods (refregierators, freezers, washing machines, dryers and dishwashers)	24.7% of residential demand (843 TWh, 2009) i.e. 208 TWh of electricity consumption for white goods	In the "role of electricity", - fridge/freezers electricity consumptions amounts to 69 TWh in EU25 in 2005 and are expected to decrease to a level of 46 TWh to 2030 - dishwashers electricity consumption will be reduced from 17 TWh in EU25 in 2005 to a level of 13 TWh to 2030 - washing machines electricity consumption will be reduced from about 23 TWh in EU25 in 2005 to a level of 15 TWh to 2030 - tumble dryers electricity consumption is expected to remain quite stable from about 12.5 TWh in EU25 in 2005 to a level of 13 TWh to 2030	A large market increase for dryers, dish washers & freezers is expected. The volume effect is rated ++	The average unit size is expected to continue growing: + combined with the continuous technology improvement of each equipment: - The overall effect is rated: --	High potential starting from 0, but limited to about half of the 2050 electricity demand due to the low controllability of fridges/freezers). The controllability effect is rated "High"		According to Eurelectric, in 2030 the gain in EE compensates the volume increase. The 195 TWh consumed in the 2012 projection would reach 217 TWh in 2013 (EU27). Under the assumption of the technical "BAT" scenario at 2030 the electricity consumption for the white goods at 2030 could go to 152 TWh (EU27) i.e. amaximum energy efficiency potential of -30% (at 2030). The reality will be in between and we could thus assume that the two compeying effects will be compensated. Provided that we consider the same trend up to 2050a neutral effect in absolute values (TWh) could be expected.	The impact on load profile will be a percentage of the load of washing machines/dishwashers/dryers. If we assume that the max of controllable load is 20% (according to timeslots), we could conclude that an order of magnitude of the max amount of controllable electricity is 20 TWh (this first calculation has to be combined to the load profile)	D1 is not retained since the two impacts on demand remain limited	
D2 – Cooking appliances	Cooking load represents 6.6% of residential demand (about 56TWh in EU27)	In the "role of electricity", figures are based on a study performed by CECED. - ovens electricity yearly consumption amounts to 18 TWh in EU25 in 2005 and is expected to decrease to a level of 13.7 TWh to 2030	We assume that the 7% of residential demand will remain stable (mark + ie accompanying the "natural" growth)	No increase in the average size of ovens, continuous technology improvement leading to a mark: -	No		The increase will be marginal and will follow the general evolution of the demadn curve	The impact on load profile will remain marginal since the slight increase of the electric load wil be distributed on the two daily peaks characteristic of the cooking needs in electricity.	D2 is not retained since the two impacts on demand remain marginal	
D3 - Lighting	Lighting represents 10% of the residential load, i.e. 84 TWh (2009)	Electricity consumption related to lighting in EU 27 (both residential and non-residential) represents around 14% of EU27 electricity consumption (JRC, 2012; IEA, 2006), i.e. around 370 TWh in 2009. among which 22% in residential i.e. about 82 TWH in EU27 in 2009. For more details see dedicated annex.	The volume effect is considered to remain stable (mark + ie accompanying the "natural" growth)	Breakthrough technologies are expected to change drastically the lighting in the next decades: LED, replacing the compact fluorescent lamps CFL and incandescent lamps, smart lighting with sensors of presence, etc..., the mark for the segment is undoubtely ---	Controllability level is "Marginal"		The energy efficiency potential indicated in the EE database is assumed toreach a theoretical max of 89% under the conditions of implementation of best available technologies whatever the costs. A more realistic figure is assumed by EURELECTRIC with a share of 8% of the residential load at 2030 time horizon (i.e. about 80 TWh in 2030 in EU27) Such slight decrease in the lighting consumption decrease will most likely be amplified in the period 2030-2050.	The impact is distributed over the hours requiring lighting, the effect on the evening peak shaving will remain limited	D3 is retained because of the structural modifications to be brought by the massive use of LED	LED as breakthrough technologies (CFL transitory product towards LED)
