

Naar een duurzame energie huishouding: belofte of mogelijkheid?

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Inleiding

- ECN/NRG ontwikkelen hoogwaardige kennis en technologie voor een duurzame energiehuishouding
- Ambitieuw maar realistisch beeld
- Richtinggevend voor energieonderzoek, inspirerend voor bedrijven en overheden

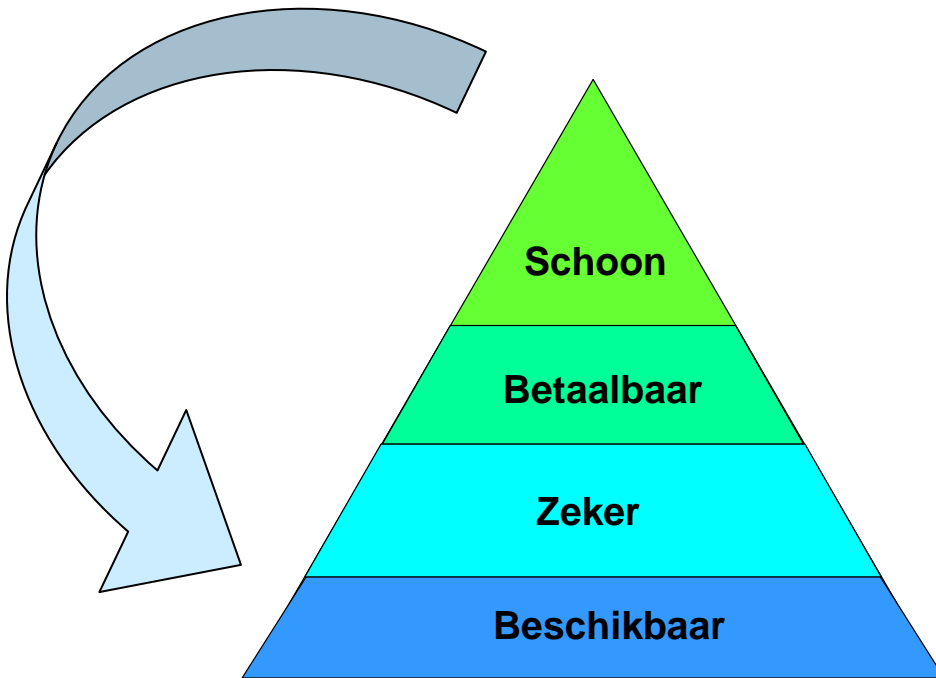


We schrijven 2050...

- Rond 2007 kwam het klimaatbeleid internationaal in een stroomversnelling – orkanen, Al Gore, warme winters
- Onrust over beschikbaarheid olie en gas – Russische gaskraan dicht, snelle prijsstijgingen olie
- Opkomst China en India
- Oliepiek in 2015 heeft geleid tot stijging van olieprijsen tot 100 \$ per vat; ook de prijs van aardgas is sterk gestegen
- Met Europees klimaatbeleid is de ambitieuze doelstelling van 60% emissiereductie t.o.v. 1990 bereikt
- In de Europese maatschappij is het economisch en maatschappelijk goed toeven



Schone energie is een basisbehoefte in 2050



Energiebehoefte piramide naar Maslov
(basisbehoeften van de mens)

- *Schoon*:
 - Lage CO₂ emissie
 - andere externe effecten beperkt (verzuring, fijn stof, kernafval)
- *Zeker*:
 - voldoende potentieel/reserves
 - elk moment beschikbaar
 - weinig import van buiten Europa
- *Betaalbaar*
- Technisch mogelijk
- Voorstelbaar op tijdschaal 2050

Duurzaamheidseisen

Kernenergie

- Politiek besluit eindberging radioactief afval in 2015
- Hoge veiligheidseisen derde en vierde generatie reactoren
- Proliferatie: versterk internationaal toezicht op splijtbaar materiaal

Kolen met CO₂ afvang en opslag

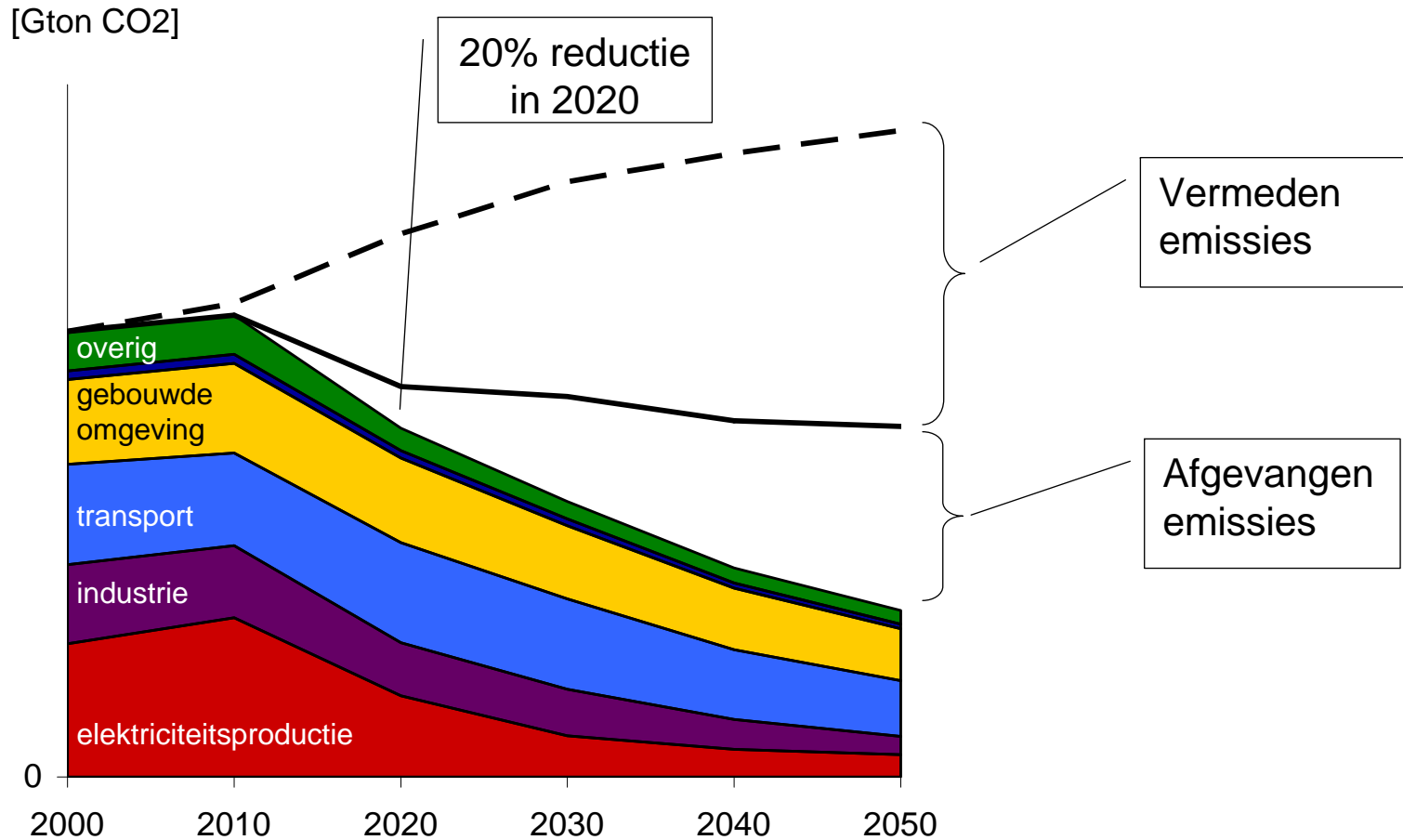
- CO₂ afvang en opslag als transitie technologie
- Strenge eisen aan arbeidsomstandigheden en milieueffecten bij kolenmijnen
- Eisen aan 'efficiency penalty', transport en opslag van de CO₂

Biomassa

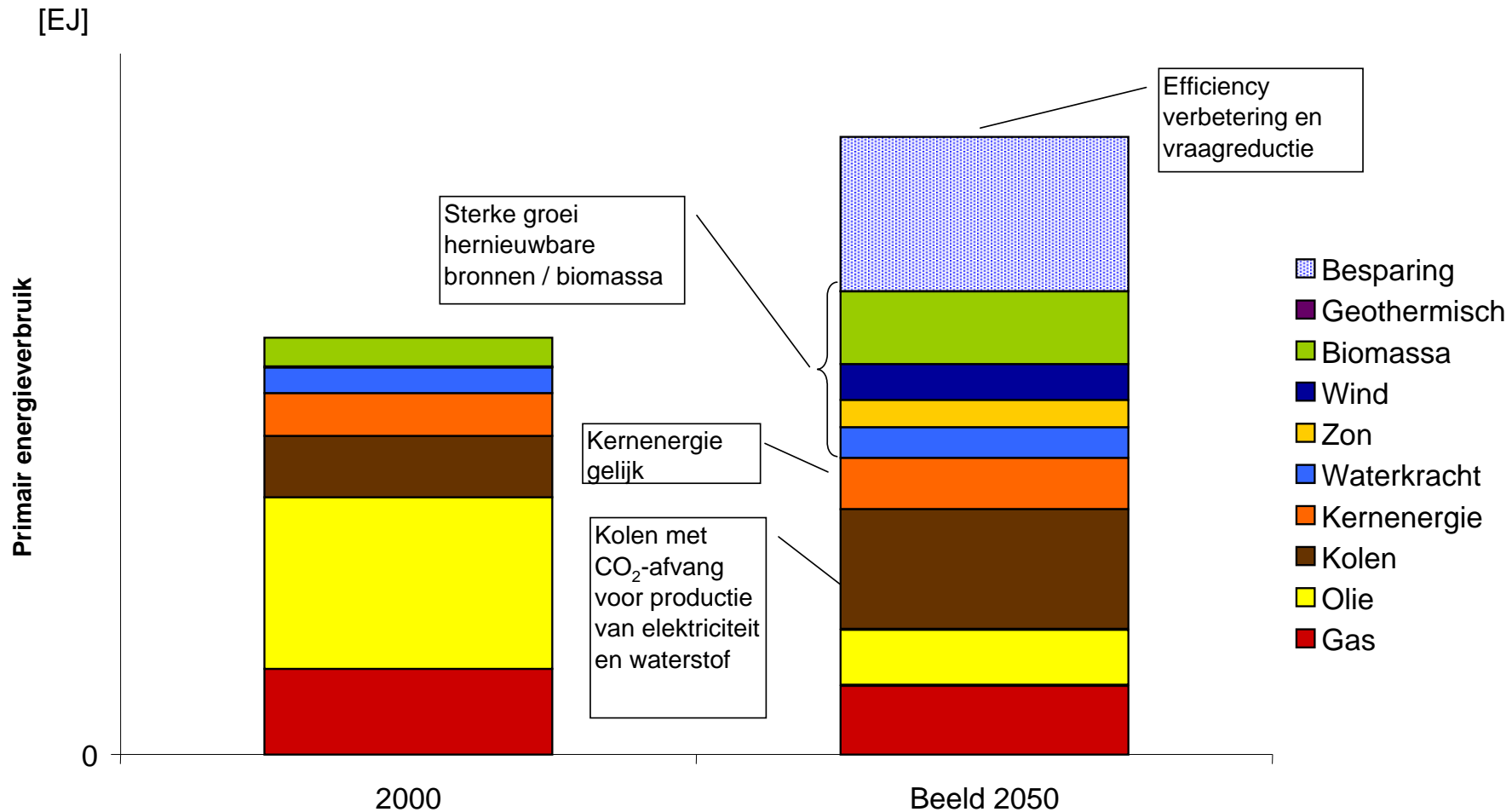
- Teelt: internationale certificering van biomassa, inclusief niet-energetische toepassingen
- Biobrandstoffen uit houtachtige gewassen of afval



Hoofdlijnen: CO₂-emissies in Europa



Mogelijkheid: primaire energiemix in Europa

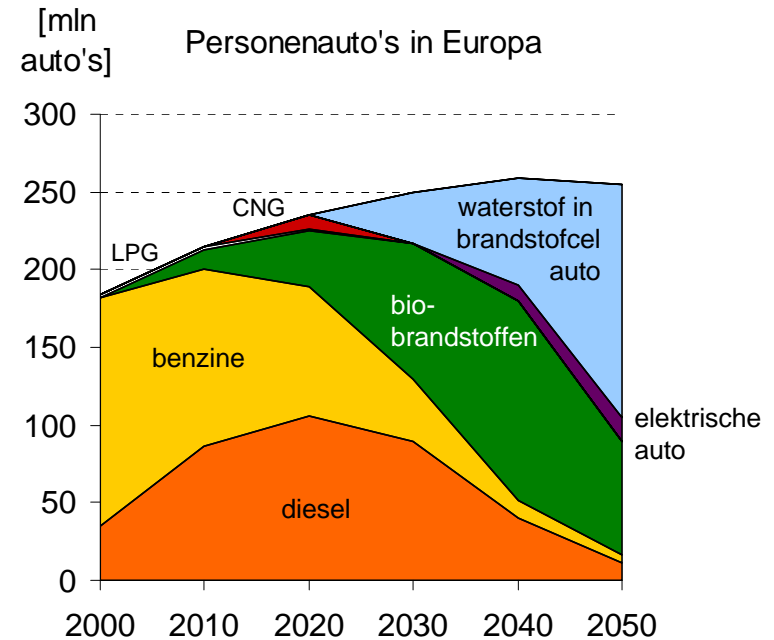


Sectoren

- **Gebouwde omgeving:**
 - verschuiving van gas naar elektriciteit,
 - veel energiebesparing
 - Zon-PV, warmtepompen

- **Industrie**
 - Veel energiebesparing
 - Biomassa
 - CO₂-afvang en opslag

- **E-productie**
 - CO₂-afvang en opslag
 - Wind



- **Transport:**
 - Zuinige auto's (hybride, licht)
 - Biobrandstoffen (vooral vrachtovervoer?)
 - Waterstof (vooral personenvervoer)

Hoe kan een duurzame energievoorziening er komen?

