Environmental Implications of Dynamic Policies on Food Consumption and Waste Handling in the European Union

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Background

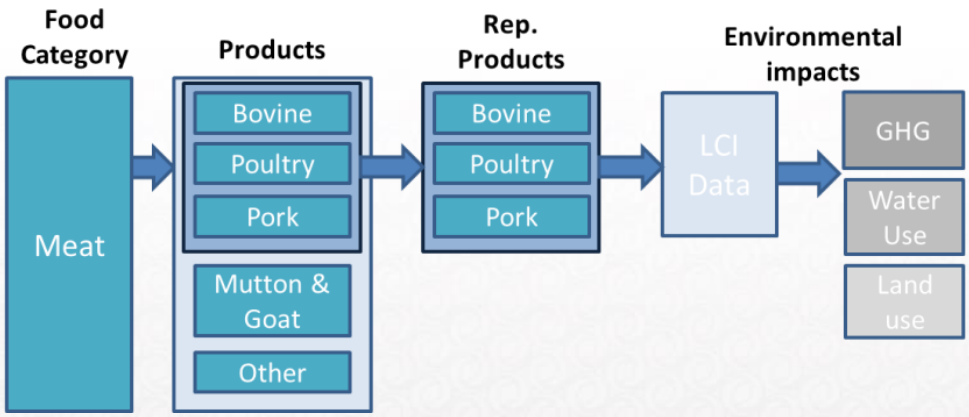
- ***EU-FP7 Project DYNAMIX - Decoupling growth from resource use and its environmental impacts***
  - ***Food, Metals, Waste, Recycling, Vehicles….***
  - ***Quantitative and Qualitative Studies on Env., Economy, Social, etc. implications of dynamic policies***
- ***Effect of Policies on Env. Performance (FOOD)***
  - Targeted information campaigns on changing diets and on food waste.
  - Development of food redistribution programmes/food donation to reduce food waste.
  - Increased value-added tax (VAT) on meat.

Outlined in Ekvall et al. (2015)

Ekvall, T, Elander, M., Umpfenbach, K., Hirschnitz-Garbers, M., Hudson, C., Wunder, S., Nesbit, M. et al. 2015. Development of DYNAMIX policy mixes. Deliverable D4.2, DYNAMIX.

Method

- FAO Food Balance Sheets (2010)- Only food for consumption (excluding for seed and other wastes)
- Raw materials (e.g. meat, cereals, fruits, fish….(many products in each category))
- Representative Food Products (RFPs)
  - At least 80% of category



- LCI data collected for each product category
- Scenarios for Reference Year (2010), 2030 and 2050
- Modelled in GABI

Assumptions/Limitations

- Does not include nutritional aspects
- Crude assumptions and not consequential based (no effect on other life cycles outside food)
- LCI data most salient for GHG emissions. Only GHG emissions and resource consumption reviewed (Blue Water Consumption (Water Footprint Network) and Land (primarily from EcoInvent))
- 100% Efficiency for years 2030 and 2050
- Consumption Scenarios (Cradle-to-Gate)
- Waste Scenarios (Cradle-to-Grave) inc. System Expansion for avoided conventional products

Consumption and Waste Scenarios…

Consumption Scenarios

- **Scenario C0-Food Consumption 2010**
  - Constant consumption patterns with increased population
- **Scenario C1-Reduced Protein Scenario**
  - Animal Based Protein Consumption (Milk, Eggs, Meat) was decreased by from current 51% of our protein intake in 2010 to 35% and 25% in 2030 and 2050 respectively
  - Increases in Vegetable based protein in 2030 and 2050
- **Scenario C2-Limits to Protein Consumption**
  - Proportion of animal based protein is shifted to model VAT changes
  - Limit bovine and pork consumption and increase poultry consumption