D4 – Water heating	Water heating represents 8.8% of the residential load ie about 73 TWh (2009)	In the "role of electricity", figures are based on a study performed by CECED. Water heaters electricity consumption will be reduced from about 73 TWh in EU25 in 2005 to a level of 56 TWh to 2030	The volume effect is considered to remain stable (mark + ie accompanying the "natural" growth)	No increase in the average size of units, continuous technology improvement and emergence of heat pumps water heaters leading to a mark: --	Controlability potential is rated "High"		The impact on the consumed energy will be marginal. The current fraction of 9% of residential load in Europe in 2009 (77 TWh) might reach 8% of about 1000TWh of residential load in 2030 (about 80 TWh). Trend is energy is stability: criticity in energy of this segment is low	If we consider that about 75% of the water heating load is controllable (already implemented in some countries but not overall in Europe), peak shaving features by a remote operator are technically possible. Therefore the criticity in power of this segment is high.	D4 is retained because of the new shape of the load profile	Heat Pumps (water heaters)

D5 – Electronic appliances	The Electronic appliances segment represents 17.2% of the residential load according to EURELECTRIC, Ms1.1. i.e. 145 TWh (breakdown: 70 TWh for TV, 14TWh for set top boxes and 61TWh for office equipment)	In the "role of electricity", the % of electricity consumption of this segment increases significantly from 10% in 2000, 15% in 2005 and to 27% in 2030.	The assessment of the volume effect has to consider the emergence of new uses (leisure appliances, smarthome control systems, etc.) and is clearly very techno-dependent. It is assumed to be at least ++ or even +++ at the 2050 time horizon. The visibility horizon for such high-speed evolving ICT usages remains limited to the next decade.	The average consumption per unit in operation (due to increased performance of appliances) is expected to increase, and the stand-by effect is assumed to decrease. The proposed mark for the energy efficiency effect is : + (The "expanded end use" component is indeed expected to win over the "energy efficiency" component.)	No	Criticity on energy will be high: an increase of the D5 load from 17% of residetial load in 2009, to a level of 27% of about 1000TWh of residential load in 2030 (about 270 TWh)	As the breakdown of the current electricity load of D5 between stand-by (base) and the evening peak load is equally shared, a strong increase in the evening peak is likely to occur.	D5 is retained because of the significant impact on peak	None: The diversity of technologies and options at that time horizon leads to challenges beyond the scope of the e-Highway2050 project
D6 - Space heating	Space heating amounts for 19.1% of the electricity demand in residential sector (corresponding to a consumption of about 160 TWh)	N/A	High performance buildings pushes for massive electrification of heating: + switch to new technology (renovation): +	Average unit size are expected to reduce by 20-25% due to improved building insulation and continuous technology performance improvement and massive deployment of heat pumps lead to a mark: --	Controlability potential is rated "High"	A slight decrease of electric heating demand resulting mainly from the improvement of building insulation	Massive deployment of heat pump technology for residential sector in Europe due to an increased energy efficiency combined to a transfer from gas to electricity will significantly modify the load profile. It is expected that the evening peak will be amplified. Criticity in power is high for this segment.	D6 is retained because of the new shape of load profile	Heat Pumps
D7 - Space cooling	Space heating amounts for 4.7% of the electricity demand in residential sector (corresponding to about 38 TWh of electricity consumption)	N/A	Ownership rate will clearly increase. A high growth is expected justifying the mark ++	Same analysis as for the space heating: unit size will be reduced due to better insulation combined to a continuous technology improvement. Proposed mark is: --	Controllability potential in new buildings is high (compared to the current situation). There is also a potential in refurbishment.	Increase in total electricity demand for cooling is expected (from 32 to 40 TWh in 2030 and a projection of 50 TWh in 2050)	Peak will be modified due to new demand in cooling	D7 is retained because of the new shape of load profile	
	NB: Other end uses (not included in D1 to D7) represent about 8.9% of residential load								

	Step 1 analysis							Step 1 analysis	Step 2 analysis
COMMERCIAL	**Volume effect**			**Energy efficiency effect**	**Load controllability potential**	**Impact on Energy demand (TWh)**	**Impact on load profile Power (GW)**	**End use segment**	**Technologies**
Segments	***Today (based on Ms 1.1 Eurelectric based on 2005 data, JRC) ; EUROSTAT 2013 (in blue color)***	***Sanity check (EURELECTRIC report "role of electricity")***	***Trends to 2050***	***Trends to 2050***	***Potential to 2050***				
