

# The role of burden sharing regimes to reach the global 2°C climate target

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[www.ecn.nl](http://www.ecn.nl)

## Agenda

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- Introduction and approach
  - TIAM-ECN energy system model
  - Reference GHG mitigation scenario
  - Burden sharing schemes
- Resource sharing scheme
- Effort sharing scheme
- Impact of limited certificate trade
- Conclusions

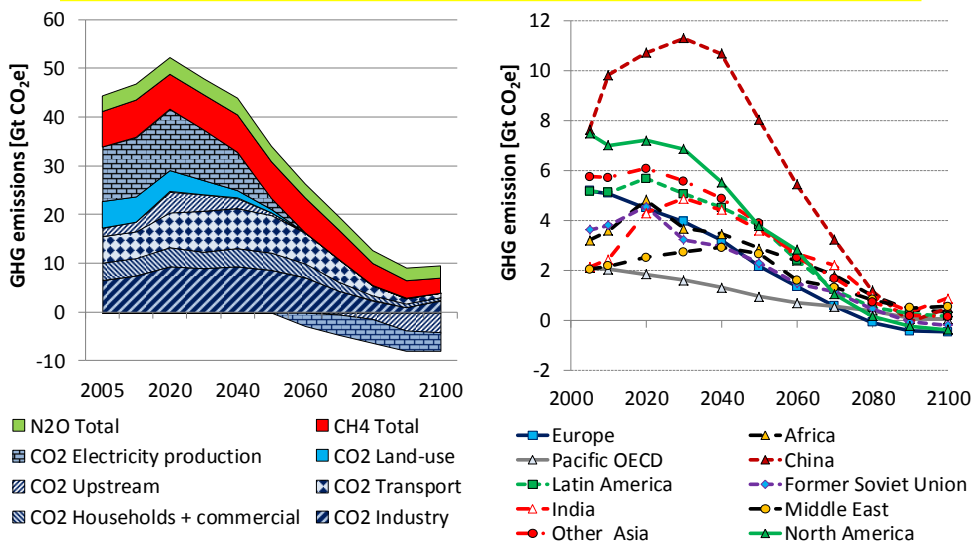
## TIAM-ECN model approach

- Global energy system model
- 15 world regions
- Time horizon: 2005 – 2100
- 6 time slices per year
- Supply and demand sectors, representing various energy conversion pathways
- Endogenous energy and emission certificate trade

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- Study conducted within LIMITS EU-FP 7 project, work in progress  
[www.ecn.nl/units/ps/themes/energy-and-emission-scenarios/global-european-projections/limits/](http://www.ecn.nl/units/ps/themes/energy-and-emission-scenarios/global-european-projections/limits/)



## Cost optimal GHG mitigation to reach the global 2°C climate target



## Two burden sharing schemes

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- **Resource Sharing:** Population related regime with contraction and convergence until 2050:

– key parameter = GHG emissions per capita

$$\frac{E_r(t)}{E_w(t)} = \frac{T_2 - t}{T_2 - T_1} * \frac{E_r(T_1)}{E_w(T_1)} + \frac{t - T_1}{T_2 - T_1} * \frac{P_r(t)}{P_w(t)}$$

$E_r(t)$ : Regional emissions in time step t

$E_w(t)$ : Global emissions in time step t

$P_r(t)$ : Regional population in time step t

$P_w(t)$ : Global population in time step t

$T_1$ : Reference year for grandfathering (here: 2020)

$T_2$ : Target year for convergence (2050)

- **Effort Sharing:** GHG mitigation cost related regime:

– key parameter = policy costs as percentage of GDP  
(GHG mitigation efforts to be harmonised)

$$\left(\frac{C_r}{Y_r}\right)_t = \left(\frac{C_w}{Y_w}\right)_t \quad \forall t \in \{2020, 2025, \dots, 2100\}$$