De ROBUST aanpak:
Realiseren van een Overkoepelende Broeikasgas
Uitstootreductie STrategie



Ook voor
voorzienings-
zekerheid

De ROBUST aanpak



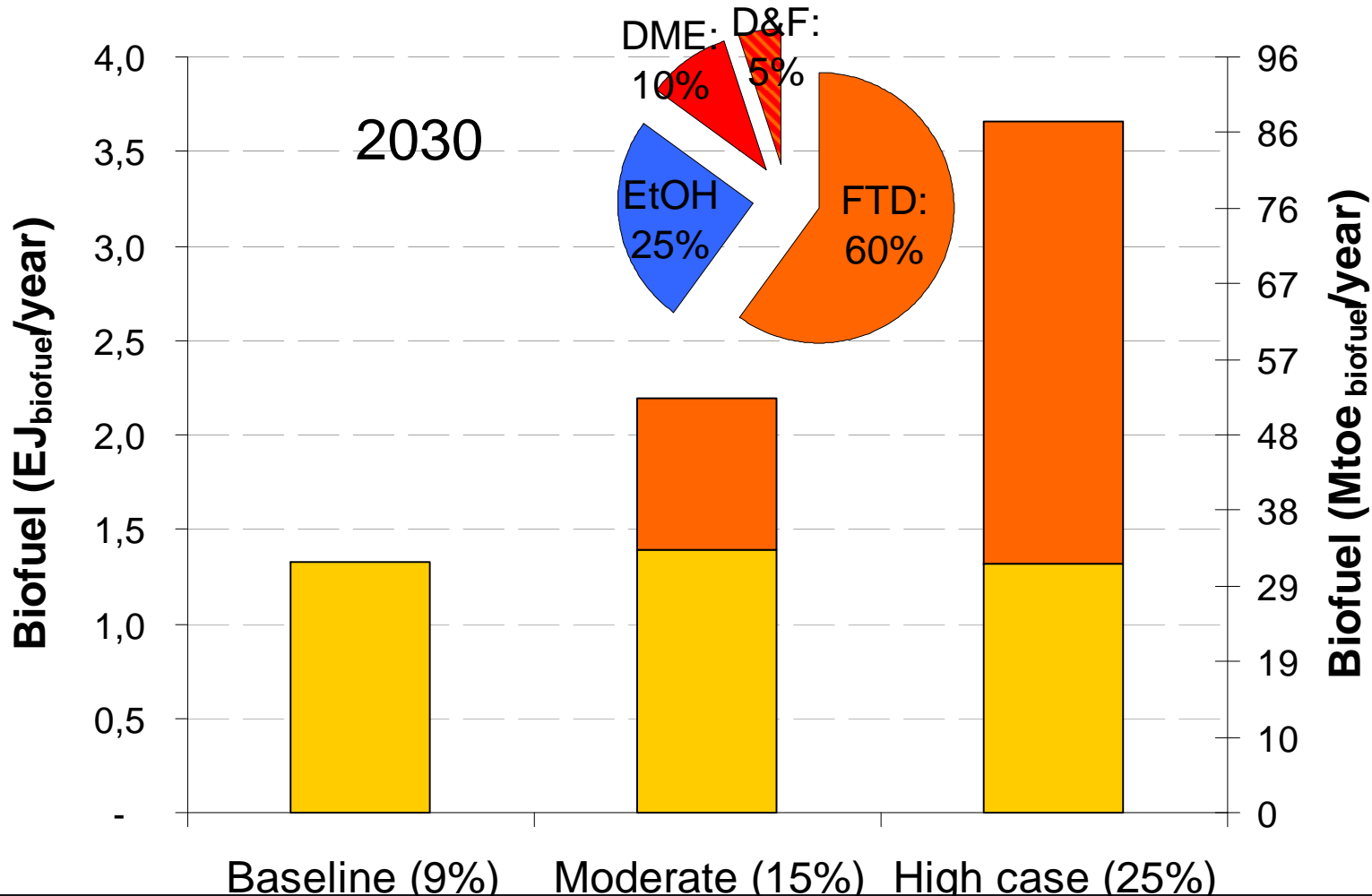
- *Lange termijn doelen en koersvastheid*
- *Een heldere visie op het portfolio van technologieën dat nodig is om de doelen te bereiken, een R,D&D roadmap*
- *Consistent pakket van beleidsinstrumenten* geënt op de ontwikkelingsstadia van technieken
- *Uitstekende samenwerking* en communicatie tussen overheid, bedrijven en burgers
- *Periodieke monitoring, evaluatie- en reflectie*
- *Internationale samenwerking*

Biobrandstoffen

- EU doelstelling: minimaal 10% (2020)
- Haalbaar met 1e generatie biofuels
- 2e generatie heeft diverse voordelen:
 - Meer biofuel per ha
 - Meer CO₂-emissiereductie per GJ biofuel