Protein for Scenarios 1 and 2

- Scenario C1

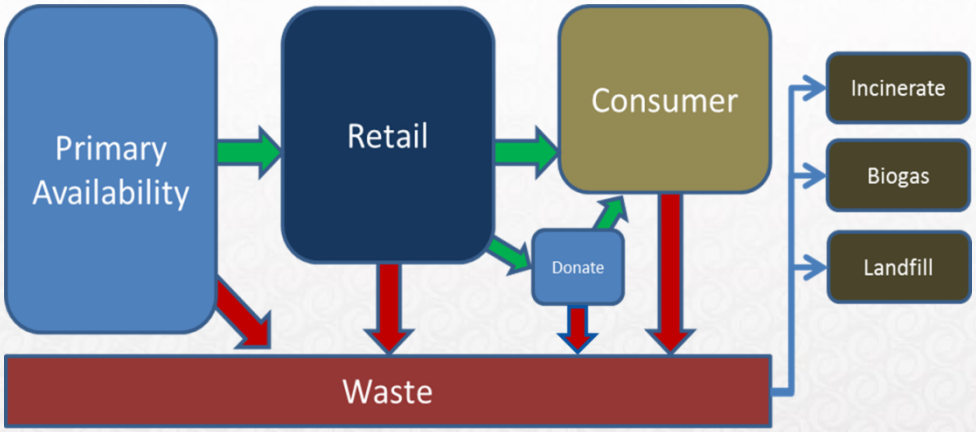
		2010	2030	2050
Total Protein Animal and Fish	g protein/capita/day	61.3	29.6	**14.7**
Total Protein Vegetable	g protein/capita/day	43.5	54.9	**44.2**
Total	g protein/capita/day	104.8	84.5	**58.9**
Total Protein Animal, Milk, Eggs (no fish)	g protein/capita/day	53.0	25.6	**12.7**
% from Animal, Milk & Eggs	%	51%	35%	**25%**

- Scenario C2

	2010		2030		2050	
	g protein/ capita/day	%	g protein/ capita/day	%	g protein/ capita/day	%
Bovine	6.2	24%	2.6	10%	1.3	5%
Pork	11.2	43%	10.4	40%	5.2	20%
Poultry	8.6	33%	13.0	50%	19.5	75%
Total from Bovine, Pork, Poultry (Excluding others)	26.0	100%	26.0	100%	26.0	100%

