



Trust In: Vocational Education and Training (VET) Course Outline Resource Efficiency in Mobility

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Structure and modules of a potential course

- Differences in modalities
- Environmental and resource impacts
- Drivers for resource and other impacts
- Strategies for reducing impacts and enhancing ecological efficiency



Mobility is a priority - main modalities

- Key modalities are
 - Persons
 - Car transport
 - Rail, bus
 - Airplane
 - Goods
 - Vans and trucks
 - Rail
 - Sea / river ship
 - Air

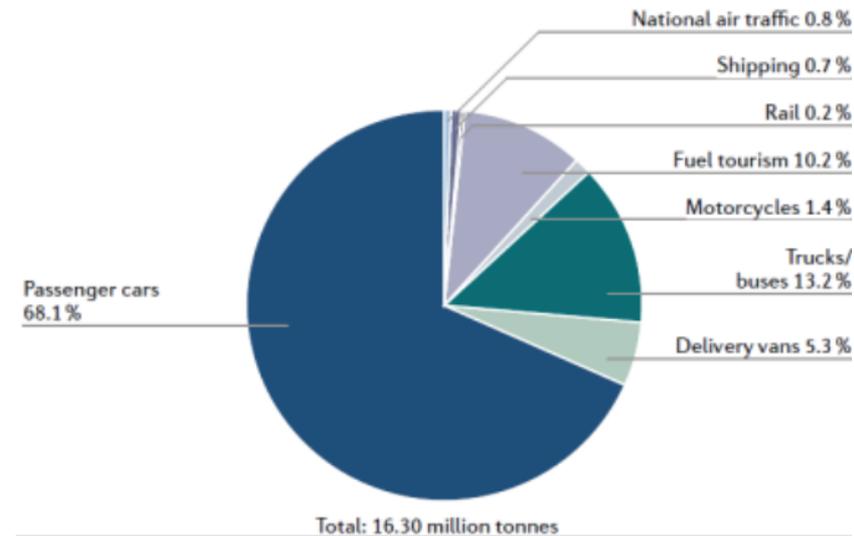


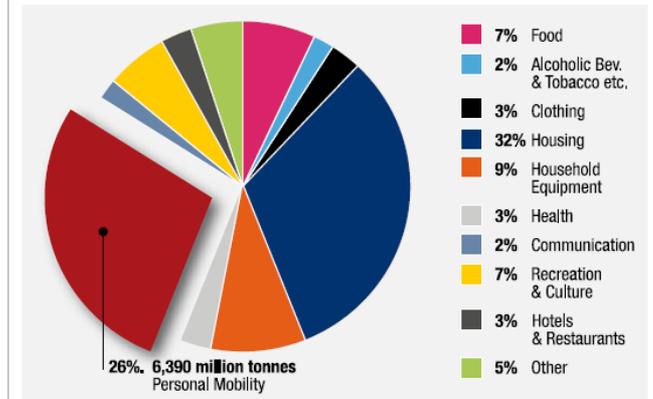
Figure 1 CO₂ emissions generated by transport, 2009ⁱ



Environmental impacts of mobility

- Responsible for 20-30 % of CO₂ emissions and other impacts such as material use
- Car transport and truck transport is dominant
- Tourism follows (mixed bag)
- Air traffic now 2%
 - But rising
 - And due to water and altitude GWP higher

