Civil Society Leads

This info-mural describes one of three scenarios and modeling outcomes developed by the POLFREE Project. The other two scenarios are Global Cooperation and Europe Goes Ahead.

Policies by Decade to Achieve European Resource Efficiency Targets

2016

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 308371.

About the POLFREE Project

The POLFREE (POLicy options For a Resource Efficient Economy) project worked through four key stages. The first was to address the key question – why have resources been used inefficiently? To do these, we constructed a theoretical framework for the analysis of resource efficiency, with detailed comparison of the trends and policies at EU and Member State (MS) level, cross-country econometric analysis to derive resource-reduction cost curves, and an analysis of business barriers to resource efficiency; thereby developing an enhanced understanding of the drivers of inefficient resource use.

This led to the second stage, an exploration of new concepts and paradigms that can bring about a radical increase in resource efficiency, and a vision for a resource-efficient economy in the EU. This included suggestions for new, more resource-efficient business models for firms, and ideas for a global governance regime that can promote resource-efficient economies among the EU's trading partners and more widely. From its new vision for a resource-efficient economy in Europe, the project proposed policy mixes, business models and mechanisms of global governance through which resource-efficient economies may be promoted.

The third stage involved intensive work on creating, modeling and visualizing scenarios for the emergence of resource-efficient economies. This involved linking quantitative economic and ecological models, and simulating the policies and policy mixes derived in the earlier work, supplemented with appropriate Life-Cycle Assessment (LCA) analysis for selected products and sectors, to ensure that the policies and business models in the scenarios lead to absolute decoupling of economic activity from resource use and environmental degradation. The scenarios and associated policy analysis considered economic, environmental and social dimensions.

The project was be explicitly geared to support policy efforts and initiatives on resource efficiency in the European Commission, and involved a wide range of stakeholders from business, the policy world, and NGOs.

Context and Assumptions for Civil Society Leads Scenario

EU and Member States

Economic Model A "beyond growth" model that recognizes the environmental limits to growth and uses new measures for progress in addition to GDP.
- Climate cities, community climate clubs and energy cooperatives are addressing climate change at local and regional levels in EU

Macro-economic Objective Increasing focus on indicators of wellbeing in parallel to GDP

Social Equality Significantly higher than today with a fairer share of work and income over all generations. Supported by policies that consider work-life balance and strengthen family owned businesses.

Technology and Resource Efficiency De-centralized technologies, systemic and social innovations

Lifestyles and Preferences Reduced paid working hours: average working time of those in employment decreases by up to 1% per annum. A corresponding fall in wages is partly offset because hourly wages increase with labour productivity. There is more tele-working and greater application of new ICTs. Innovative forms of energy, water and resource efficient housing e.g. Co-housing Private spaces are reduced and common services and spaces emerge with their multifunction qualities

MacroVU® Analytics
Created by Robert E. Horn, Stanford University - hornbob@earthlink.net
Produced by MacroVU®, com
Some portions of this work are copyright by MacroVU,

During the 2010s | During the 2020s | During the 2030s and 2040s

Resource Governance
(Policies that affect most or all sectors below)

NARRATIVE
Citizens of EU Member States with policy & media leadership undertake a massive change in consumption habits and beliefs

During the 2010s
- All Environmentally Harmful Subsidies removed
- Harmonized labelling on resource (and energy) consumption of products
- Ecological tax reform introduced. Decrease in tax on income; increase in taxes on resource use
- Market and policy incentives that reward business investments in efficiency
- Investments in coordinated Research, Development and Innovation for material, water and energy efficiency
- Green Public Procurement : Public authorities required to purchase more products with lower environmental impacts
- All River Basin Management Plans implemented, including effective and fair water pricing and water efficiency targets in all river basins

Additional Important Policies
- Landfill bans for untreated waste
- Infrastructure for the collection and recycling of used paper and timber products improved throughout the EU
- Waste Framework Directive fully implemented
- "Sustainable Resource Management Programmes" established to provide a harmonized approach for decoupling and a platform for developing "Sustainable Biomass Action Plans"

During the 2020s
- Educational reforms across the EU integrate systemic approaches to problem-solving and basic education about all aspects of sustainability
- Payment systems for eco-system services introduced
- Strong focus on raising awareness on sustainable resource use