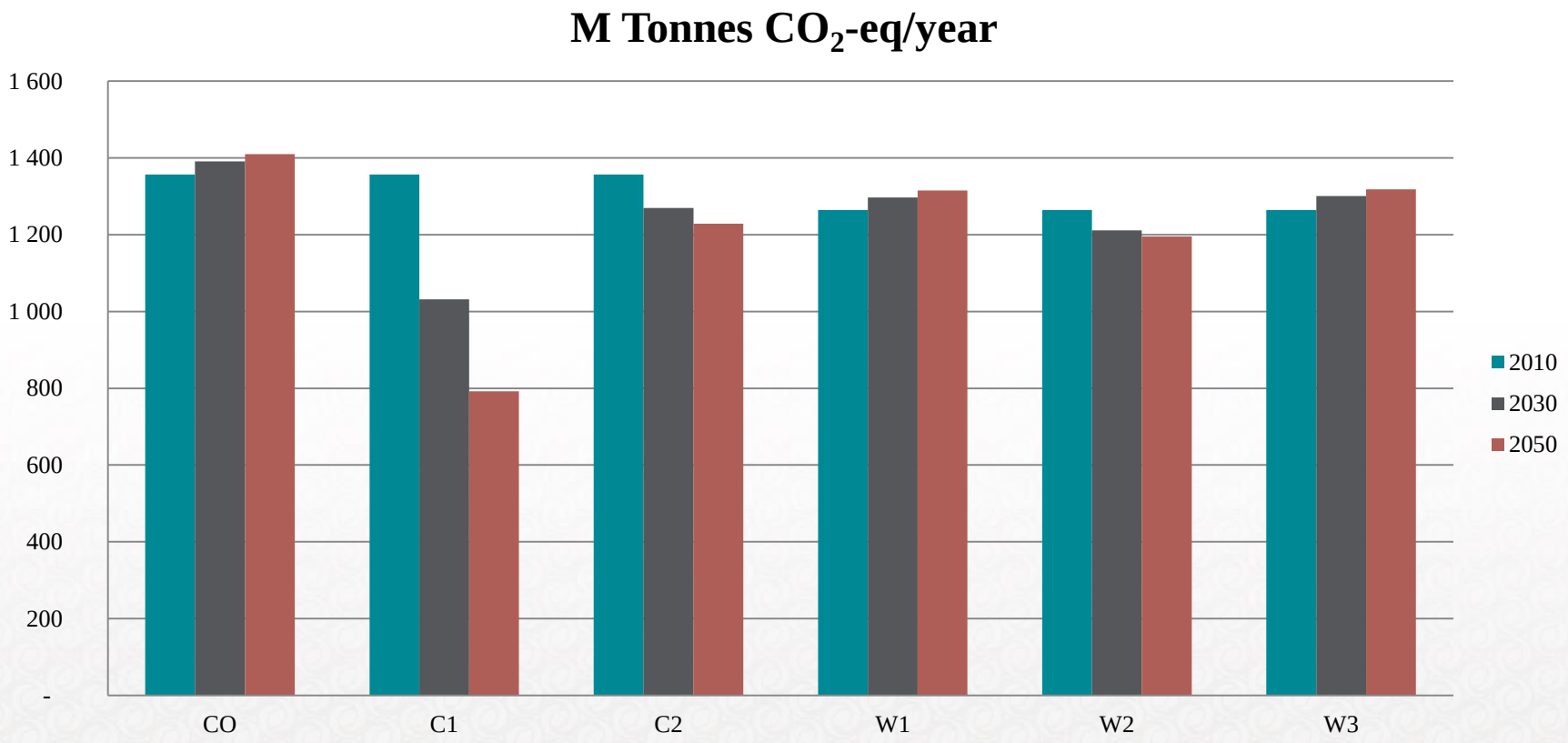
Waste Scenarios

- **Scenario W1-** Reductions in waste (total and avoidable) at the retail and consumer sectors; including reductions of 60% and 85% in 2030 and 2050, respectively
- **Scenario W2-** Same as W1, but will also reduce the food input due to reduced waste
- **Scenario W3-** Food donations (20% of otherwise wasted food) from the retail sector may have on the environmental impacts.



Waste Management Paths for Food Waste	2010
Incineration	7%
Incineration w/ Energy Recovery	24%
Anaerobic Digestion	10%
Composting	9%
Landfill	50%

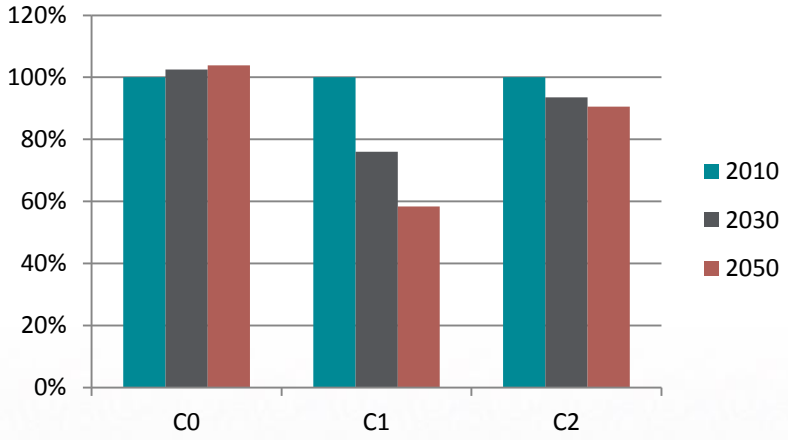
Results- (GHG Emissions) All Scenarios



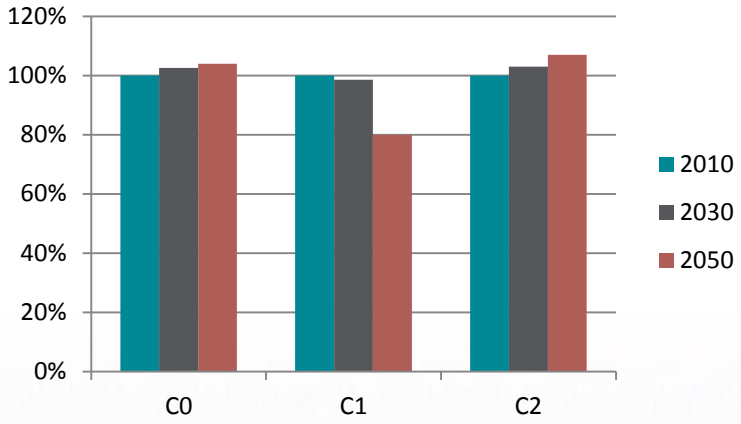
All scenarios lead to GHG emission reductions compared to CO…but lets review these to shed more light