TOTAL commercial	EUROSTAT: 827 TWh of electricity consumption in commercial sector in EU27 in 2009; 909 TWh in 2010; 865 TWh in 2011. Estimation of EU COMMERCIAL electricity demand at 834 TWh (2009, based on 2005 data).	In the report "Role of electricity" the annual electricity consumption is provided for both residential and commercial sectors at 1532 TWh in 2005.	Estimated at 1300 TWh in 2050 (about 1080 TWh expected in 2030- autonoumous scenario in the EE database).	*Detailed per end use: see below*	*Detailed per end use: see below*				
D8 - Office equipment	Office equipment load represents 5.9% of commercial demand (about 50 TWh, Ms1.1) (2005, EU25).	A value of 58 TWh (share of 8%) is provided in report "The role of Electricity" (2005)	The increased market penetration of computer related technologies combined with new uses as well as a continuous tertiarisation of activity (towards a service-oriented economy) justifies a mark ++ for the volume effect.	The average unitary needs/employee is expected to continue growing: + combined with the continuous technology improvement of each equipment: - The overall energy efficiency effectis rated: --	No	Criticity on energy will be high because of the strong increase of the D8 load from the 6-8% level to about 200 TWh in 2050	Crticity on the load profile will remain limited since the needs are mainly distributed over working hours with low controllability possibilties	D8 presents a criticity on energy due to the expected growth in the next decades.	None: same reason of low visibility on technologies at the 2050 time horiizon as for D5
D9 - Cooling and ventilation in tertiary buildings	D9 represents 15.3% of commercial demand (128 TWh).	The report "Role of electricity" gives 105 TWh in 2005, EU25 for cooling and ventilation in tertiary sector.	Increased requirements of more comfortable conditions in the workplace leads to a ++ mark for the volume effect.	Continuous technology improvement of equipment: -	Controllability potential is "high"	According to Eurelectric report "Role of electricity", the 105 TWh consumed in 2005 will reach a level of 235 TWh in 2030 and 320 TWh in 2050. The criticity in energy of this end-use is high. significant	Controllability will allow to activitly modify the load shape (seasonal and day/night effects)	D9 is retained because of the new shape of load profile	Heat Pumps
D10 - Commercial lighting	Office lighting represents 20.8% of commercial demand (173 TWh)	The electricity consumption of D10+D11 together was estimated at about 210 TWh in report "the Role of electricity" in 2005, EU25	The volume effect is rated ++ due to the pregressive shift towards an economy of services and to the emergence of new uses	Same analyses as for D3 with breakthrough technologies (LED, smart lighting,...). The mark for the segment is ---	Controllability potential is "high"	According to Eurelectric report "Role of electricity", the 115 TWh consumed in 2005 will reach a level of 150 TWh (2030) and 250 TWh (2050). The segment is critical due to the increase in energy.	Controllability potential during the peak hours will modify the load profile.	D10 is retained because of the structural modifications to be brought by the massive use of LED	LED as breakthrough technologies (CFL transitory product towards LED)
D11 - Outdoor lighting	4.7% of commercial demand (i.e. about 39 TWh)		A rating of ++ is proposed for the volume effect taking into account an annual replacement rate of 3%/year. Penetration is bound by the administrative and legal constraints of procurement laws	As D10 overall mark for the energy efficiency effect is - -	Controllability potential is "high"	The consumption of the segment could see a limited increase to about 50 TWh in 2050. Criticity on energy of the segment is low.	Controllability potential will modify the load profile.	D11 is retained because of the penetration of breakthrough technology and its controllability features	LED and smart lighting
D12 - Commercial refrigeration	8,6% of commercial demand for commercial refrigeration (about 71 TWh)	N/A	A slight increase is expected in line with the natural growth. Mark +	Continuous technology improvement of equipment and improved efficiency: -	Implementation of demand response programme are constrained by regulations on foods. The controllability potential is considered "low"	The consumption of the segment could experience an increase from about 70 to 100 TWh in 2050 in EU27. Criticity on energy is low.	Low criticity of the load profile of the segment	D12 is not retained since the two impacts on demand remain marginal	
D13 - Heating in tertiary buildings		Space and water heating represent about 20% of commercial demand ie about 170 TWh (report "Role of electricity")	Limited increase of requirements of more comfortable conditions in the workplace pushes for a + mark (one drgree below the mark given for cooling requirements)	Same analysis as for D6 (better insulation of buildings, heat pumps), proposed mark is --	Controllability potential is "high"	The consumption of the segment could reach 190 TWh in 2050. Criticity on energy is low.	Controllability potential will modify the load profile.	D13 is retained because of the new shape of load profile	Heat Pumps