Additional Important Policies
- Differentiated Value Added Tax rates introduced for material-intensive products
- Personal resource use quota cards introduced
- Unconditional basic income is introduced in all Member States
- Improved monitoring methods, tools and transparent indicators introduced and continually updated on the state and use levels of all natural resources
- Research, Development and Innovation funding on resource efficiency increases
- Material efficiency agencies established in all EU Member States'
- Deposit schemes for resource-intensive products introduced
- National Strategies for Sustainable Lifestyles implemented
- Water Framework Directive fully implemented
- Ecodesign Directive expands to cover 20 most material-intensive products, and follows 'Top Runner' approach
- Support for resource-efficient business models

During the 2030s and 2040s
- Value Added Tax is fully transformed into a material added tax with border tax adjustment and tax rates by 2040

Economic Outcomes

	2030	2050
EU GDP	-8.8%	-21.4%
Global GDP	+0.1%	-1.4%
EU Number of Jobs	+4.3%	+9.3%

Difference against "Business-as-Usual" (Reference) scenario projections for 2030 and 2050

POWER

MAJOR FEATURES
- Energy infrastructure is largely decentralised, flexible and collaborative.
- Centralized large-scale systems and decentralised systems work together and depend on each other.
- Micro-generation and more localized renewable sources.
- Some EU countries use fracking and nuclear options, though at a moderate level as demand is reduced

During the 2010s
- Consumption made transparent, e.g. regular billing with clear consumption and cost information
- Average EU CO2 intensity target for generation for generation is established (130gCO2/kWh)
- Significant proportion of electricity grids under local government or community ownership

Additional Important Policies
- Substantial investments in combined heat and power plants, and the decentralisation of power generation
- EU Emissions Trading System reformed
- Smart grid regulation and standardization completed and substantial roll-out begins
- Energy Taxation Directive reformed to align the carbon price on energy products for sectors not subject to EU ETS
- Each Member State has a one-stop-shop for renewables for authorisation and permitting

During the 2020s
- Average EU CO2 intensity target for generation for generation is established (250gCO2/kWh)
- Most electricity grids owned and managed by local governments or communities
- Payment system for energy services (e.g. for storage) introduced

Additional Important Policies
- Smart grids fully established and operational
- Economic instruments used to promote the use of residues from forestry and agriculture at sustainable levels

During the 2030s and 2040s

Additional Important Policies
- Further support for decentralised renewable electricity generation by 2040

MOBILITY

MAJOR FEATURES
- Highly efficient intermodal transportation options combining public transport, biking and walking
- Integrated, system spatial planning reduces travel needs
- People work close to where they live
- International travel reduced
- Lifestyle change: an extreme shift in transport modes towards combining public transport, biking and walking - Variable sharing concepts (car & bike sharing schedules and car & van pooling)
- Less air traffic

During the 2010s
- Congestion charging differentiated by CO2 intensity introduced for key urban areas
- Reduced tax rates and/or grants for community/share d-ownership vehicles
- Reduced tax rates for all businesses and companies that implement employee mobility plans and/or lease business fleets based on hybrid, plug-in and e-mobility vehicles
- Information and Communication Technologies used to allow matching of mobility supply and demand and planning of multi-modal travel
- Significant investments made in establishing a high-speed rail network in Europe

Additional Important Policies
- Electric vehicle charging infrastructure in large urban areas significantly expanded
- Significant increase in investment in infrastructure for pedestrians, cycling and shared-ownership vehicles
- Investment in new motorways and airport infrastructures strongly reduced
- Vehicle Excise Duties aligned across the EU and linked to CO2 intensity
- CO2 intensity standard for new cars (95gCO2/km) and new light goods vehicles (147gCO2/km).
- CO2 labeling of all vehicles mandatory
- All EU aviation and shipping brought under the EU Emissions Trading System
- Transport management systems coordinated across Europe with intermodal ticketing