Results-*Consumption Scenarios*

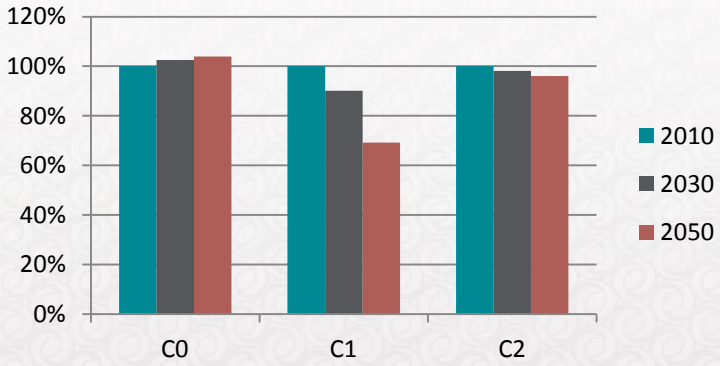
GHG Emissions



Water Consumption



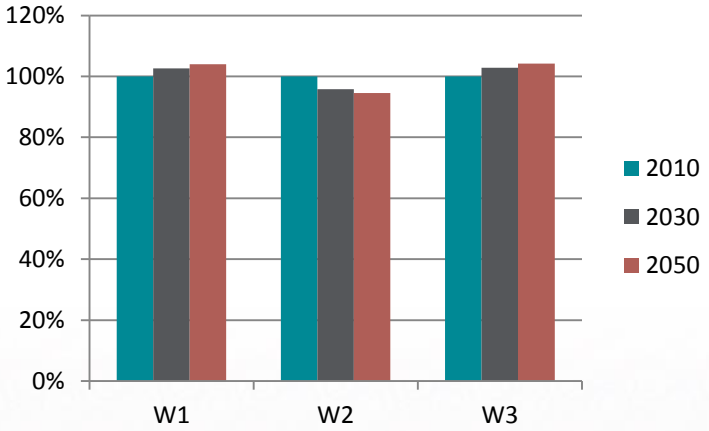
Land Occupation



- Reducing Animal Protein offers improved Environmental Performance
- Shifting animal protein to poultry, does not show as large of environmental impact reductions

Results-*Waste Scenarios*

GHG Emissions



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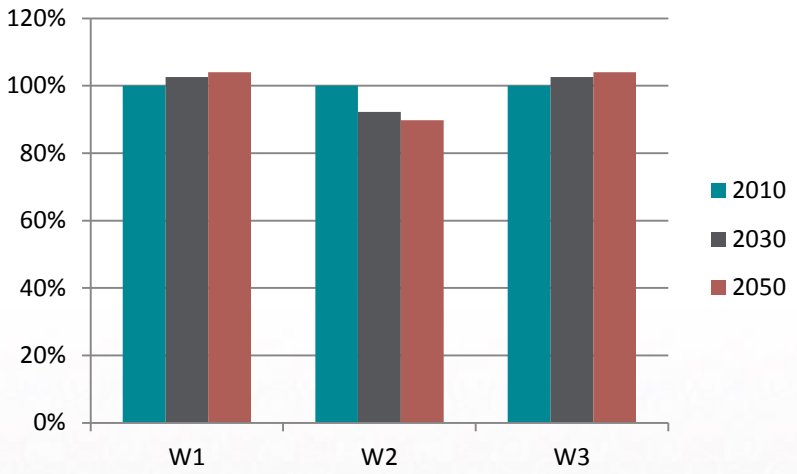