Figure 4: Global CO₂ emissions of personal mobility



Source: One Planet Business Global Evidence Base, 2006¹⁸

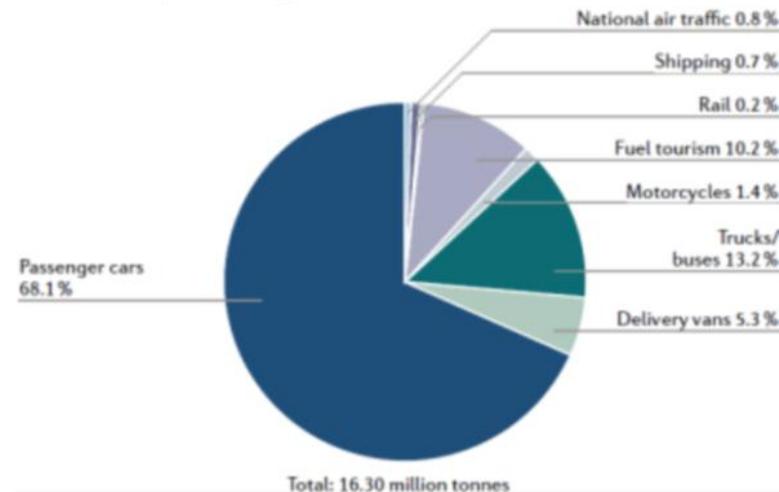


Figure 1

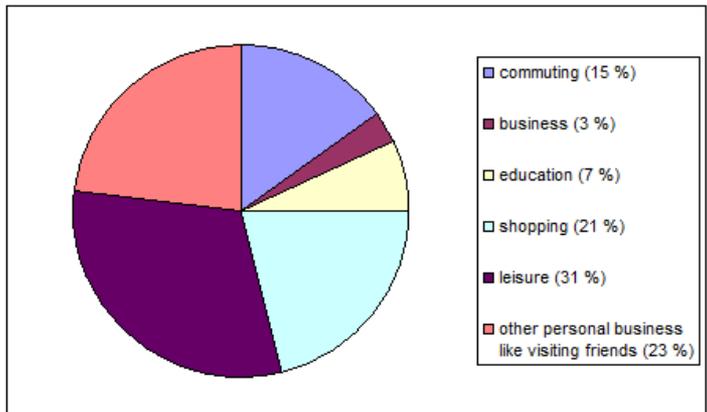
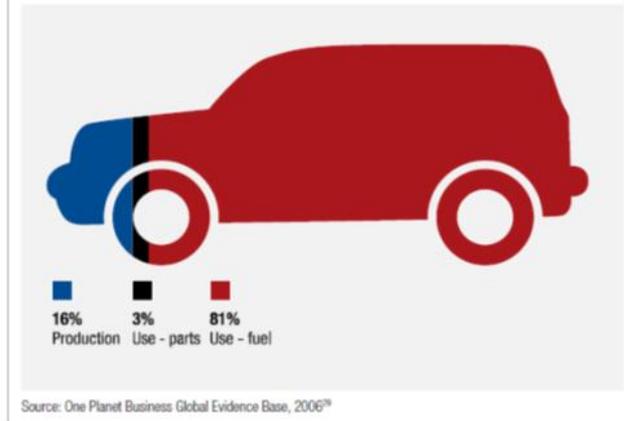
CO₂ emissions generated by transport, 2009¹



Some more insights in impacts: automotive

- Over 80% impacts in the use phase, just 16% for car making
- Just 10% or less of fuel used for transporting the person(s) in the car, the rest is car mass and fuel
- This is equally true for other modalities (although a bit less pronounced)

Figure 8: CO₂ emissions over the life cycle of an average vehicle

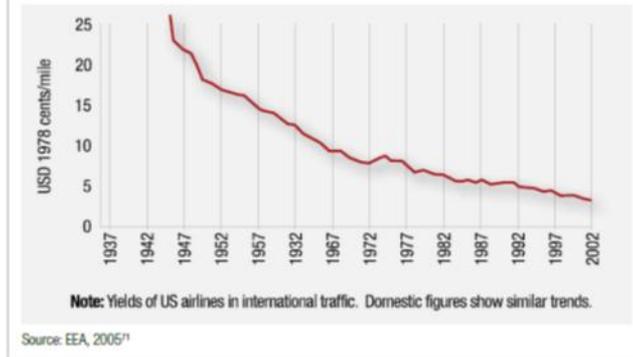




Typical drivers

- Brevier law: 1 hour single journey commute is accepted over the decades
- Other drivers - Public
 - Public
 - Urban sprawl -> longer home-work distances, less potential for public transport due to low density
 - Double income households -> longer home-work distances, 2 instead of one family member commutes
 - Individualisation -> more leisure and networking outside the home
 - Leisure time -> more leisure outside home
 - Lowering prices and rebounds in combination with higher wealth -> more long range travel

Figure 15: Rapid decrease in international flight prices





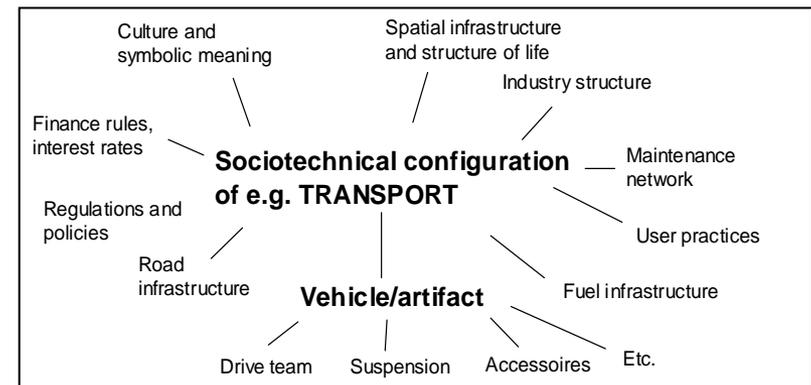
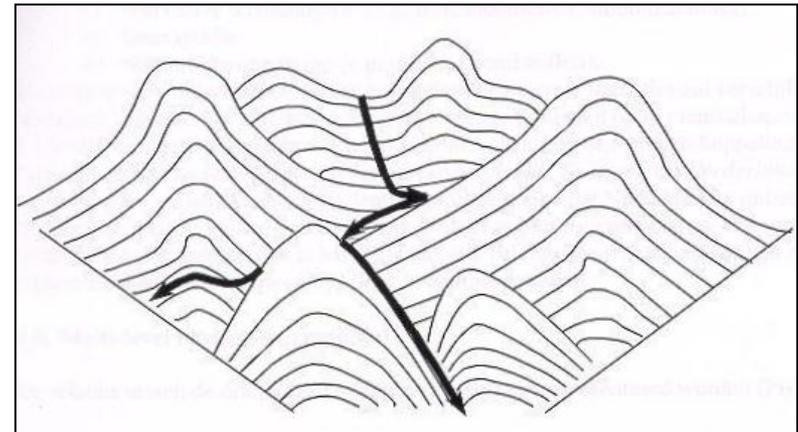
Typical drivers (ctd.)