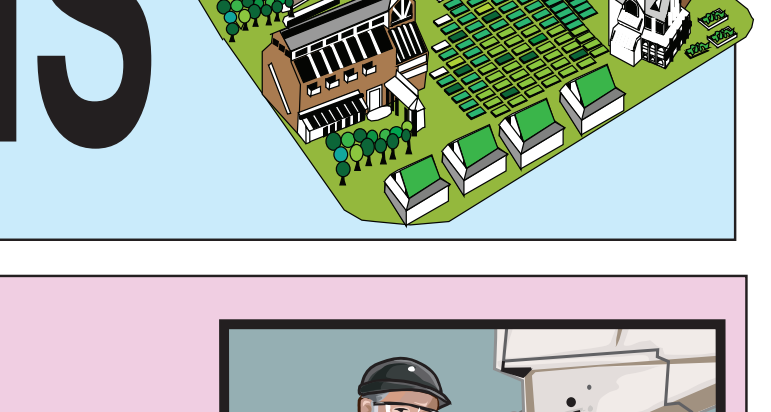
During the 2020s
- Spatial Planning Directive implemented to promote low-carbon mobility and housing, and green spaces in cities
- Congestion charge significantly increased for CO2-intensive vehicles
- CO2 intensity standard for new cars, new light goods vehicles and heavy goods vehicles
- Investment in a high-speed train network for passengers and freight connecting European core cities (approx. _ billion Euro)

Additional Important Policies
- Tax relief for car-pooling/-sharing schemes and for working at home
- Use of cargo-bikes (and e-bikes) for inner-city suppliers and delivery services is subsidized
- Electric vehicle charging infrastructure rapidly expanded in rural areas and on long distance routes
- Further investment in infrastructure for pedestrians, cycling and shared-ownership vehicles
- Hydrogen refilling infrastructure is established (primarily for heavy goods vehicles) at key nodes
- Taxes on airline tickets increased in all EU Member States

During the 2030s and 2040s
- CO2 intensity standard for new cars, new light goods vehicles
- Increased stringency of Spatial Planning Directive further emphasises priority for low-carbon mobility and buildings, and green spaces

Additional Important Policies
- Electric vehicle charging infrastructure available in all areas by 2040
- Hydrogen refilling infrastructure in place for all hydrogen vehicles in all urban areas and rural nodes by 2040
- EU high-speed rail network is fully operational by 2050
- All conventionally fuelled cars banned from all urban areas by 2050

BUILDINGS



MAJOR FEATURES
- Renovation and refurbishment of existing buildings sourced by high rates of recycled materials from urban mining
- Modular construction enabling easier repair, rebuilding and rearranging of the building
- Efficient heating and cooling with the natural advantages of earthen walls, rooftop gardens, and indoor vegetation

During the 2010s
- All new buildings required to be 'near zero-energy' and to consider integrated renewables in construction
- Tax relief for builders using reclaimed, locally and regionally sourced and natural construction materials
- Targets for thermal retrofitting, renovation and refurbishment for existing buildings together with innovative funding mechanisms
- 'Smart meters for electricity required for 80% of domestic properties. Targets introduced for smart gas and water meters

Additional Important Policies
- District heating must be installed if appropriat e/feasible
- Higher taxation on the use of virgin material
- Tax incentives to encourage innovative co-housing & living models
- Building regulations introduced to ensure that major components of buildings are standardized for modular construction
- Economic instruments and information campaigns support installation of green roof
- Generation tariffs introduced for renewable heating/cooling technologies
- Separate collection schemes for all recyclable waste streams
- 3% annual renovation rate for public buildings to raise energy efficiency standards
- Planning for closed-loop water treatment for large urban areas begins
- Additional fees for bringing construction materials to landfill established

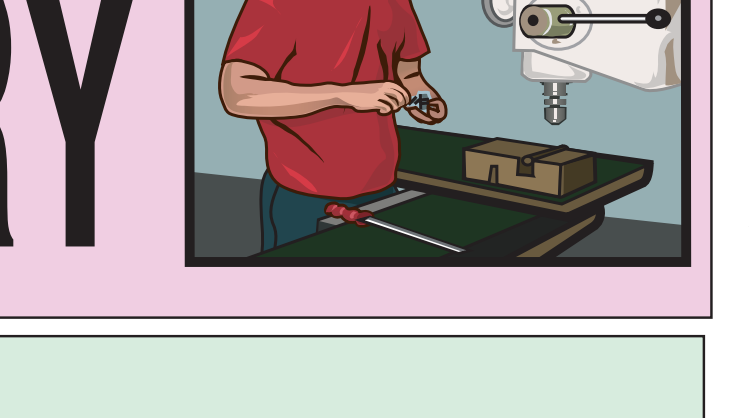
During the 2020s
- 100% of domestic properties fitted with smart meters for energy and water
- All new buildings required to have a materials pass showing quantities and location of raw materials to support coordinated urban mining efforts