D14 - Data management	Not detailed in Ms1.1	Not detailed in role of electricity	New uses in ICT (cloud computing, e-economy, ...) will increase significantly the needs. Proposed mark is +++	Continuous technology improvement combined with infrastructure optimisation. Proposed mark is -	No	The consumption of one "big" data center in 2009 is of the order of magnitude of 0.1-0.2 TWh	Low criticity of the load profile of the segment (base load)	D14 is not retained as the overall energy demand will remain limited and not controllable	
	NB: Other end uses (such as circulators or cooking appliances and not included in D9 to D14) represent about 14.6% of commercial electricity demand								

	Step 1 analysis							Step 1 analysis	Step 2 analysis
INDUSTRY		**Volume effect**		**Energy efficiency effect**	**Load controllability potential**	**Impact on Energy demand (TWh)**	**Impact on load profile Power (GW)**	**End use segment**	**Technologies**
Segments	***Today (based on Ms 1.1 Eurelectric based on 2005 data- Odyssee report ; EUROSTAT 2013 (in blue color)***	***Sanity check (EURELECTRIC report "Role of electricity")***	***Trends to 2050***	***Trends to 2050***	***Potential to 2050***				
TOTAL industry	EUROSTAT: 964 TWh of electricity consumption in industry sector in EU27 in 2009; 1027 TWh in 2010; 1032 TWh in 2011 (industry sector excluding the energy sector - Eurostat assumption). Odysee database describes a breakdown of the 964 TWh (ie 82.9 Mtoe) per industrial branches (see below). The share of electricity in industry has significantly increased (from 23% of total energy consumed in industry in 1990 to 32% in 2009).	Electricity demand in Industry estimated at 1071 TWh in 2006 (Role of electricity)	In the EE database, autonomous scenario provides 1225 TWh in 2012 and 1516 TWh in 2030. Under a best available technologies scenario this annual electricity consumption is reduced down to 1187 TWh (EU27, 2030).	In industry energy efficiency is already thoroughly addressed but improvements are still expected. ENER25 (European Environmental Agency): "Over the period 1990-2009, in EU-27 countries, energy efficiency in industry has improved by 30% at an annual average rate of 1.8% per year, with large differences among countries. Energy efficiency improvement has been realized in all industrial branches except textile. Over the period 2005-2009 energy efficiency improved by 1.5%/year with an important deterioration in 2009 due to the economic crisis." Typical proposed mark is therefore - for all segments which will not be involved in a major technology evolution. Otherwise mark could be --	*High and already partially exploited*			All segments to be retained: high criticity on energy and load shape	Scope beyond the e-Highway2050 project (multiplicity of different technologies impacting the load)
D20 - Chemicals	Odyssee report (electricity consumption on the segment): about 195 TWh in 2008 - 175TWh in 2009	213 TWh in 2010 (254 TWh in 2030)	Electricity in the chemicals sector is the most rapidly growing energy form: 1.78% per year in 2005-2030. Proposed mark for the volume effect is +	Technological progress in the chemical industry concerns increasingly electrochemistry. Proposed mark for energy efficiency effect in this segment is --	*High and already partially exploited*	*Criticity on energy*			
D16 - Paper & Pulp	Odyssee report (electricity consumption on the segment): about 140 TWh in 2008 - 122TWh in 2009	157 TWh in 2010 (263 TWh in 2030)	Production from recovered and recycled paper is less energy intensive (less than half of that of pulp production) and is more dependent on low enthalpy heat and electricity. The related volume effect is negative: -	Energy efficiency gains of 0.6% per year on average are expected in the period 2005-2030. Proposed mark is -	*High and already partially exploited*	*Criticity on energy*			
D15 - Steel	Odyssee report (electricity consumption on the segment): about 135 TWh in 2008 - 110TWh in 2009	Blast Oxygen Furnace: 11.4 TWh in 2005 (12.6 TWh in 2030) Electric Arc Furnace: 33TWh in 2005 (48 TWh in 2030)	Steel is produced either by integrated steelworks or electric arc furnaces. The former produces steel of high quality from iron ore and coal or coke. The latter uses scrap and allows for greater operational flexibility. Driven by new technological developments, electric arc has started to be used also for flat steel production. Proposed mark for the volume effect is +	The deceleration of the penetration of electric arc processing will lead to a slowdown of energy intensity gains (average amount to -1.4% per year in 2005-2030). In parallel significant energy intensity improvement of integrated steelworks which require in 2030 15% less energy per unit of output than in 2005. In terms of electricity consumption, EAF technology is more demanding (0.42 MWh/t) when compared to Blast Oxygen Furnace (0.1 MWh/t) Proposed mark is -	*Idem. The EAF is flexible (EAF production can be stopped at any time and restarted very rapidly). This characteristic is interesting for load management.*	*Criticity on energy is high*			