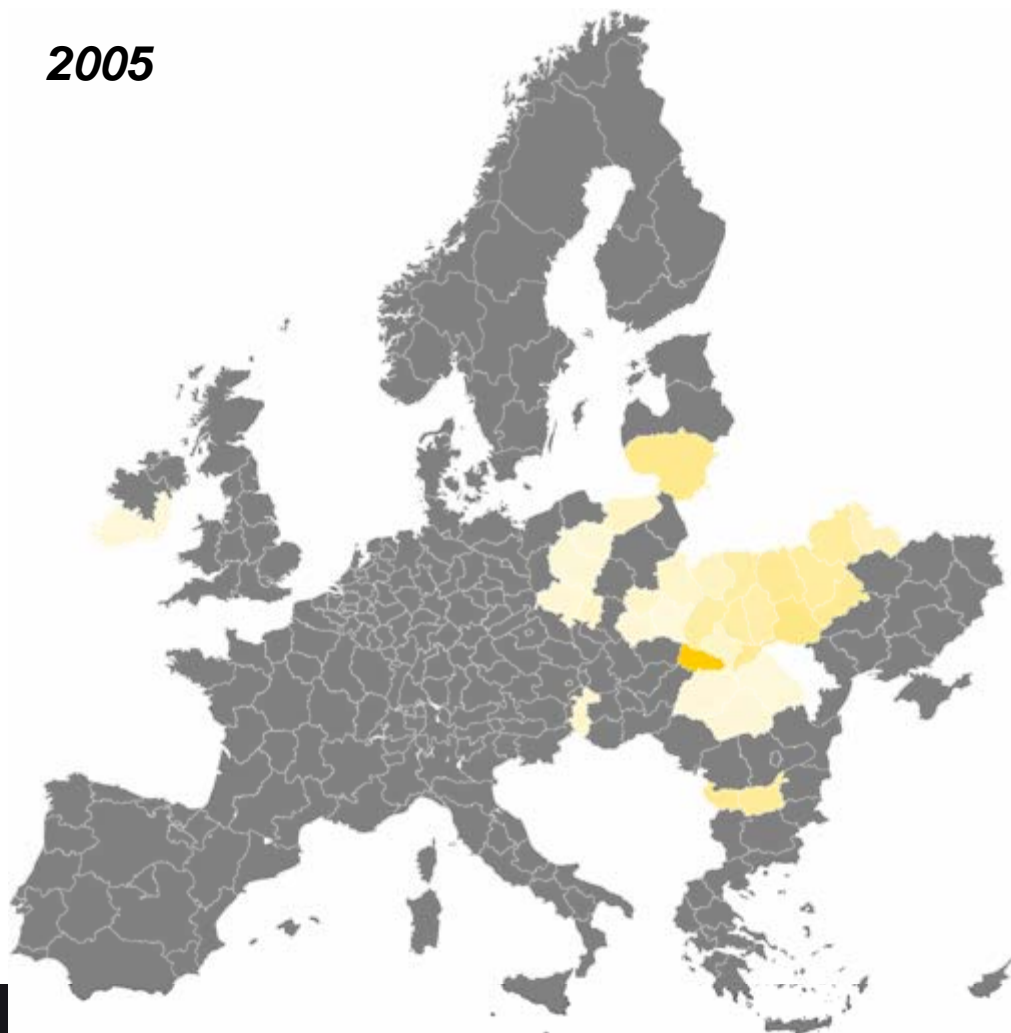







Ontwikkeling bij alleen productie in EU



Producterende regio's

2005

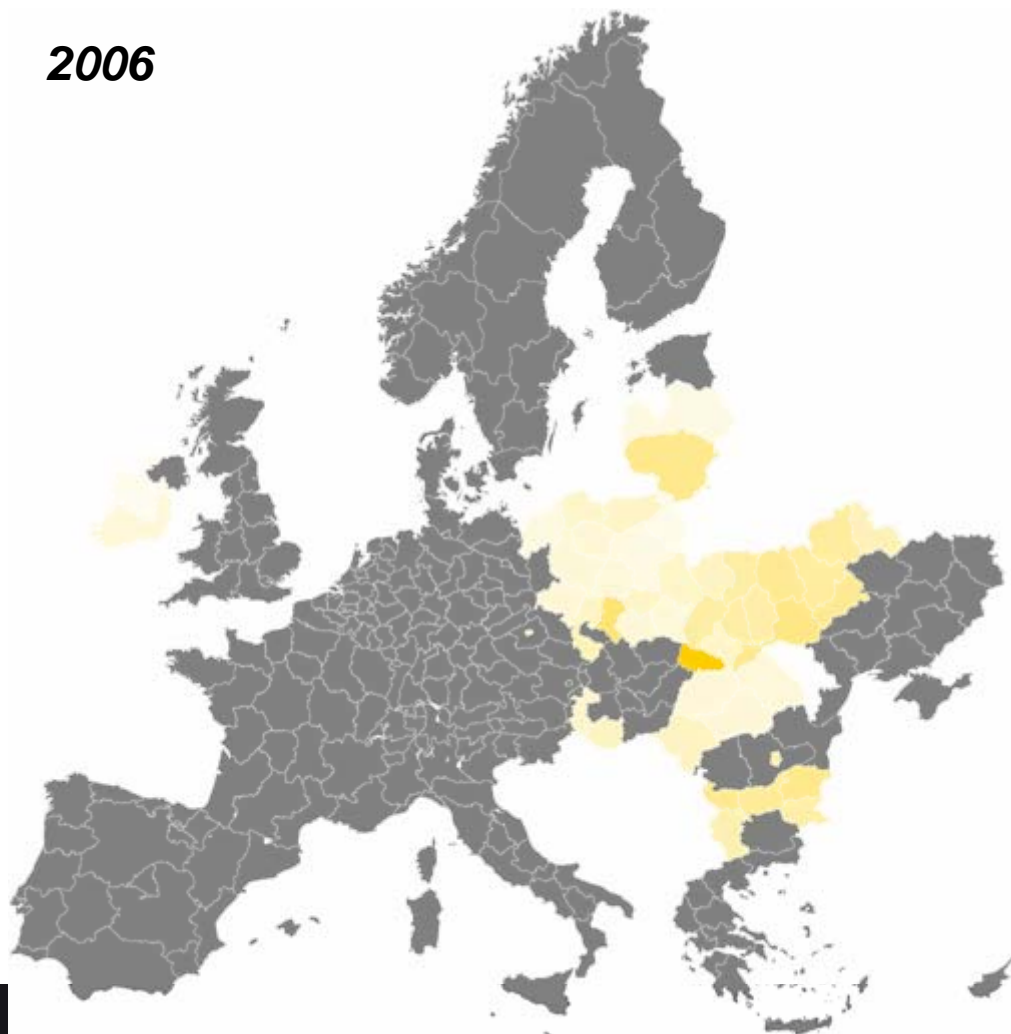







	Oil crops
	Grassy crops
	Woody crops
	Starch crops
	Sugar crops



Producterende regio's

2006

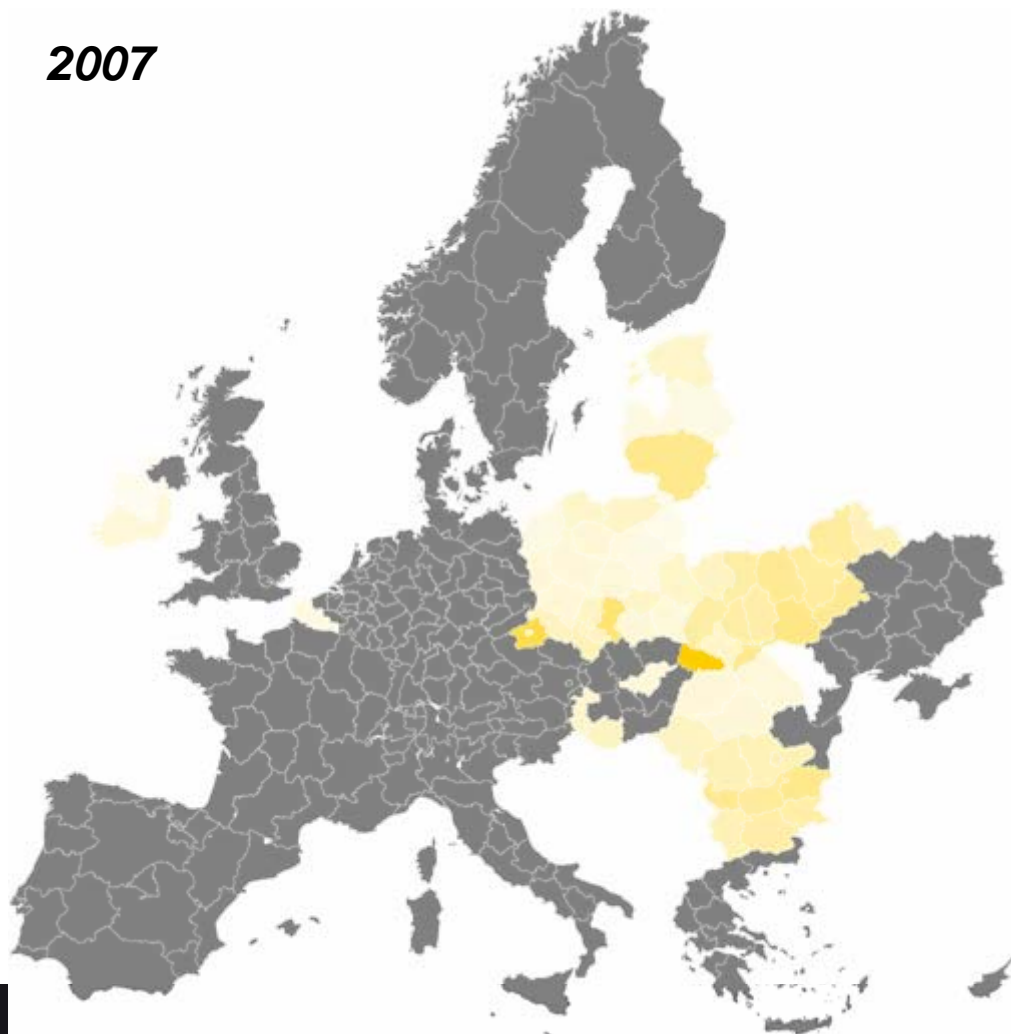







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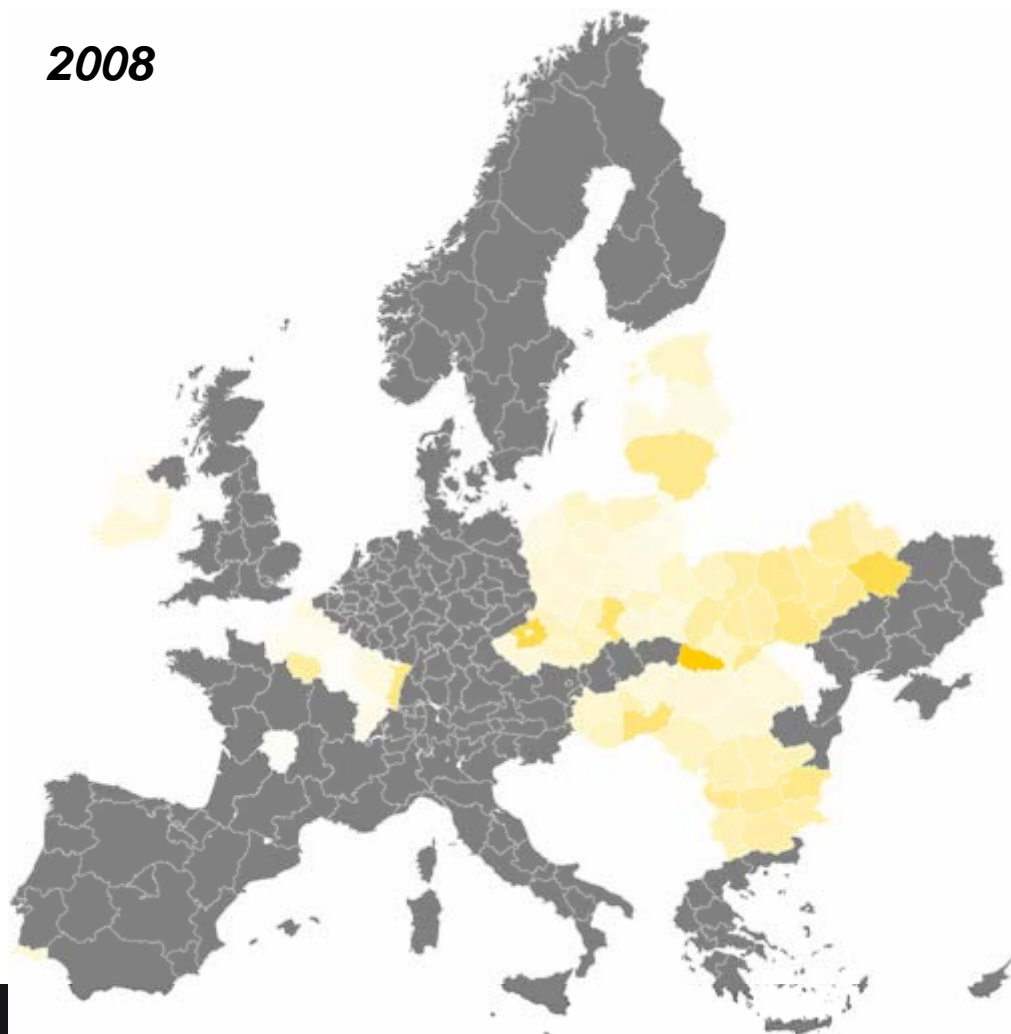







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2008

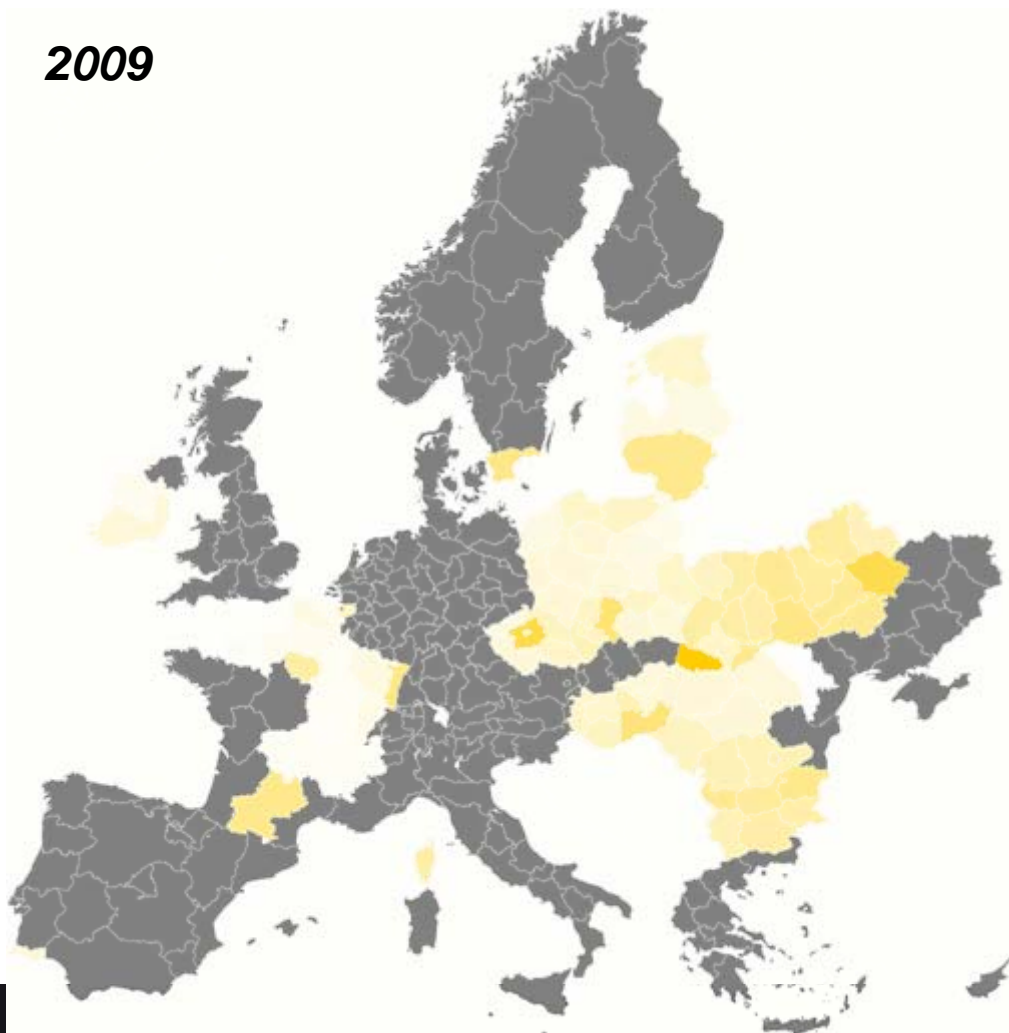







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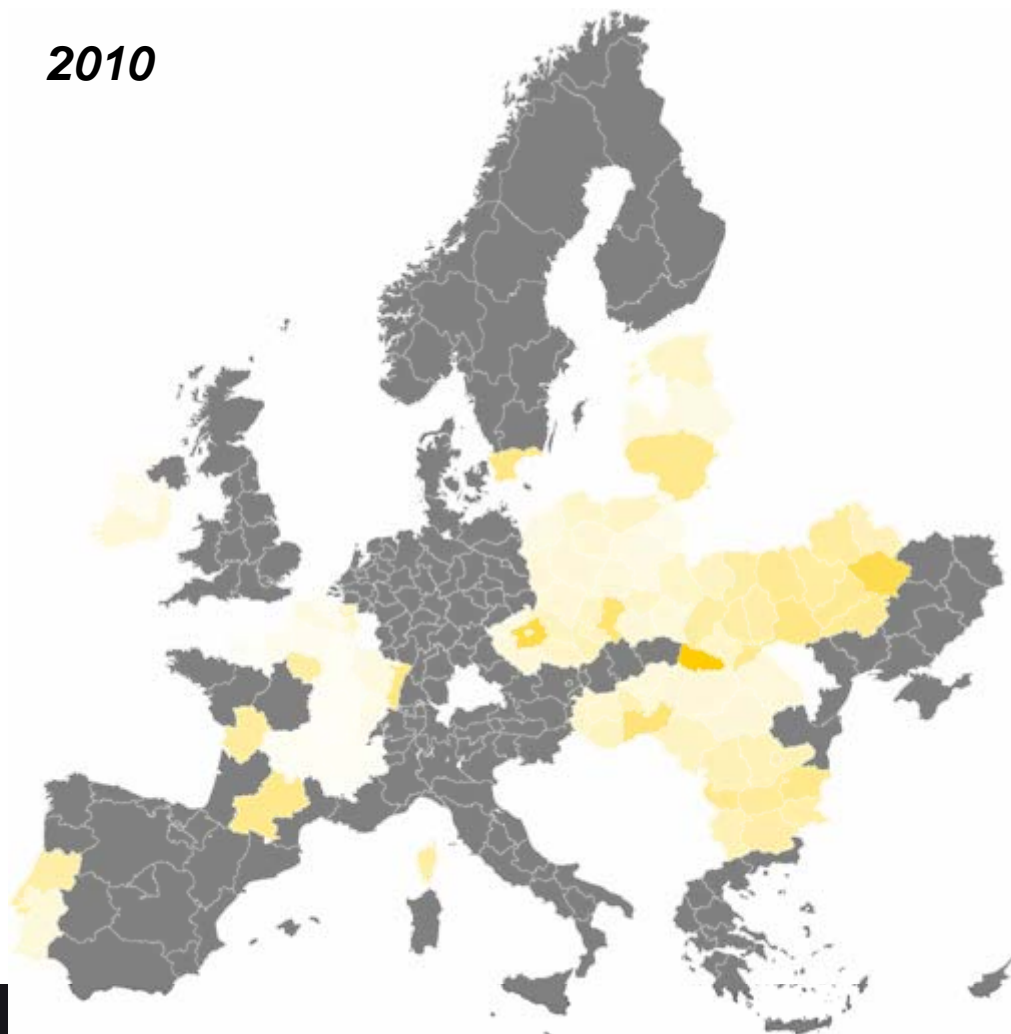