Additional Important Policies
- Expansion of built environment halted through more innovative living communities and concepts of shared space
- Value-added Tax reduced to 0% for repairs
- 3% annual renovation rate to higher energy efficiency standard for public buildings required
- Mandatory waste prevention targets
- "Pay as you throw" fees in all EU Member States.
- Bringing construction materials to landfill banned
- Standards for resource-light structures established
- Vacancies in buildings avoided through business models, e.g. short-term exploitation models and higher taxes for owners with vacancies
- Most new key appliances required to have 'smart' capabilities
- Significant number of closed-loop water treatment systems for large urban areas installed

During the 2030s and 2040s

Additional Important Policies
- Incentives for product services provided, in particular, by SMEs for water, energy and materials by 2040
- Widespread implementation of rainwater harvesting by 2040

INDUSTRY



MAJOR FEATURES
- Supply chains in all areas are small, with local networks of suppliers working together to build collaborative and sustainable methods of production and delivery to market.
- Corporate responsibility and transparency is high, but without formal systems of reporting.
- Most products are of high quality, made from renewable resources, can easily be repaired and upgraded and provide a large amount of service to their users and can be recycled at the end of their lifespan.

During the 2010s
- Financial incentives introduced for business investments in efficiency, particularly product-service systems and second-hand schemes
- Institutional barriers for the recycling market removed
- Obligatory accounting system introduced for material costs, waste expenditures and other social costs in all companies

Additional Important Policies
- Concessions to energy-intensive industries are removed
- Increased regulation and monitoring to reduce illegal waste exports'
- Use of hazardous substances in all products banned
- Expansion of entrepreneurial networks and creation of an infrastructure for social entrepreneurship
- Mandatory corporate reporting of full range of resource nexus issues for all large publicly listed companies
- Investments in the verification of timber across supply chains
- EU Emissions Trading System reformed
- Sector-level voluntary agreements are reached on energy/emissions reductions

During the 2020s
- Zero-Value Added Tax policies for waste prevention strategies
- Standards introduced for reusability, reparability and upgrade potentials for new products and for innovative products and services

Additional Important Policies
- Obligatory material product passes showing all amounts, qualities and locations of materials contained in components and final products
- Voluntary corporate reporting of the full range of resource nexus issues in small and medium sized companies
- Investments for the establishment of bio-refinerieses
- Carbon capture and storage is demonstrated for key industrial processes and mass deployment begins
- Labels for timber products allowing tracing to their origins
- Individual extended producer responsibility begins for all relevant waste streams

During the 2030s and 2040s

Additional Important Policies
- Continued support provided for the development and use of advanced materials and production technologies

LAND
FOOD, AGRICULTURE, FORESTS

MAJOR FEATURES
- Local food production by smaller businesses
- 95% of farms are organic
- Specialized and niche products
- Fertilizers and pesticides have been substantially reduced
- Food supply chains are generally short
- High self-sufficiency at national level
- Diets based on local, regional, seasonal and organic food
- Less meat-consumption
- No food waste

During the 2010s
- Support for the establishment of urban gardens, Community Supported Agriculture initiatives, Community Food Cooperative Programmes
- Common Agricultural Policy revised to support agro-ecological and organic farming and a return to diversified land production systems

Additional Important Policies
- Health promotion programmes and policies to support changes in dietary habits
- Restaurants and retailers required to provide small, medium and large portions and nutritional information
- Programmes to promote a healthy diet in schools
- Financial support for young farmers and small farms
- Regulations to restrict the advertising of unhealthy products and meat targeting children
- Regulations introduced to require businesses to use front-of-pack nutritional labelling and to restrict the use of addictive elements in processed foods
- Transparency regarding the purchase and leasing of land abroad is increased