D21 - Food	Odyssee report (electricity consumption on the segment): about 115 TWh in 2008 - 110TWh in 2009	In the EURELECTRIC "Role of Electricity" report, electricity consumption data about "food and drink" are provided: 20TWh at 2005 and 27 TWh at 2030	Proposed mark for the volume effect is +	In this segment efficiency is already thoroughly addressed but improvements are still expected. Proposed mark is -	N/A	N/A			
NC - Machinery	This line does not correspond stricto sensu to an industry segment". The gathered data refer to all motors and driven systems used in industry. It is also kept as a transveral sector consuming electricity for multiple industrial segments. Odyssee report (electricity consumption on the segment): about 110 TWh in 2008 - 95 TWh in 2009	In the "Role of Electricity", motors and driven systems (enabling technology for all industry segments) account for approximately 65% of industrial electricity load: according to scenarios from about 800TWh in 2010 to 700-1100 TWh in 2030 and 900-1500 TWh in 2050	N/A	A significant evolution of energy efficiency is expected due in particular to an increased use of high efficiency motors (EEMs- Efficient Energy Motors). Demonstration have proven margin of improvements at the level of 35% today. It could be expected that these margins will be fully exploited at 2050. Proposed mark is --	*Controllability depends on the industrial process in which the machinery is integrated*	*Criticity on energy. Experts of IFW University of Hannover estimate the energy saving potential of 1GW for Europe.*	*For all industry segments, criticity on load shape depends on two factors: - controllability potential (already partially implemented in industry): margins of progress remain limited - modification of technologies/processes which might impact the load shape and the controllability*		
D19 - Non metallic	Odyssee report (electricity consumption on the segment): about 85 TWh in 2008 - 70 TWh in 2009	Cement: 23 TWh in 2010 (21 TWh in 2030) Glass: 29 TWh in 2010 (45 TWh in 2030) Timber: 38 TWh in 2010 (69 TWh in 2030)	Proposed mark for the volume effect is +	Cement: An energy saving potential if 3% each every 5 years to 2030 is assumed in the role of electricity due to the increase used of roller presses as part of modern grinding technology. Proposed mark is - Glass: the increasing use of electricity in the glasss melting process will be compensated by the overall reductino of energy consumptin. Proposed mark is -	*High and already partially exploited*	*Criticity on energy*			
D17 and D18 - Non ferrous	Odyssee report (electricity consumption on the segment): about 75 TWh in 2008 - 65 TWh in 2009	Primary Aluminium: from 37 TWh (in 2005) to a range of 56-66 TWh in 2030 according to scenarios. Secondary Aluminium from 2 TWh in 2005 to almost 5 TWh in 2030. Zinc from about 6 TWh in 2005 to 4 TWh in 2030	Proposed mark is + (natural growth) but bound by possible deindustrialisation	Production of primary aluminium, through electrolysis of alumina, is by far the most energy intensive process in this sector. Secondary aluminium uses thermal processing, which is much less energy intensive, to recycle scrap aluminium. It is expected that around 60% of the EU non ferrous metal output will come in 2030 from recycling, up from around 40% in 2000 Proposed mark is -- (due to the recycling effect)	*High and already partially exploited*	*Criticity on energy: a slight increase in electricity consumption in this segment is expected (about 8% over the period 2005-2030)*			
NC - Textile	Odyssee report (electricity consumption on the segment): about 27 TWh in 2008 - 23 TWh in 2009	N/A	Decrease in the needs in electricity as a consequence of the decrease of activity in Europe. Proposed mark for the volume effect is -	Continuous technology improvement. Proposed mark is -	*High and already partially exploited*	*Low criticity*		End use not retained	

NC - Others	Odyssee report : this segment includes all other industrial branches (about 195 TWh in 2008 and 2008)	N/A	N/A	N/A	N/A	*N/A*		End use not retained	

NC=No code of end-use in Ms1.1

	Step 1 analysis							*Step 1 analysis*	*Step 2 analysis*
TRANSPORT	**Volume effect**			**Energy efficiency effect**	**Load controllability potential**	**Impact on Energy demand (TWh)**	**Impact on load profile Power (GW)**	**End use segment**	**Technologies**
Segments	***Today EUROSTAT 2013 (in blue color)***	***Sanity check (EURELECTRIC report "Role of electricity")***	***Trends to 2050***	***Trends to 2050***	***Potential to 2050***				