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2010

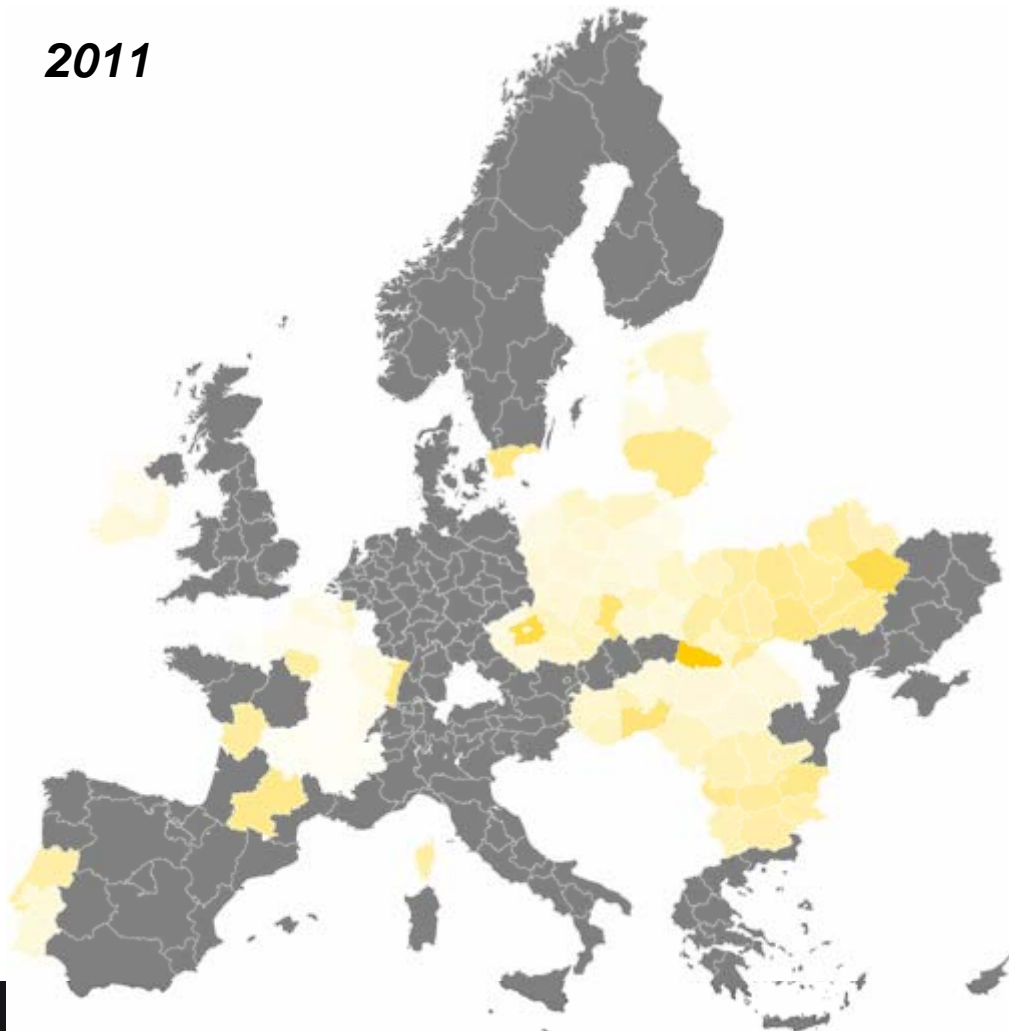







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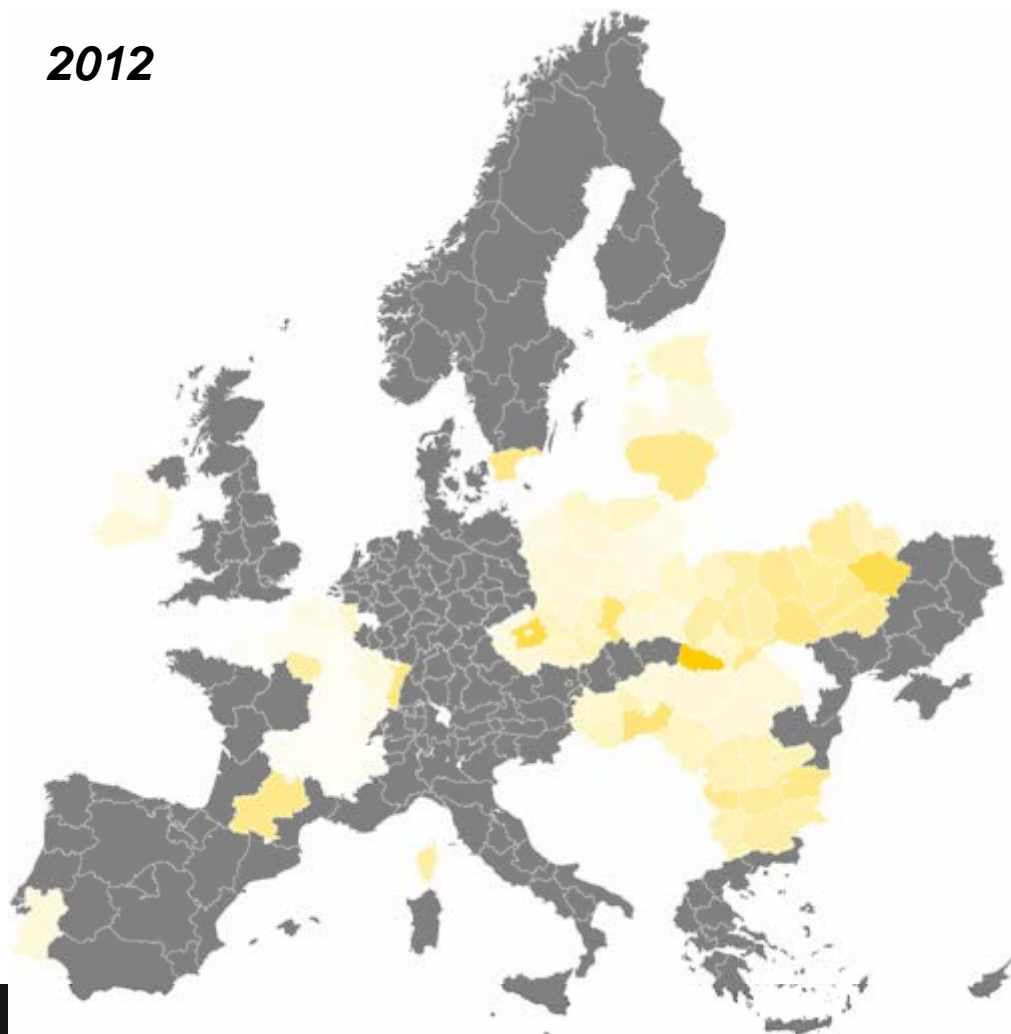







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2012

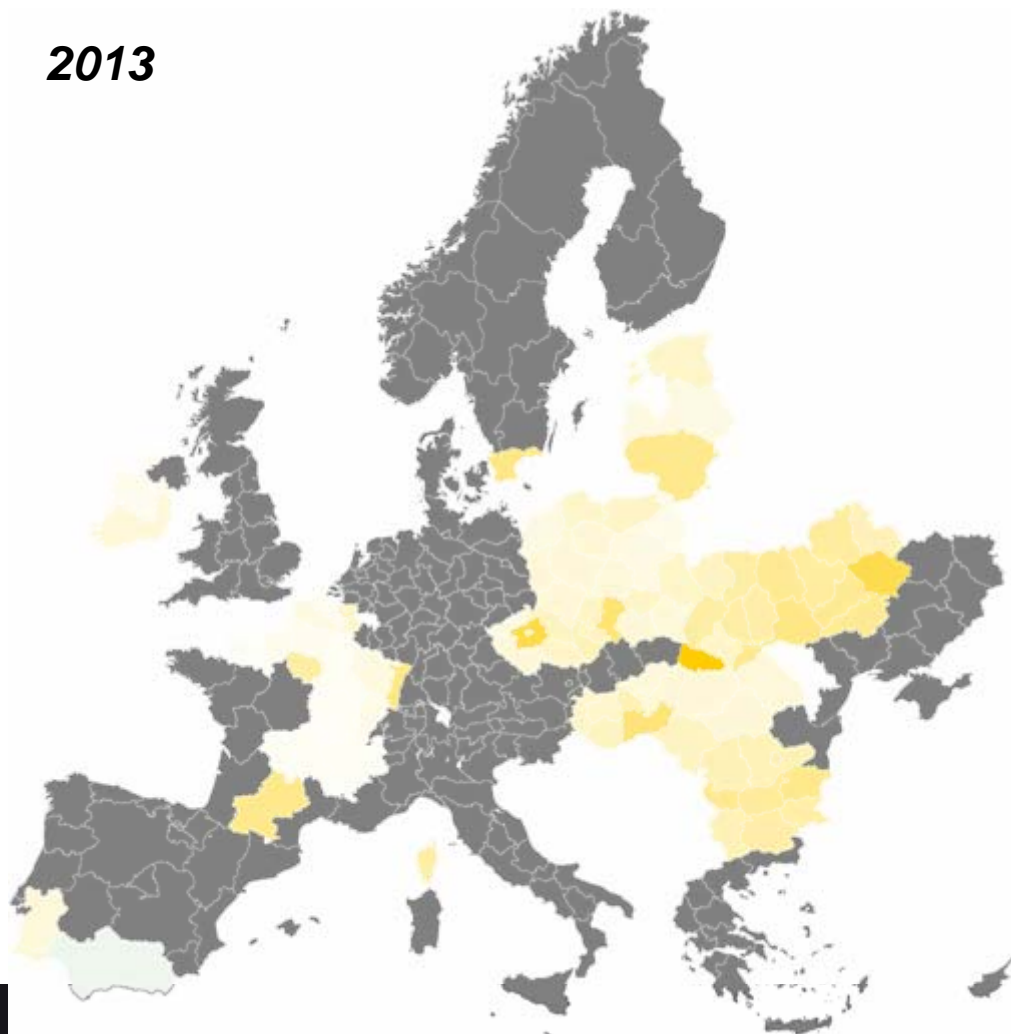







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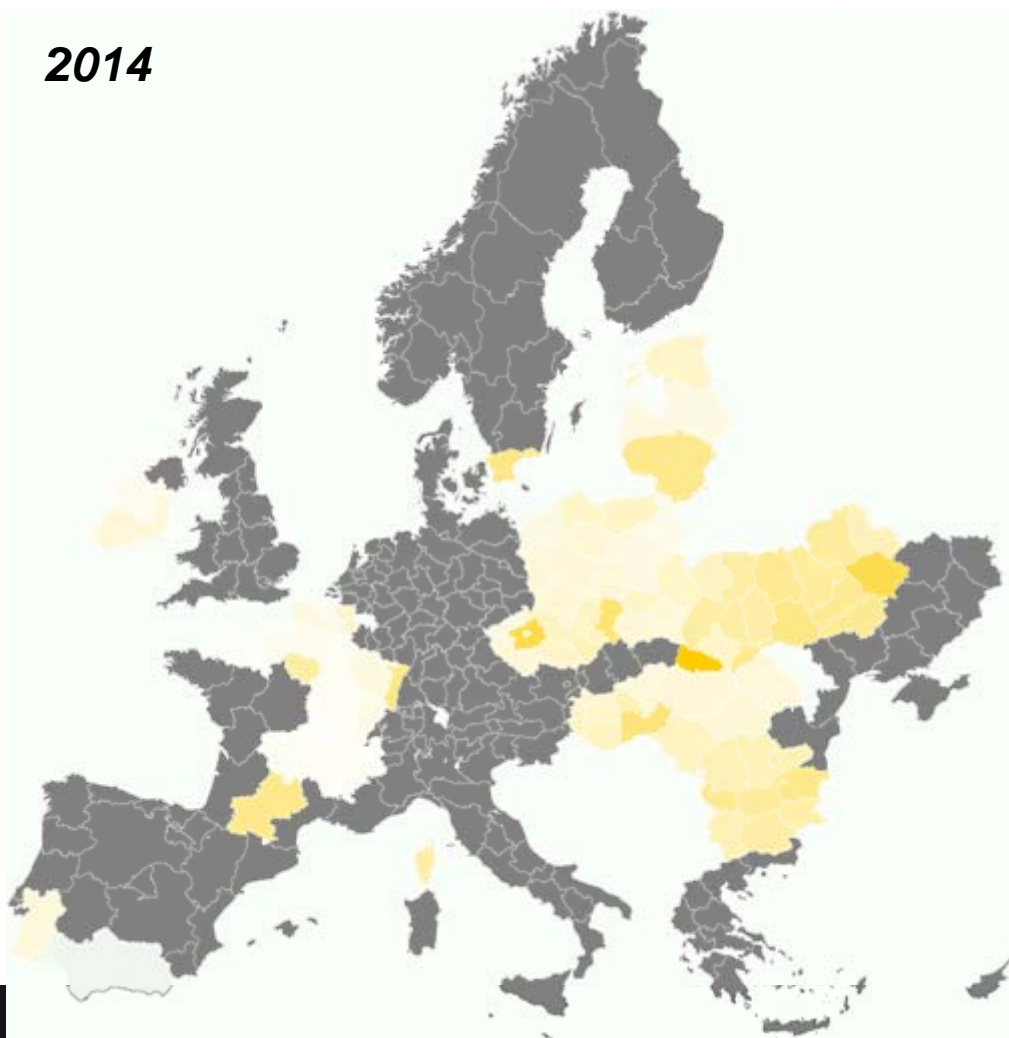
2013








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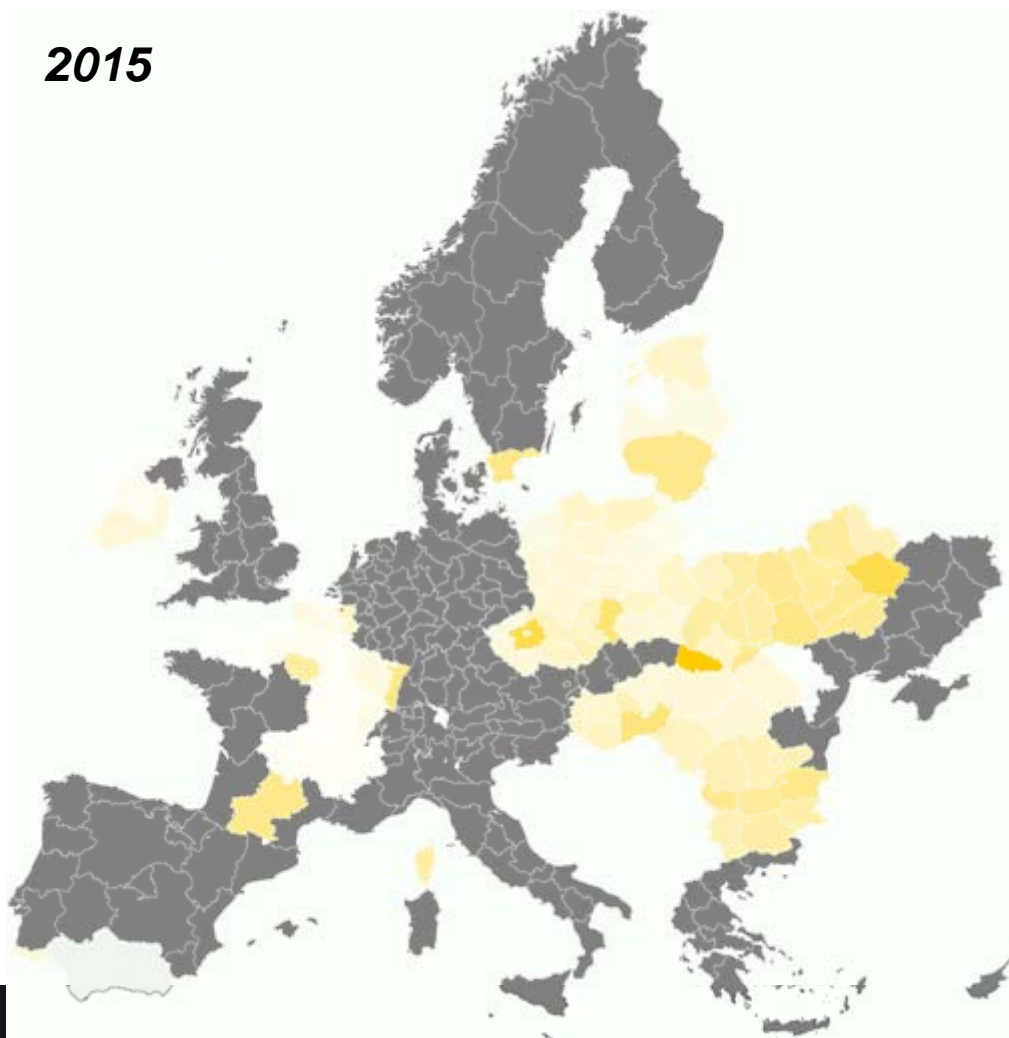
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