$C_r$ : Regional absolute mitigation costs

$C_w$ : Global absolute mitigation costs

$Y_r$ : Regional GDP

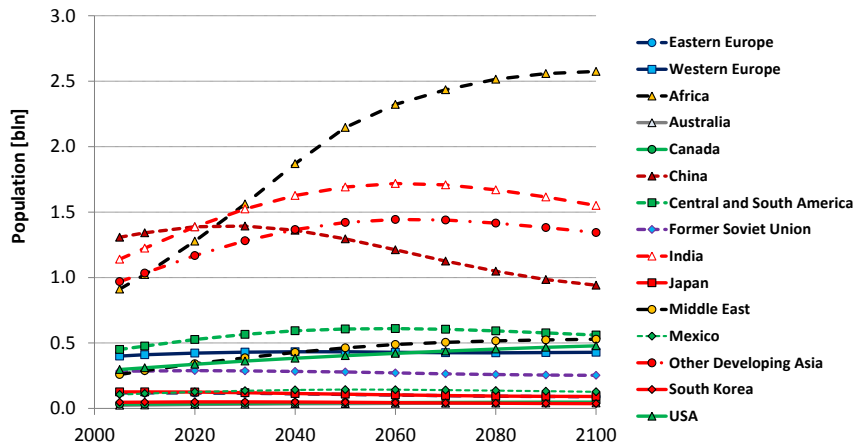
$Y_w$ : Global GDP

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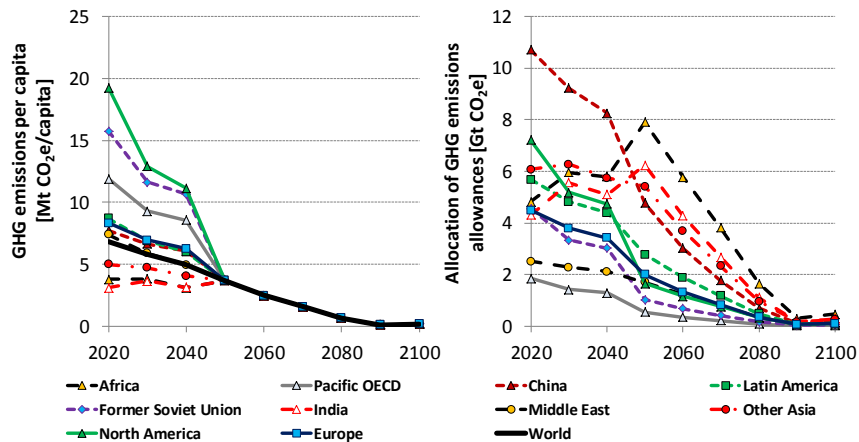
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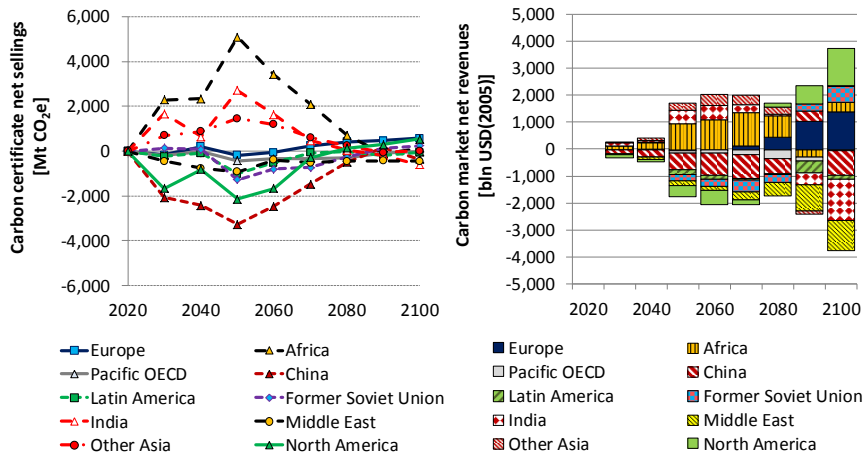
## Population development



## Certificate allocation rule under Resource Sharing



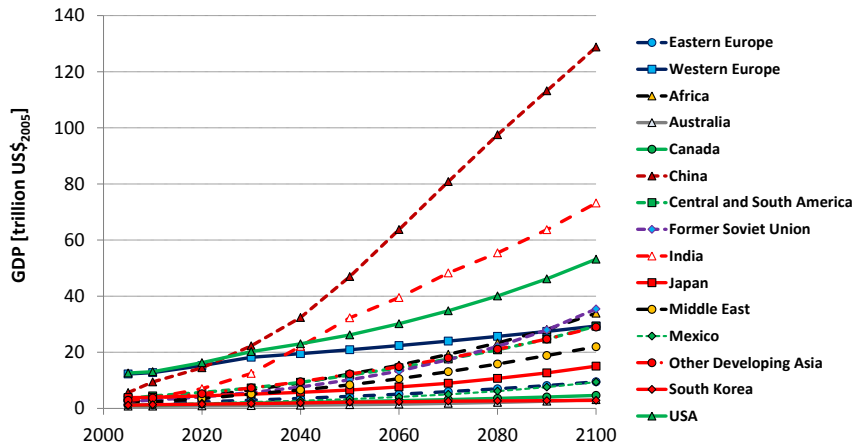
# Certificate trade and GHG market capital flow under Resource Sharing