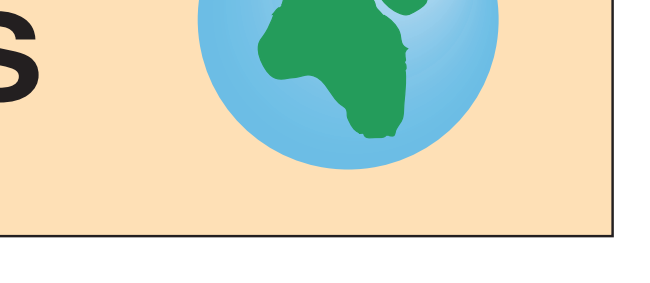
During the 2020s
- Value Added Tax for organic products reduced by 50%.
- Tax breaks for the use of regional and seasonal foods in schools, hospitals and canteens as well as at catered events
- Common Agricultural Policy reformed further to provide strong support for organic farming, reduce water abstraction in agriculture and widespread application of the principles of agro-ecology

Additional Important Policies
- Water footprint tax for food
- Support (training and funding) for innovative food services (e.g., SMEs, living room canteens, food cooperative) and more sustainable agricultural and forestry practices
- Tax based on greenhouse gas emissions related to meat production
- Innovative funding and knowledge networks to support soil restoration
- Broad shift of forest management practices from "sustained-yield" forestry to "multiple-purpose management"

During the 2030s and 2040s

Additional Important Policies
- Widespread voluntary agreements to eliminate "buy one get one free" campaigns by 2040
- More cooperatives for shopping and cooking established across Europe by 2040

GLOBAL DEVELOPMENTS



International Context Most participatory processes take place at the local level but are linked to other initiatives outside of nation-state boundaries. Solutions are not prescribed through international agreements but are relevant to local contexts

Global Governance New forms of governance are based on participatory processes focusing on transitions to sustainability. Relationships and networks operate at the local level and extend outside of nation-state boundaries. Well-designed processes empower communities to develop and implement solutions to persistent problems of unsustainability.

World Trade Local and regional fair trade of products and services, global exchange of concepts and ideas for resource efficient lifestyles significantly more than in 2010

World Finance Local/alternative currencies co-exist with conventional currencies and enable local communities to use their existing productive resources more effectively.

Climate Change Based on the Representative Concentration Pathway (RCP)4.5, atmospheric concentrations of greenhouse gases stabilize by the end of the century at about twice those of the pre-industrial period (650 ppm CO2 equivalent).CO2 emissions rise slowly until about 2050 and then fall significantly from about 12 GtC per year in 2050 to less than 5 GtC per year in 2080. Climate model simulations show that with this pathway the rise in global mean surface temperature by the end of the 21st century is more likely than not to exceed 2 degrees C above preindustrial levels.

KEY

Modelled Values	39%
Tax	
Investment/ Payment	
Subsidy "Support"	Remove Subsidy
Regulation	
Price	Price
Essential Policies	🟨

The Modeling Process and Outcomes

Key contextual assumptions and policies presented in each of the three POLFREE scenarios were introduced to the interlinked GINFORS (environmental-economic) and LPJml (vegetation) models, in order to quantify economic and environmental outcomes across various domains. Key outcomes for the Civil Society Leads scenario are presented below.

Economic Sector | **EU Outcomes**

Resource Governance

Environmental tax – share of total tax revenues	2010	2030	2050
	9.0%	4.3%	1.6%
Carbon Price (2010/tCO2)	13.0 -	161.8	279.9

Ave. annual increase in resource productivity [GDP/RMI abiotic) (2010-2050): 1.5%

Standards for implementation of water saving measures are introduced by 2030, and become more stringent by 2050.

Proportion of demand for metals and minerals covered by recyclates by 2030. High proportion of demand covered by recyclates by 2050.

Increasing national and local markets for secondary materials, used components of capital goods and leasing of products become established by 2030, and becomes more important than markets for primary materials by 2050.