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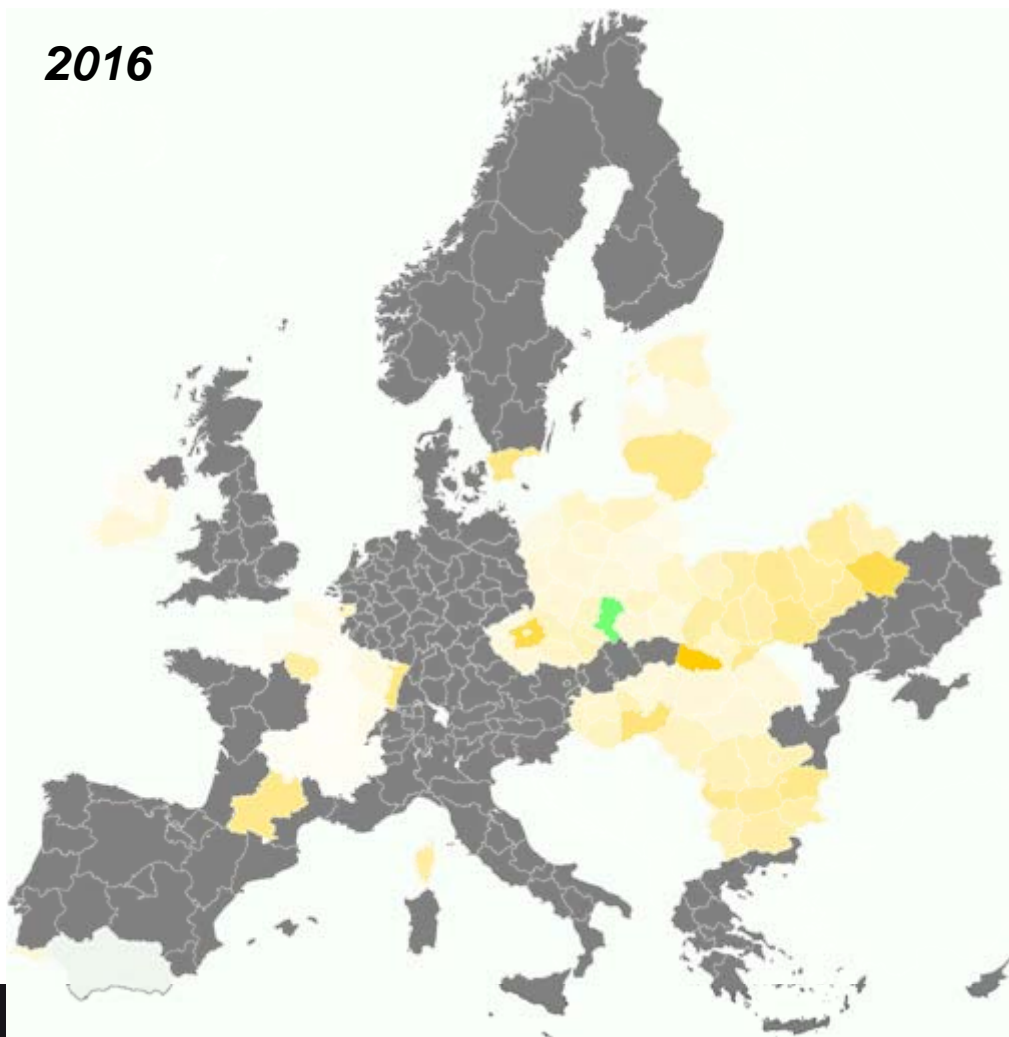







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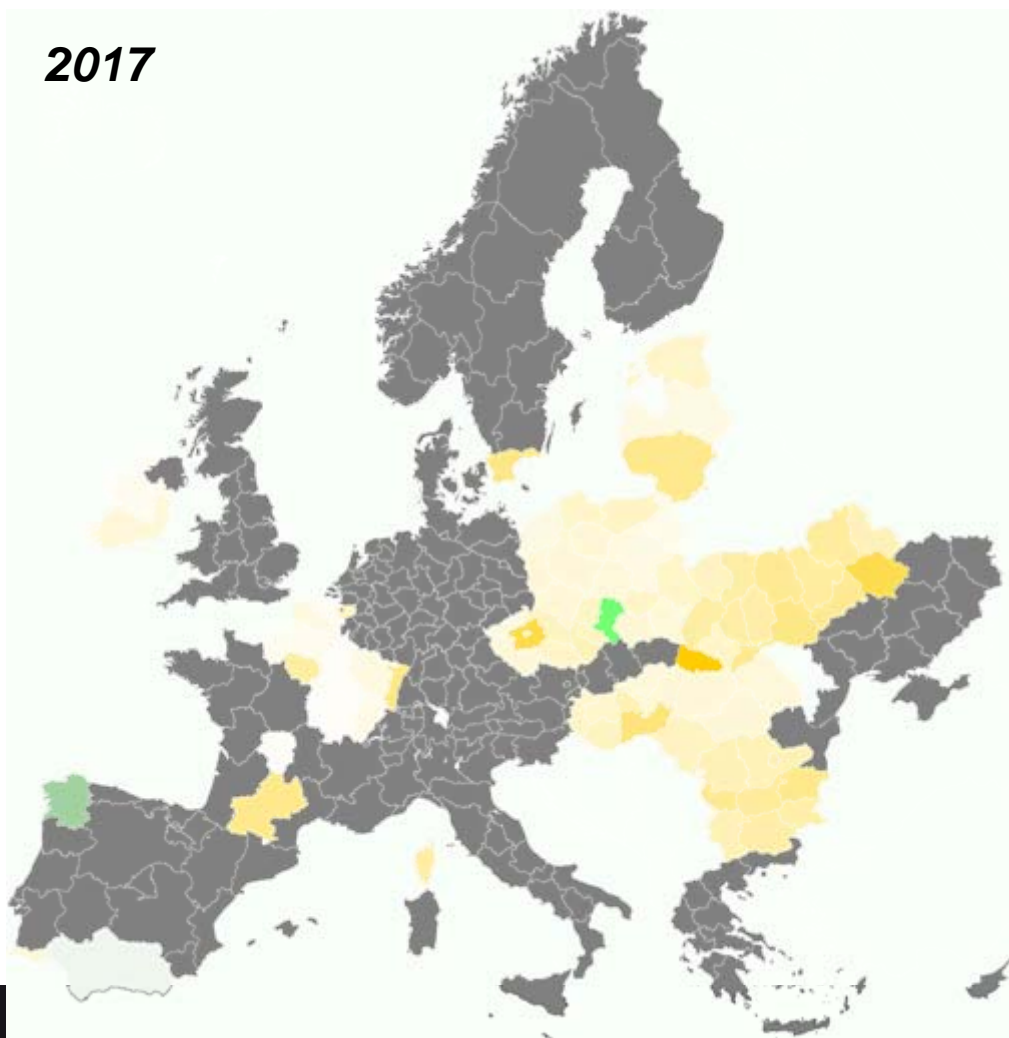
2016








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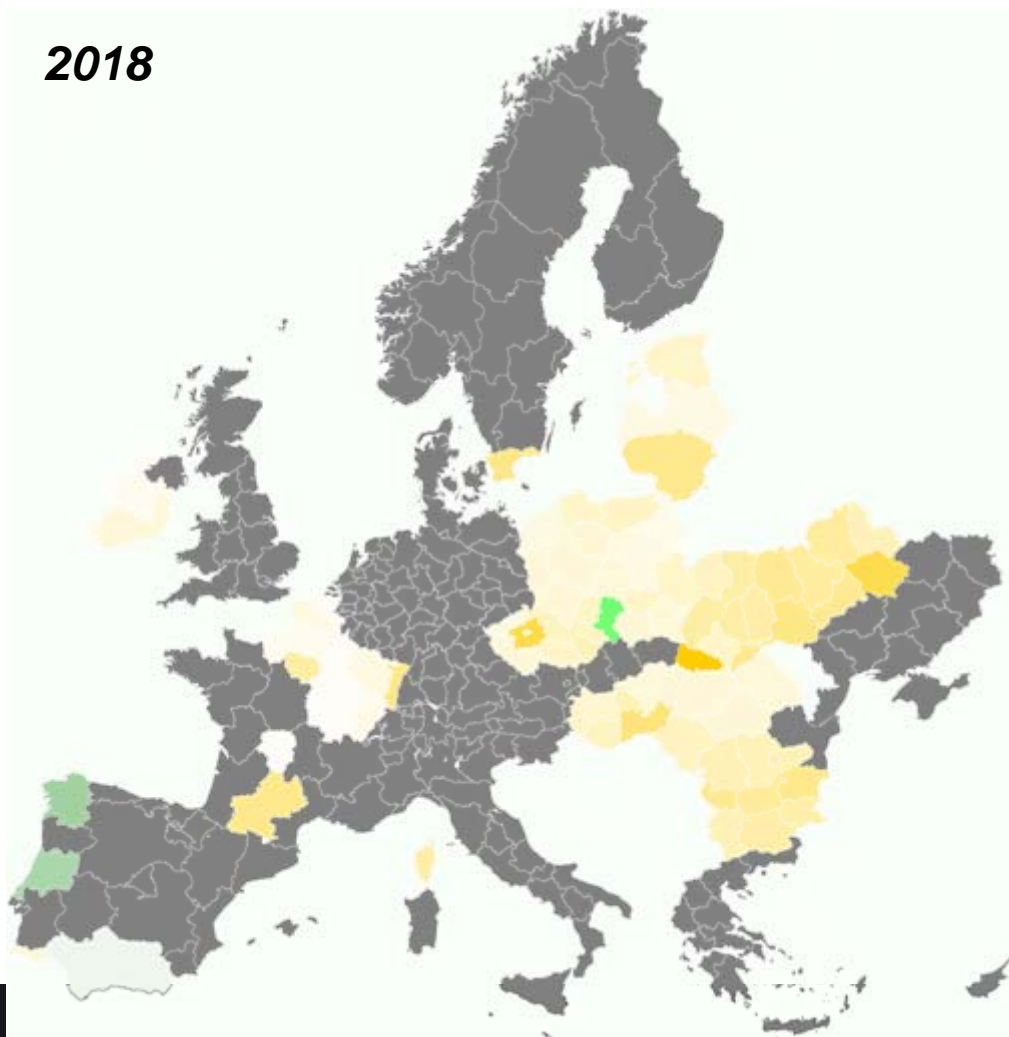
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





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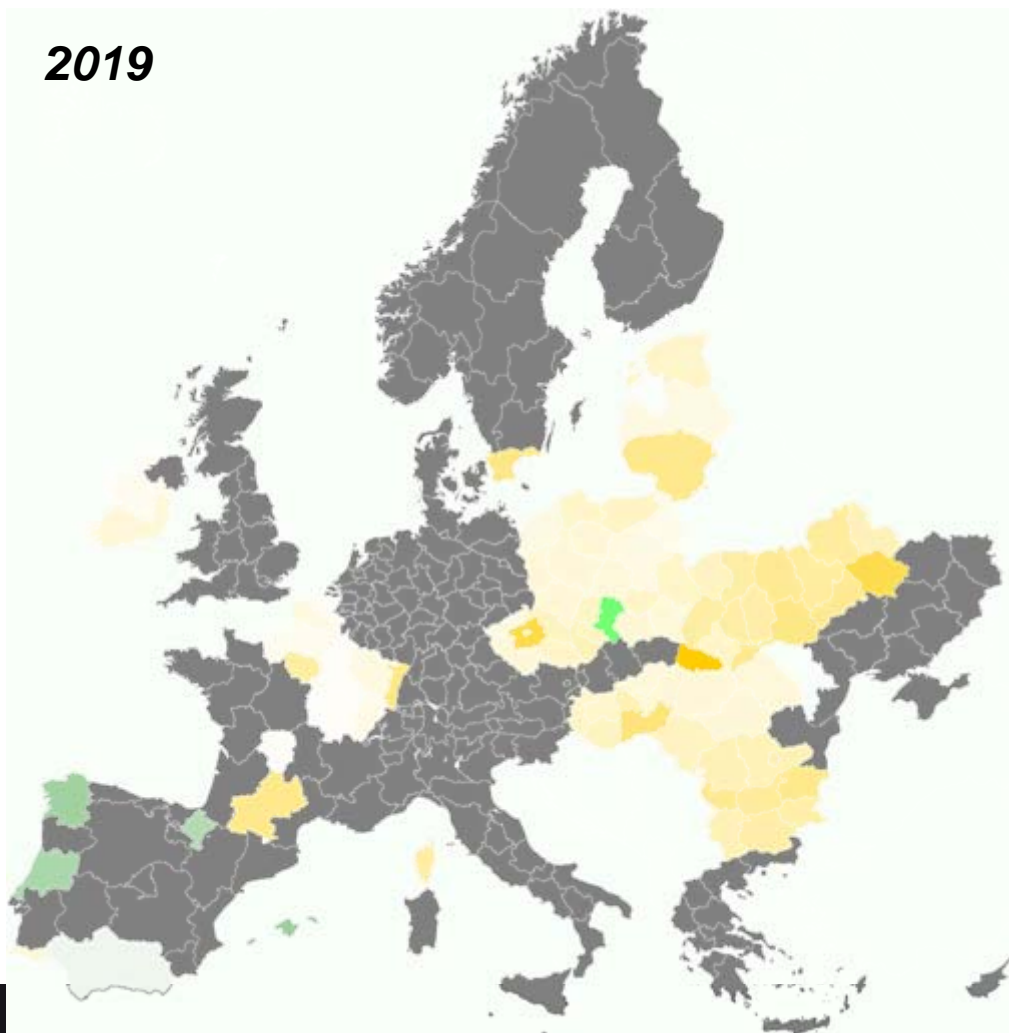