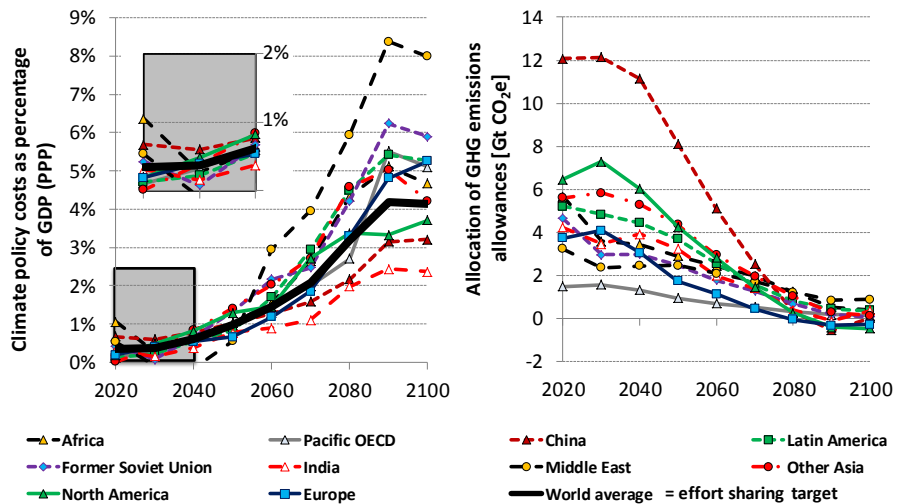
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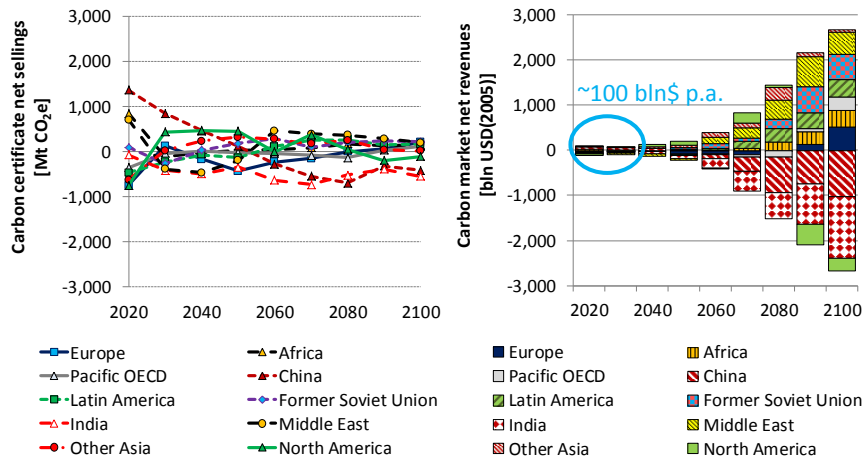
## Development of GDP (PPP)