Increased recycling rate of major materials (e.g. metals, electrical and electronic equipment, vehicles, plastics, paper)

POWER

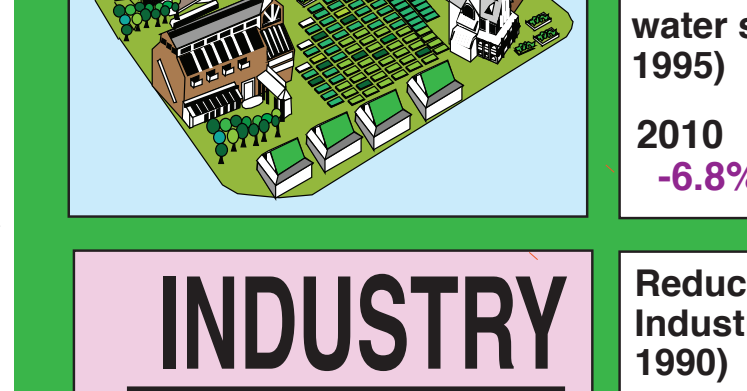
	2010	2030	2050
CO2 intensity of electricity generation (gCO2/kWh)	404	188	30
Final energy demand across EU supplied by renewables	6.9%	20.5%	42.5%
Share of electricity in total final energy demand	20.6%	34.2%	47.1%
Reduced water abstraction ((Change against 1995))	-9.7%	-12.3%	-31.8%

MOBILITY

	2010	2030	2050
Reduction in CO2 emissions from land transport from 1990 levels	19.3%	-40.8%	-94.2%
Reduction in CO2 emissions from aviation and shipping from 1990 levels	33.5%	15.0%	-13.5%
Share of electricity in total energy consumption in land transport	1.6%,	37.9%	82.4%

The use of private cars in cities is significantly reduced by 2030, and almost eliminated by 2050: N/A

BUILDINGS



	2010	2030	2050
Reduction of CO2 emissions from residential buildings from 1990 levels	-7.3%	-15.4%	-18.2%
Reduction in primary Raw Material Input (RMI) into construction (Change against 1995)	-8.7%	-34.1%	-53.1%
Water abstraction for public water supply (Change against 1995)	-6.8%	-8.2%	-11.7%

Increased recycling rate of construction minerals: N/A

INDUSTRY

	2010	2030	2050
Reduce CO2 emissions from Industry (Change against 1990)	-38.8%	-61.9%	-79.4%
Reduction in primary Raw Material Input (RMI) into Industry (Change against 1995)	15.7%	5.2%	-21.4%
Reduce energy intensity of industry (Change against 1995)	-9.8%	-42.3%	-56.2%

Keep water use within sustainable levels: N/A

LAND
FOOD, AGRICULTURE, FORESTS

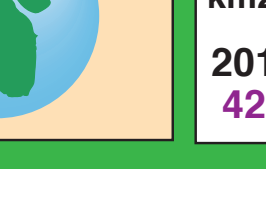
	2010	2030	2050
Reduced meat demand per capita (change against 1995)	5.3%	-16.1%	-34.7%

Avoidable food waste is halved by 2030 and eliminated by 2050: N/A

Loss of biodiversity due to land-use change is halted by 2030: N/A

Keep water use within sustainable levels: N/A

GLOBAL DEVELOPMENTS



	2010	2030	2050
CO2 emissions (change against 1990)	45.6%	78.9%	54.9%
Primary abiotic raw material use (in tons per capita)	7.5	9.2	8.9
Agricultural land use (in mio. km2)	42.8	45.0	47.0
Water abstraction (in mio. cbm per day)	11957	12547	13115

Targets for Europe - 2050

Required to Prevent Dangerously Exceeding Planetary Boundaries
(As developed in the POLFREE Visioning Process)

AIR

Greenhouse gas emissions reduced by 80 to 95% by 2050 (compared to 1990)

2010	2030	2050
-9.1%	-41.8%	-72.2%

Mean carbon footprint per capita reduced 60-80% (below 2004 levels}

2010	2030	2050
-9.3%	-38.4%	-74.8%

METALS & MATERIALS

5 tonnes of raw materials consumption per capita

2010	2030	2050
12.3	8.8	5.6

No net additions to built-up stock

N/A

LAND USE

Use of global cropland (ha/person)

2010	2030	2050
0.31	0.23	0.16

Average annual loss of cropland for EU27 (2045-2050)

-0.03%

WATER

Mean water footprint per capita reduced 30-50% (below 2004 levels)

N/A

Water Exploitation Index below 20% in all EU Countries

2010	2030	2050
10.2%	9.7%	9.0%