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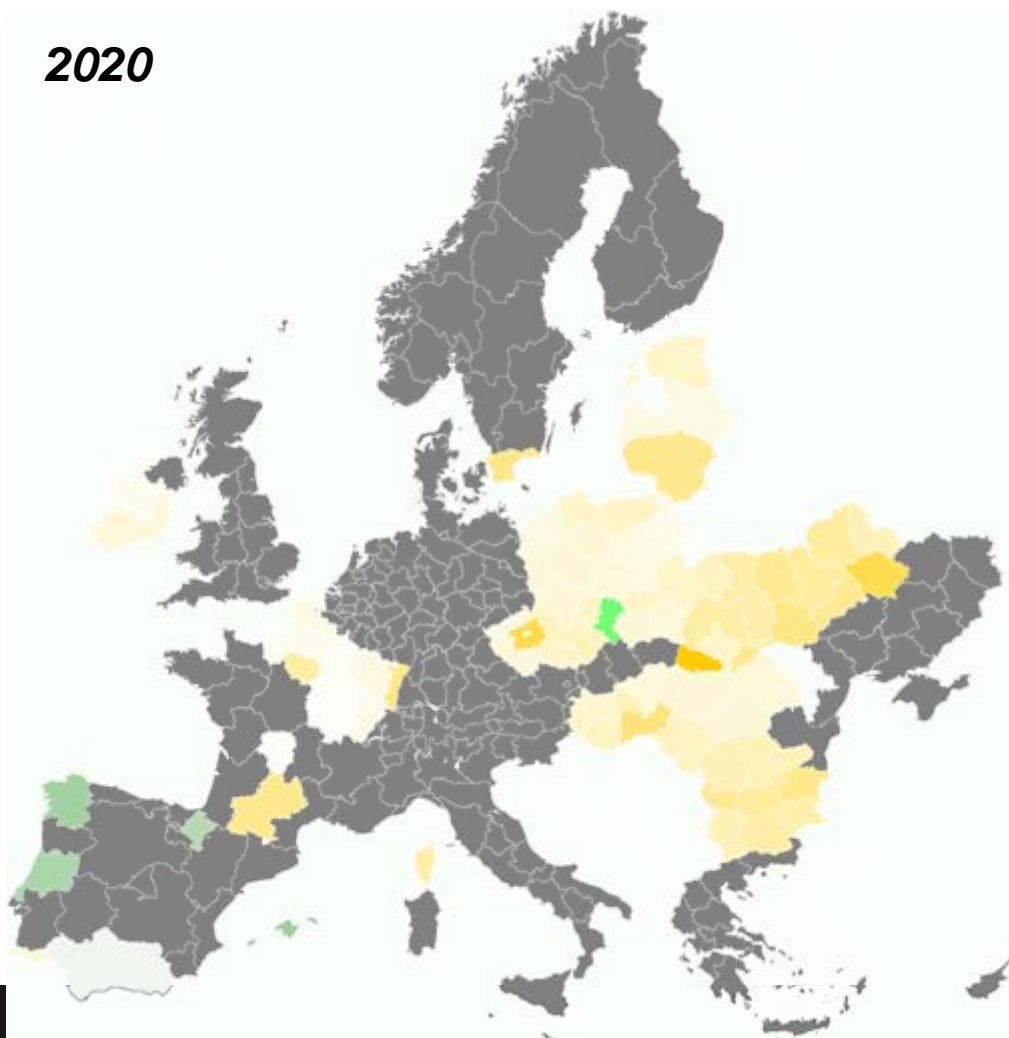
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





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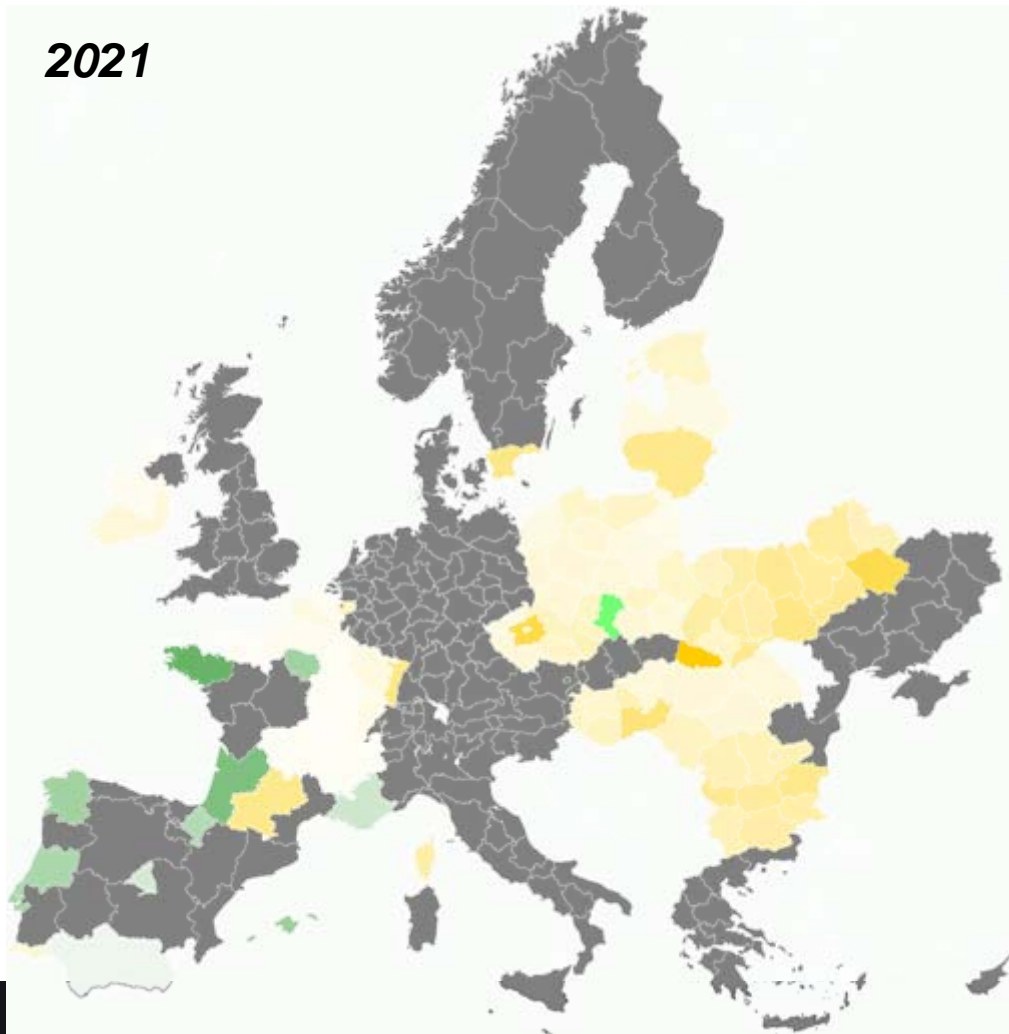
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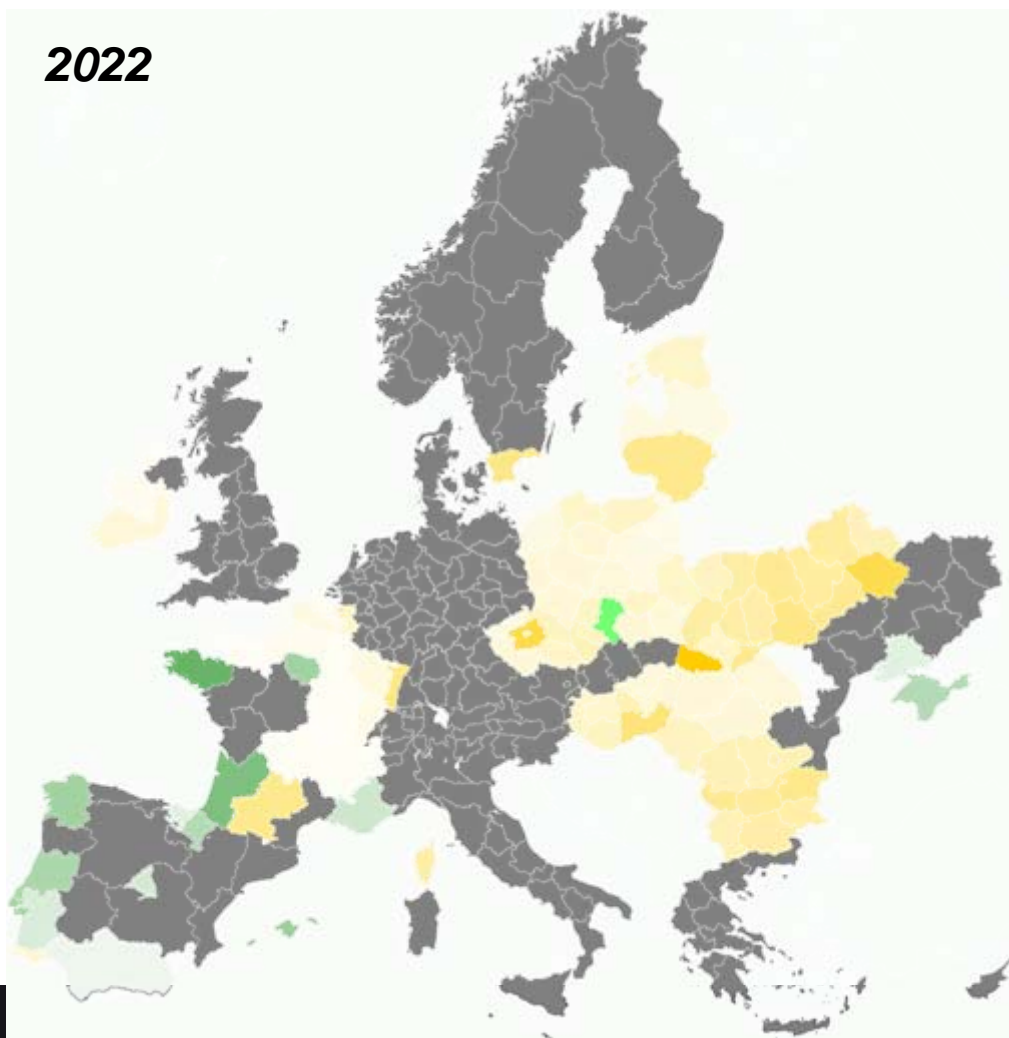
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





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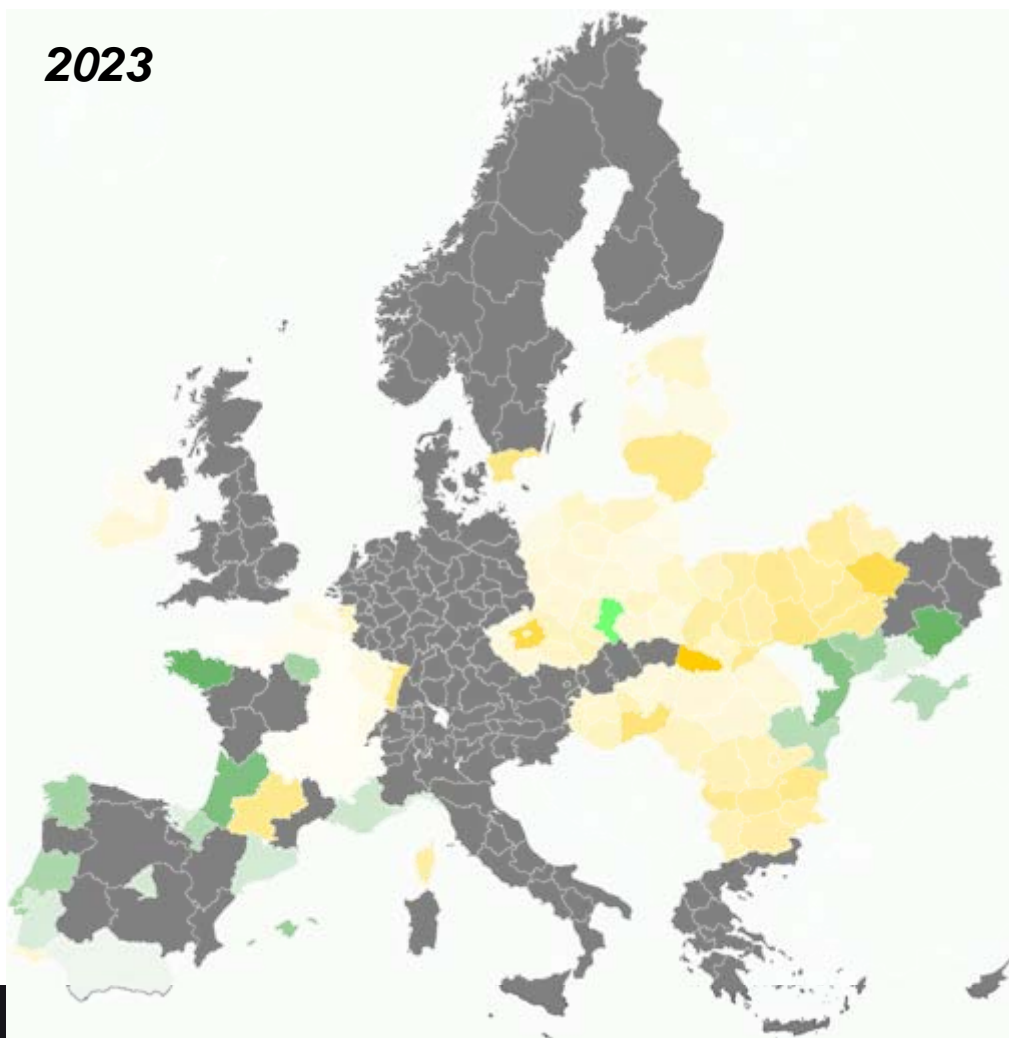
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