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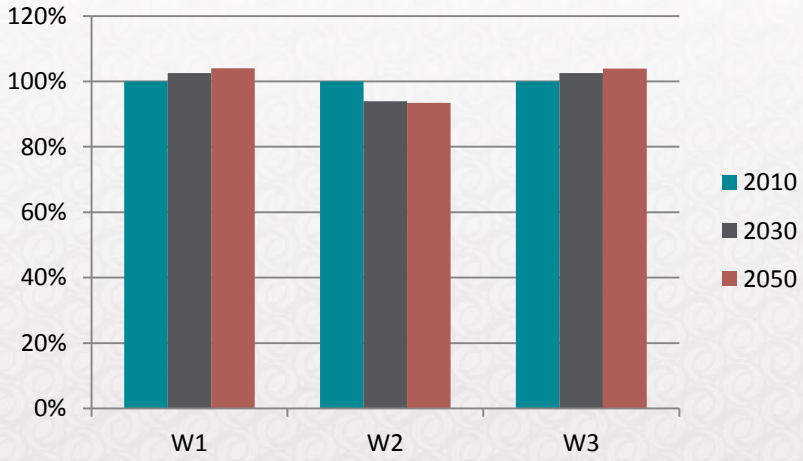
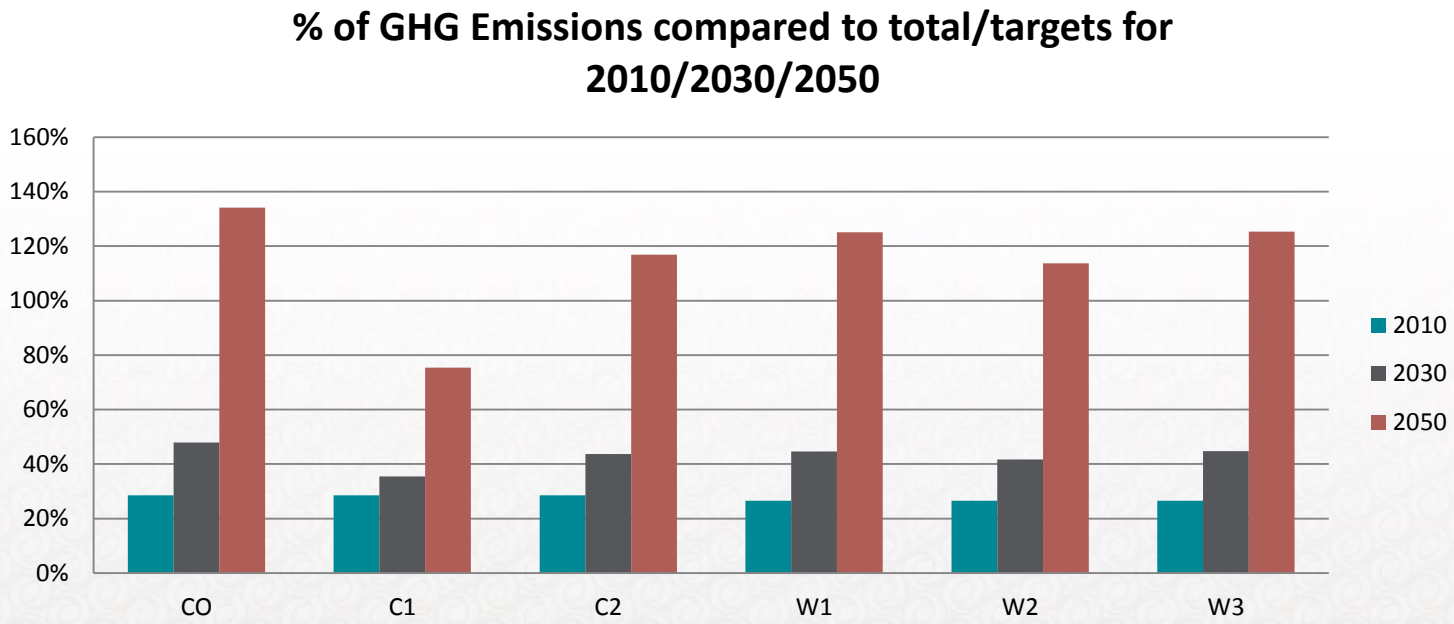


- Reducing Waste and Food Production Leads to largest reductions
- Donations, although good, have little impact on reducing impacts from food (slightly higher thanW1 due to less replaced conventional products)

Does this Illustrate a Decoupling (GHG)?

	2010	2030	2050
Per Capita Emissions (Tonnes CO_2-eq per capita)	9.4	5.6	2.0
Population	506 014 000	518 499 060	525 527 890



- Reducing Animal Protein offers improved Env. Performance
- Shifting animal protein to poultry, does not show as large of env. Impact reductions
- Previous slides show potential to reduce water and land use

Land

- It was estimated that the European Union had roughly 164 million hectares of cultivated land and 76 million hectares of permanent pasture land (Fischer et al. 2010) as a reference for 2010

Scenario	2010	2030	2050
C0	130%	133%	135%
C1	130%	117%	90%
C2	130%	127%	125%
W1	130%	133%	135%
W2	130%	122%	121%
W3	130%	133%	135%

- Decreases seen in e.g. C1 and W2 (no significant changes in other scenarios)
- >100% due to imports

Water Consumption

- European Environmental Agency Estimates that Total Freshwater Resource (which is renewed) amounts to 2 270 km3/year
- Roughly 13% of this is extracted for various uses

Scenario	2010	2030	2050
C0	4.3%	4.5%	4.5%
C1	4.3%	4.3%	3.5%
C2	4.3%	4.5%	4.6%
W1	4.3%	4.4%	4.4%
W2	4.3%	3.9%	3.8%
W3	4.3%	4.4%	4.4%

No large increases, but no significant decreases

Conclusions

- Individual Policy mixes may lead to large environmental impact reductions but not enough to decouple env. Impacts and resource consumption
- May be difficult to meet climate goals (2kg CO2eq/person/year) even with outlined policies
- Important to couple policy mixes to improve the food production, consumption and waste handling systems
- Portray other resource consumption indicators (nutrient use, land use change, etc.)
- Reduced impacts from agricultural stage of importance for policies (e.g. reduced fossil fertilizers, pesticides, etc.)
- Importance of consumers to reduce food consumption and waste is paramount

Future Work/Recommendations

- Couple Policy Mixes to see implications of reduced consumption /waste/waste handling policies in combination
- Include Nutritional Aspects
- Revise the waste handling scenarios (e.g. increased biogas, reduced landfilling)
- Improve LCI databases for food production (e.g. other impacts than GHG emissions)