- Drivers - business
 - Globalisation -> global value chains
 - Economies of scale combined with lower transport prices -> concentration of production
 - Just in time -> 'fine mazed' transport (trucks) pays off



Result: a markedly stable, unsustainable system

- Landscape factors
 - Globalisation
 - Individualisation
 - Wealth rise
 - Etc.....
 - ..set regime boundaries
- Regime factors
 - Interlinkages
 - Etc.
- Provide a very stable situation...





The challenge differs remarkably per world region

Type of Economy	Example countries	Main sustainability challenge
1. Consumer	US, Japan, Western Europe	<u>Radical decoupling</u> Dramatically lowering resource use while maintaining economic output ('Factor 10') ..while facing high lock in factors
2. Emerging	China, S-E Asia, South America	<u>Leapfrogging</u> to sustainable structures of consumption and production without copying Western examples first
3. Bottom of the pyramid	Many countries in Africa	<u>Ensuring basic needs</u> Developing dedicated solutions for the 'Bottom of the pyramid'; providing a basis for sustainable growth

Adapted from: Hart&Milstein, Sloan Management Review, Fall 1999, and C.K. Prahalad, The Fortune at the Bottom of the Pyramid, 2005



Reductions needed

- Carbon: 80% or more
- Materials: less critical, if 'abundant' materials like steel etc. are used
- Biotic materials: forget 1st or 2nd generation biofuels!
- Land: we have to limit landscape divisions by roads

Type of resource	Fraction of global resource extraction	Basis for planetary limits	Potential limit	Reference
Fossil fuels	20%	Absolute scarcity CO ₂ emission targets	EU GHG targets (20-20-20 or 30% reduction by 2020) Scientific targets (>80% reduction by 2050)	EC (2008, 2010). Meinshausen et al. (2009), IPCC (2007)
Biomass	30%	Maximum Human Appropriation of Net Primary Production of Biomass (HANPP)	Currently, 30-35% of available biomass is extracted by humans. Target may be stabilization or minor growth	Vitousek et al. (1986); Haberl et al. (2007)
Metal ores and industrial minerals	10%	Absolute scarcity (varies by metal). Most metal ores need high levels of energy to be transformed implying a 'linkage' to CO ₂ emission targets and energy constraints	Focus on 14 critical raw materials identified in Raw Materials Initiative. Changes in energy and mobility infrastructure (solar cells, batteries) determine future criticality	RMI (2009) For linkages with energy use, see Graedel and Van der Voet (2010)
Construction minerals	40%	Absolute scarcity seems not relevant, except in densely populated areas where space for sand, clay and gravel winning is limited.	Implicit targets for construction minerals that need high levels of energy in their production (e.g. cement, ceramics)	
Land	p.m. (not expressed as mass)	Available bioproductive land, with reservations for nature areas (e.g. rainforests)	Conflicting information about remaining areas that can be converted to agricultural use	Nature (2010), Erb et al. (2009), WWF, (2010), OECD/FAO (2009)
Water	p.m. (usually not included in MFA)	Renewable supply (varies by region); agriculture is dominant user	A global 'water gap' of 30% expected in 2030,	Water resources group/McKinsey (2009); Chapagain and Hoekstra (2007)



Strategies for reducing impacts

- Reduction targets of high percentages can be realised
- Can be done via smart combi of product design, PSS, and reduction of use...
-but must be done smartly by Organising patterns of consumption so that maximum quality of life is realised while using the same resources

Intervention mechanism	Potential reductions of impact per unit Quality of Life
Reducing emission factors	<ul style="list-style-type: none">- Small mass flows: several factors- Large mass flows: Limited
Improving production	<ul style="list-style-type: none">- Usually limited to intermediate,- Factor X in case of system innovation
Enhancing use intensity	<ul style="list-style-type: none">- Factor 2 or more, depending on the sharing, pooling or function combination system
Enhancing immaterial consumption	<ul style="list-style-type: none">- Factor 2 (if limited to changes within existing product and service categories)
Enhancing the ratio Quality of life and consumer expenditure	<ul style="list-style-type: none">- Several factors?