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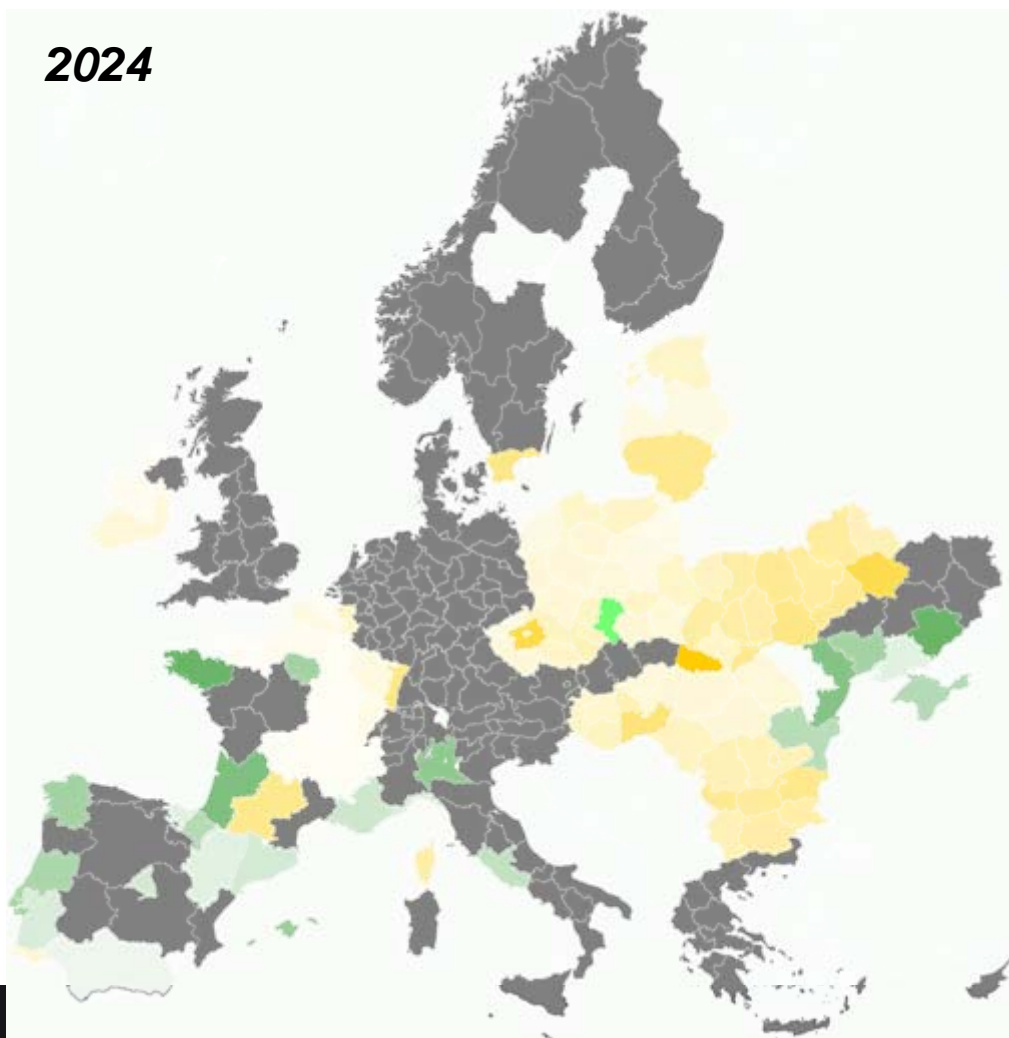
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





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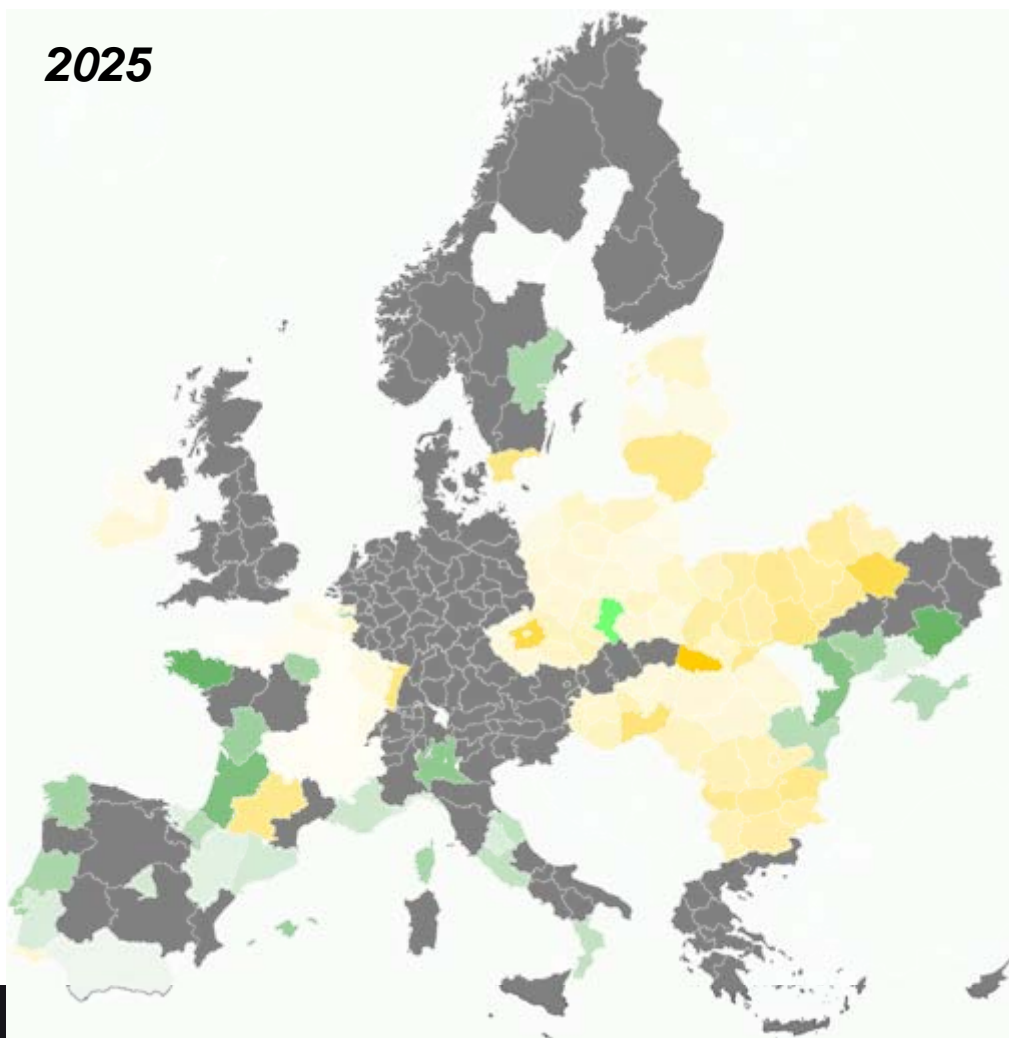
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





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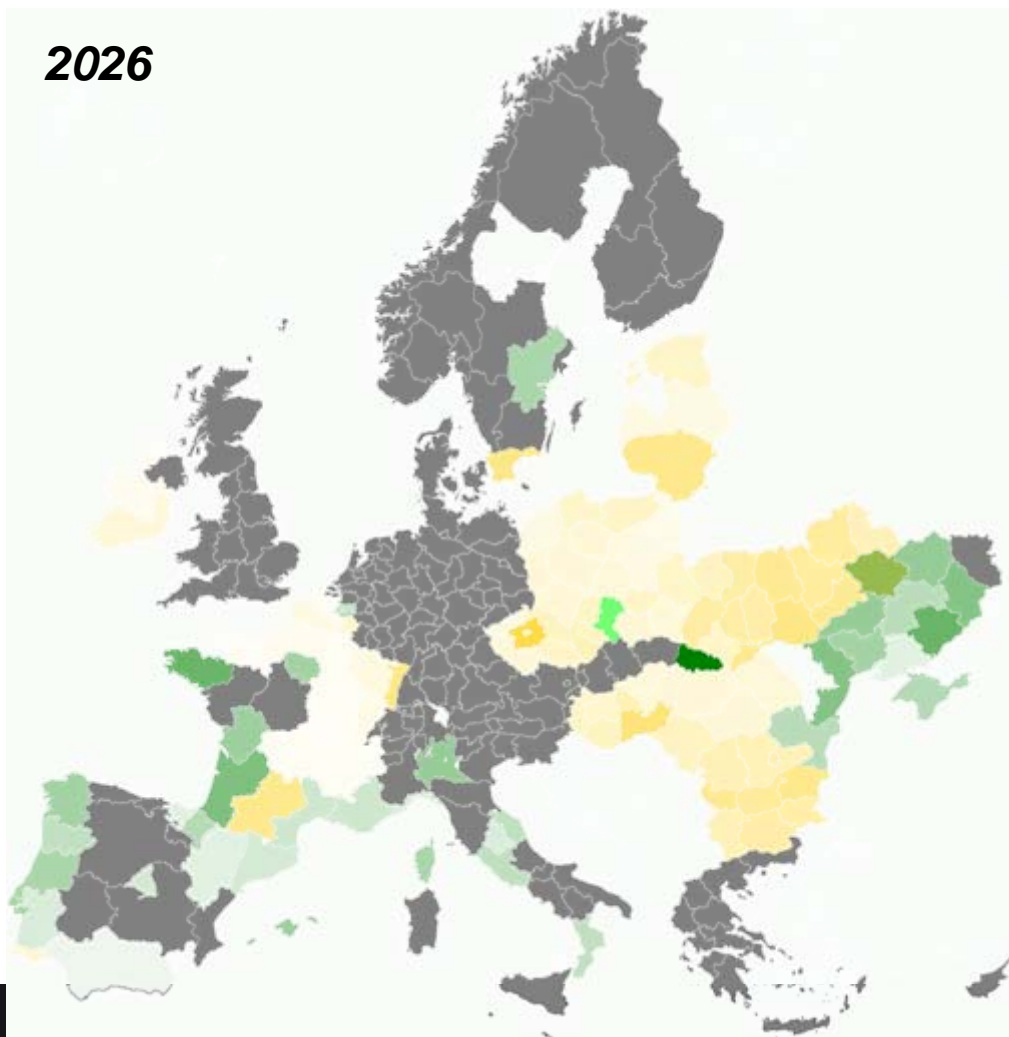
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





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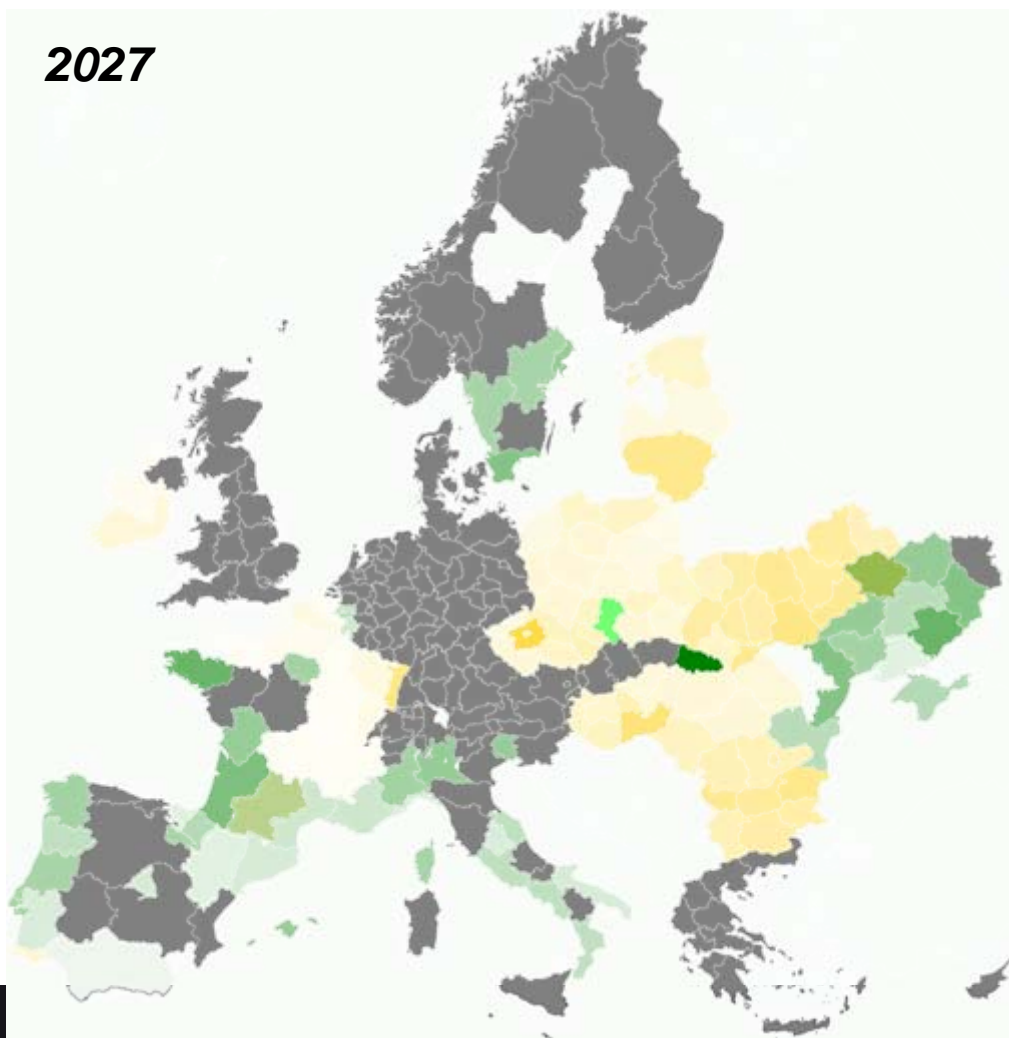
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