TOTAL transport	EUROSTAT:66 TWh of electricity consumption in transport sector in EU27 in 2009; 68 TWh in 2010; 68 TWh in 2011	Electricity demand in transport in EU27 estimated at 71 TWh in 2006 (Role of electricity)	In the report "Role of electricity", a forecast at 2030 for transport foresees 80TWh for electricity demand at 2030 time horizon						Scope beyond the e-Highway project
D23 - Electromobility (vehicles)	Electricity consumption in EU27 in D23 is marginal due to the low penetration of electric vehicles and hybrid	N/A	EVs typically represent a new use with a strong potential impact on electricity demand: +++	EE: - decrease (less weight) but limited due to battery limits	Controllability potential is "high"	Significant impact in energy : the constraints on the grid will be very high especially in case of fast charge and non controllable charge. Uncertainty on the speed of deployment: under massive deployment (e.g. 150 million BEV and 120 million PHEV in 2050), plug-in EVs could generate an additional demand of around 200 to 250 TWh/year	Crticity in power is even higher than the impact on energy: If no demand-side management measures are implemented, the charge of plug-in EVs will have a major impact on the demand load profile, as most of the charges will take place at the same time (evening peak)	High criticity on energy and load shape	Electric vehicle, plug-in hybrids
D24 - Freight	Electricity consumption in EU27 in D24 is limited since only 10% (in EU27 in 2004) of freight is transported by rail (about 13 TWh of electricity consumption in this segment)	Today the freight is exclusively powered by diesel type engine	Two complementary effects contributing to an increse of electricity consumption could be foreseen: - a progressive transfer from road to rail for freight - an emergence of hybrid diesel motors for light and medium duty trucks, light duy trucks could also be fully electrified in urban areas	See rail and electromobility. Proposed mark is --	No	Impact will remain limited even though some transfer from road to rail are likely to occur (development of intermodal transport)	Impact on load profile will remain limited	D24 is not retained since the two impacts on electricity demand remain limited	
D25 - Buses	Electricity consumption in EU27 in D25 is marginal due to the low penetration of electric vehicles and hybrid	Today bus are mainly powered by internal combustion engine	An electrification effect is expected but mainly focused on urban areas: - electric micro and minibus (urban context) - hybrid for periurban bus. New technologies are expected such as distributed inductive recharge for electric buses that reduce the battery wheight and increase the drive distance. This electrification will compete with an expected deployment of biogas. Thus proposed mark is +	See electromobility (vehicles). Proposed mark is -	Low. However new technologies such as distributed inductive charging system to be deployed in future electric bus networks, the charging power can be controlled and optimized in order to avoid peaks.	Impact in consumed electricty (energy) will remain limited despite the electrification	Impact on load profile will remain limited. Some local constraints could appear in the case of massive deployment of electric bus with fast charging features. This conclusion might be revised in case of continuation of the growth rate increase in railway/tramway systems.	D25 is not retained since the two impacts on electricity demand remain limited	
D26 - Electrified railways	This segment represents most of the electricity consumption in transport.	Electricity consumption for electrified railways (excluding Tramways) in 2005 (report "Role of electricity", EU25) is 55 TWh	Number of km*passagers which is expected to grow (from 400 bn passenger.km of heavy rail in 2005 to a forecast of 538bn passenger.km in 2030) (source: Eurelectric report "Role of Electricity"). Significant improvements are expected both for long distance/high speed railway system (trans-European transport network TEN-T Programme) and for urban and suburban metro which might have a significant impact on the electric system.	Expected energy efficiency measures are : application of storage systems and bidirectional substations (regenerative brakes), reduction of weight per seat, improved aerodynamics, reducing energy losses in transformers, power electronics and traction motors, optimisation of auxiliary equipments, reducing energy losses from overhad lines. Proposed mark is -- (almost 50% efficency gains from 2005 to 2030)	No	Impact will remain limited. Electricity consumption for electrified railways (excl. tramways) in 2030 (role of electricity, EU25) is 59 TWh	Impact on load profile will remain limited	D26 is not retained since the two impacts on electricity demand remain limited	