'Regime compliant' strategies

- Reduce emission factors
 - Ok for emissions
 - Less clear for resources
- Design for low fuel use (3 or 1 liter car)
- Product services: car sharing
 - Factor 2
 - Lower quality of service?
- Low-need transport cities
 - Curitiba
 - Other good Public Transport Examples

Substance	Emission EU15 (1990)	Emission EU15 (2000)	Emission EU15 (2020)
Km	2.150 Mio T	2.700 Mio T	3.400 Mio T
CO2	570 Mio T	710 Mio T	900 Mio T
NOx	5.5 Mio T	3.8 Mio T	1.1 Mio T
CO	19 Mio T	17.5 Mio T	5 Mio T
VOC	3.5 Mio T	2 Mio T	0.5 Mio T



1 l/100km



3 l engine,
20-50 l/100km





Radical change: carrot and stick

- Provide institutions putting pressure on regime
- Lead change that can be realised now
- Provide inspiring examples of more far-reaching change
- ...is probably needed for more tough things like air transport and goods transport

A: Establish a basic institutional framework

Actions	Expected leadership	Examples of tools for change
Turn the UNEP Resource Panel into an IPCC equivalent on resource use and consumption	UN, EU	EU and UN Sustainable Development Strategies
Develop policy frameworks and plans covering all the below at EU and Member State levels	EU and Member States	7th Environmental Action Programme; UN and EU Sustainable Development Strategies
Place SCP policy units at a strategic level in governments	EU and Member States	A European Commissioner level Sustainable Development Committee
Develop monitoring systems for SCP	EEA, EUROSTAT and national counterparts	
Where relevant, facilitate networking and access to knowledge and finances for the activities below	EU, Member States; Finances All: networking	Specific CSD projects in FP7; national government funding for CSDs; Global Environment Fund
Develop social policy and structures to create more equal societies, allowing active engagement	EU and Member States	

B: Lead change that can be realised within existing structures and mindsets

General actions	Expected leadership	Examples
Maximise use of policy instruments along the production-consumption lifecycle	EU and Member States	Articulated sustainable industrial policy development; enforcing ILO standards; green/sustainable public procurement; coherence between sustainability objectives and fiscal mechanisms (taxes, subsidies, emission trading, etc)
Maximise implementation of business instruments	Business and business organisations like WBCSD	Corporate Social Responsibility, choice editing, supply chain management, new business models
Maximise opportunities for sustainable consumption and practices/lifestyles	CSDs and Individuals EU and Member States	Political consumerism, education, responsible advertising
Focus financial support like innovation and recovery packages on fundamental change	EU and Member States	Abolishing perverse subsidies, internalising external costs, investment in sustainable infrastructure
Consumption-area specific actions		
Built environment and housing		Maximise use of domain-specific instruments limiting emissions and resource use:
Energy using products	EU, Member States, local governments and businesses	• Sustainability standards / minimum requirements for houses, cars, electronics, agriculture
Food and drink/agriculture		• Fiscal mechanisms (e.g. aviation fuel tax, emissions trading, subsidies, etc)
Mobility (including for tourism)		

C: Develop inspiring approaches towards change that is still resisted now

Activity	Expected leadership	Examples
Provide practical, inspiring examples showing fundamental change can work	CSDs Front runner businesses, EU, Member States, local government	WWF's One Planet Future programme, Transition Towns, Slow movement, eco-chicks, Individuals "walking the talk"
Provide convincing evidence of how change can work and where it is most needed, e.g. <ul style="list-style-type: none"> • assessing environmental and resource limits • providing indicative roadmaps for change in key consumption domains • performing 'paradigm challenging' research 	EU/UN: establish an Intergovernmental Panel on Resource Consumption; CSDs/independent think tanks	IPCC for climate change; new economics foundation; and UK Sustainable Development Commission
Organise a process of deliberation, learning and analysis on 'pieces de resistance'	CSDs Front runner businesses EU, Member States	"Beyond GDP" conference; "Svilgjar Commission"



Conclusions

- Reduction of resource use in transport is relevant but difficult
 - 30% of impacts
 - High level of lock ins
- Various regime compliant strategies are promising
 - Eco-design (1 or 3 liter cars)
 - PSS – if of equal quality as car ownership
- More radical approaches needed too
 - Spatial planning
 - Life style changes (air transport)
 - Production structure changes (goods transport)