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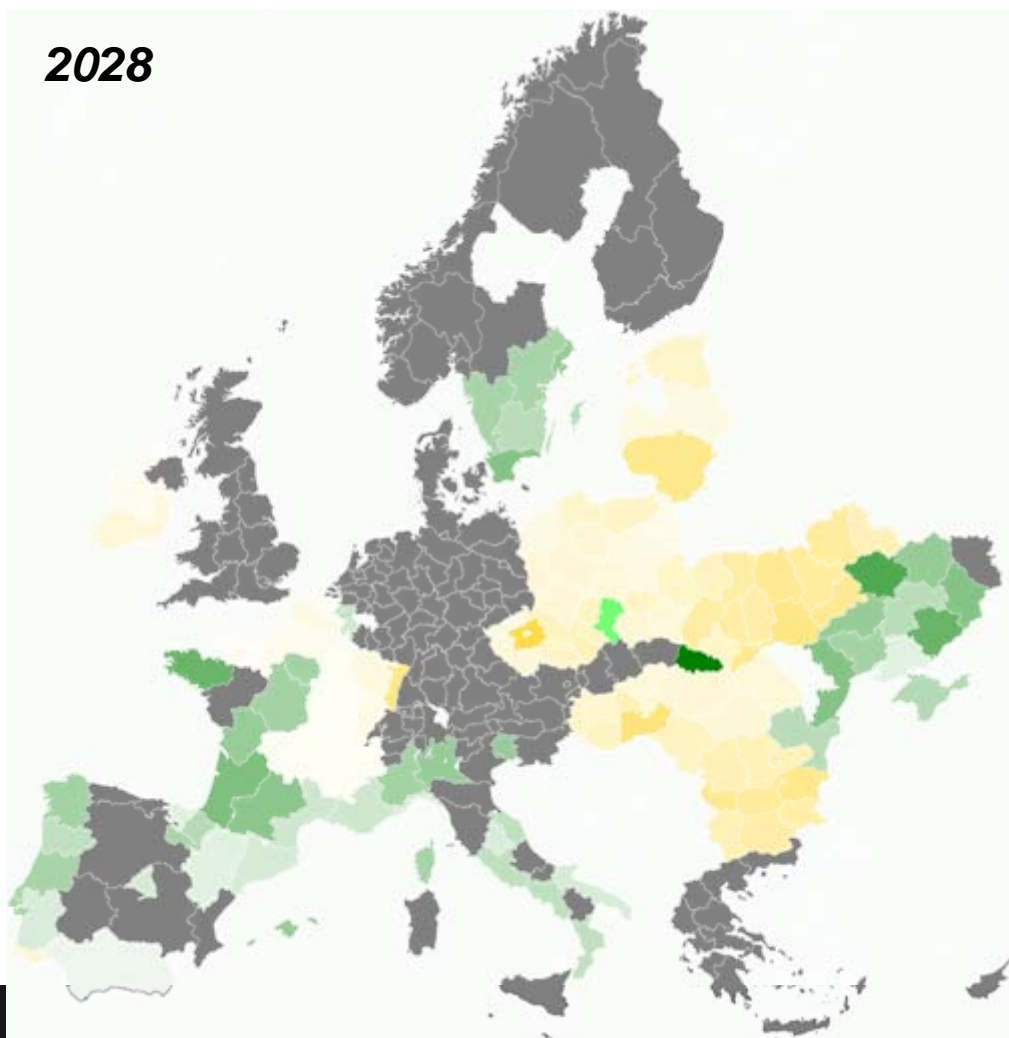
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





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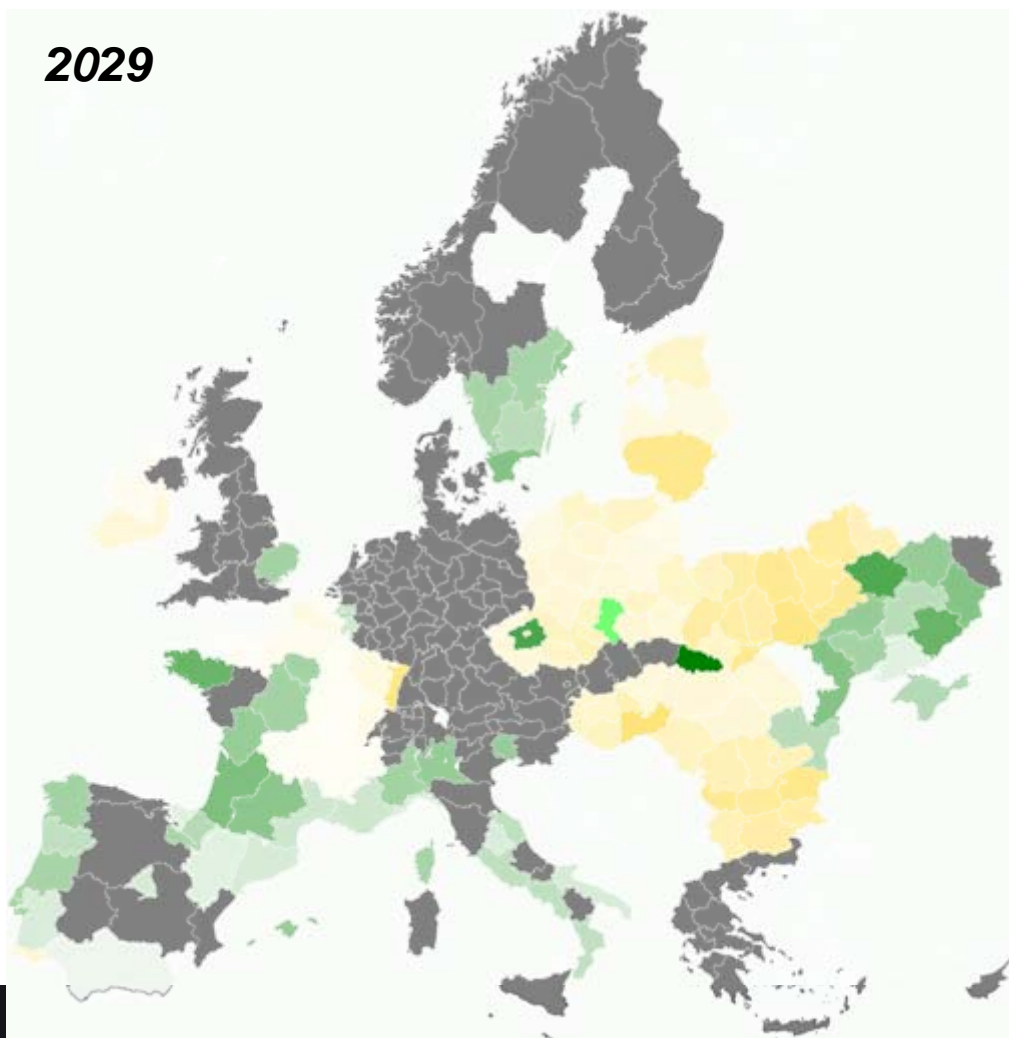
Producterende regio's








	Oil crops
	Grassy crops
	Woody crops
	Starch crops
	Sugar crops



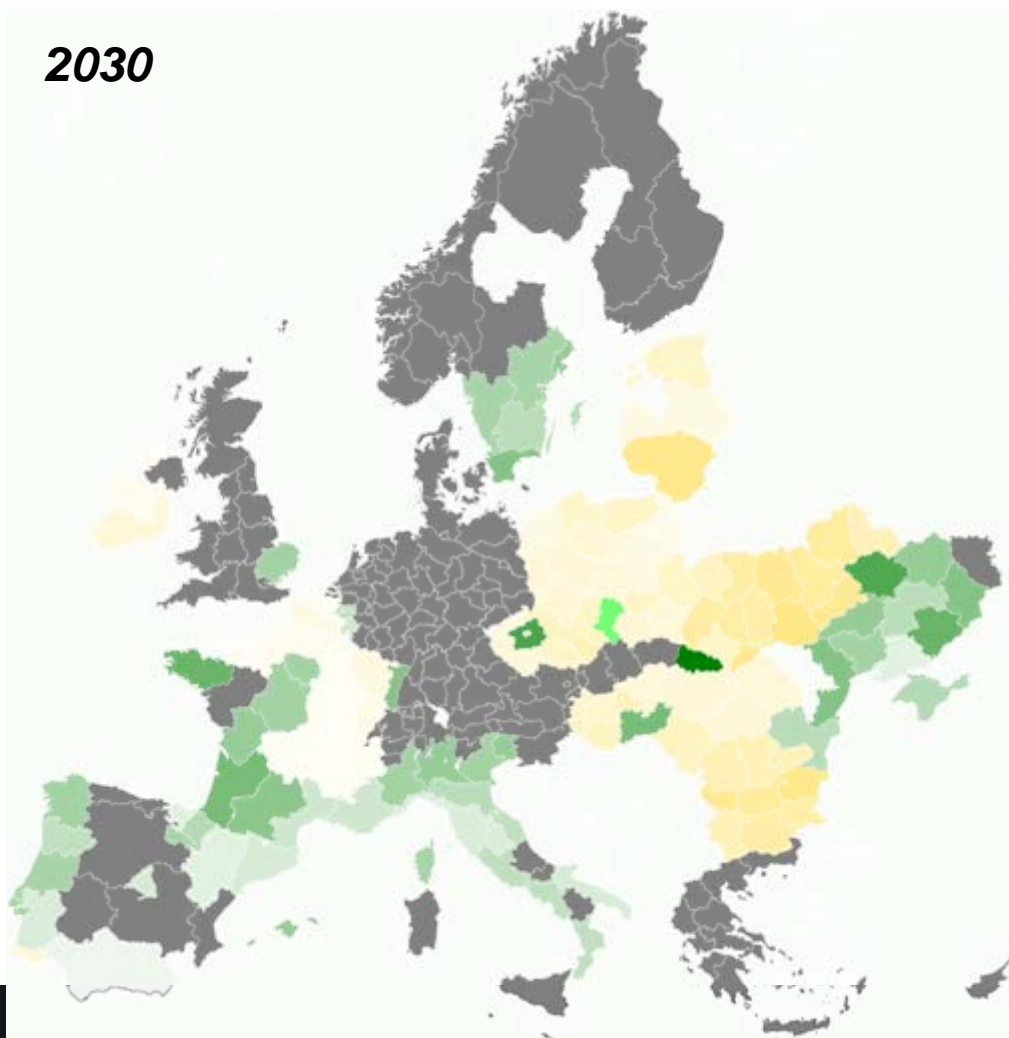
Producterende regio's








	Oil crops
	Grassy crops
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Producterende regio's



	Oil crops
	Grassy crops
	Woody crops
	Starch crops
	Sugar crops



Het kan ook anders lopen...

Geen CO₂ beleid

“Comfort, consumptie, lage energieprijzen”

- Fossiel blijft dominant, verschuiving → kolen
- Elektriciteitsopwekking (centraal): weinig verandering, geleidelijk meer kolen, meer wind en biomassa
- Transport: olieproducten, op termijn elektriciteit
- Weinig energiebesparing

“Hoge olie- en gasprijzen, SoS bedreigd”

- Olie en gas op hun retour, kolen groeit
- Elektriciteitsopwekking: kernenergie, kolen, biomassa bijstook, offshore wind
- Transport: coal to liquid (CTL)
- Veel energiebesparing
- Importeren kolen en biomassa
- Nieuw type zeehavens

**Doorbraken
Innovatie
Verrassingen**

Ruim olie & gas

Krap olie & gas

“Klimaatbeleid en comfort”

- Elektriciteitsopwekking: gas/kolen met CO₂-afvang, kernenergie, wind, biomassa, zonnepanelen
- Transport: waterstof/brandstofcellen en biobrandstoffen
- Veel energiebesparing
- Waterstof uit fossiel met CO₂ afvang
- Waterstof infrastructuur (variant: ook in GO)

“Duurzaamheid met weinig fossiel”

- Elektriciteitsopwekking: offshore wind, zon-PV, kernenergie, kolen met CO₂-afvang, biomassavergassing.
- Transport: veel besparing, biobrandstoffen, H₂
- Heel veel energiebesparing
- Veel duurzame energie, ook import door EU
- H₂ voor transportsector en opslag elektriciteit; Interactieve netwerken

Stevig CO₂-beleid

Duurzame Europese energiehouding is haalbaar met forse beleidsinspanning

- Breed portfolio van energie-opties is de meest robuuste strategie:
 - Energiebesparing, hernieuwbare energie en schoon fossiel krijgen een veel grotere rol; kernenergie onder voorwaarden
 - Groeiende rol voor elektriciteit, biobrandstoffen en waterstof
- In 2050 nog geen volledig duurzame energiehouding, duurzaamheidseisen blijven monitoren
- Realisatie vergt consistent beleid, inspanningen op meerdere fronten en een lange adem



Dank u wel!

Duurzame energie:

www.ecn.nl/ps/onderzoeksprogramma/hernieuwbare-energie

Biobrandstoffen:

www.refuel.eu

www.elobio.eu

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