## Certificate allocation rule under Effort Sharing



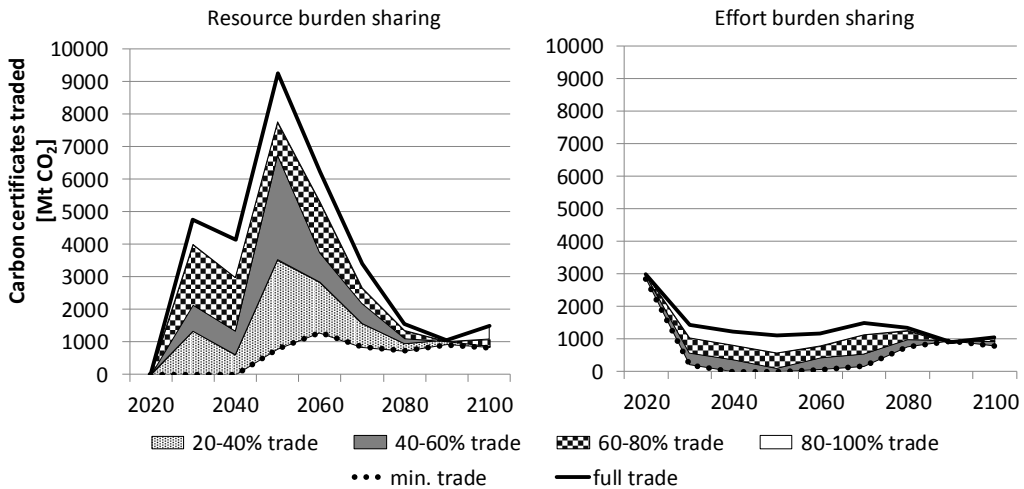
# Certificate trade and GHG market capital flow under Effort Sharing



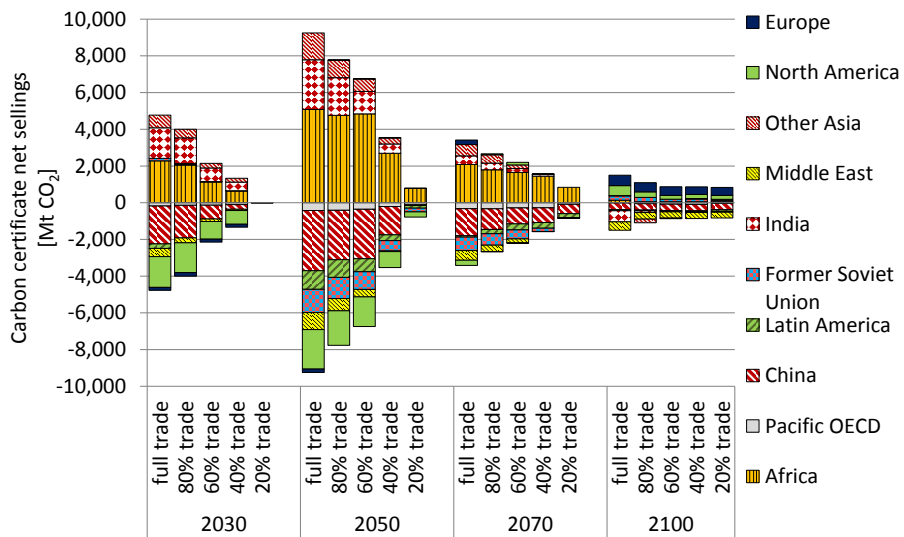
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# Timing effects of limited certificate trade

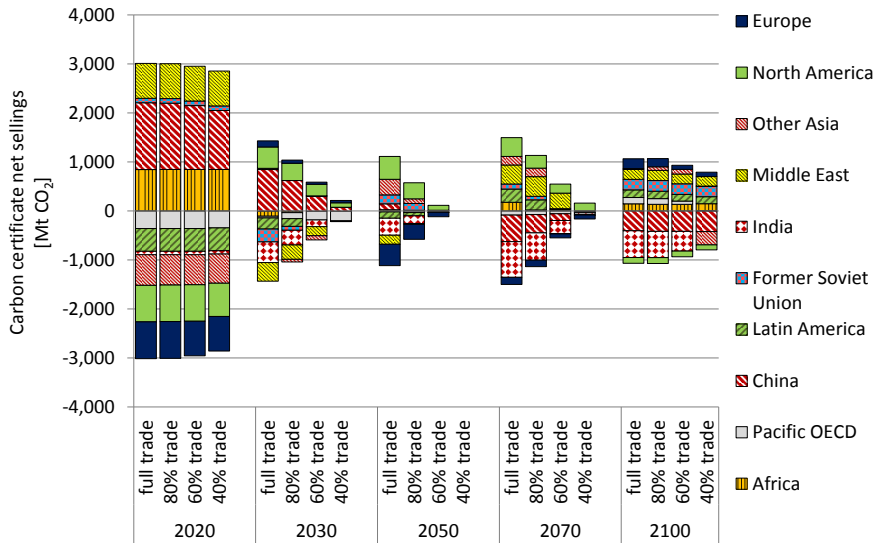


# Resource sharing scheme with limited certificate trade

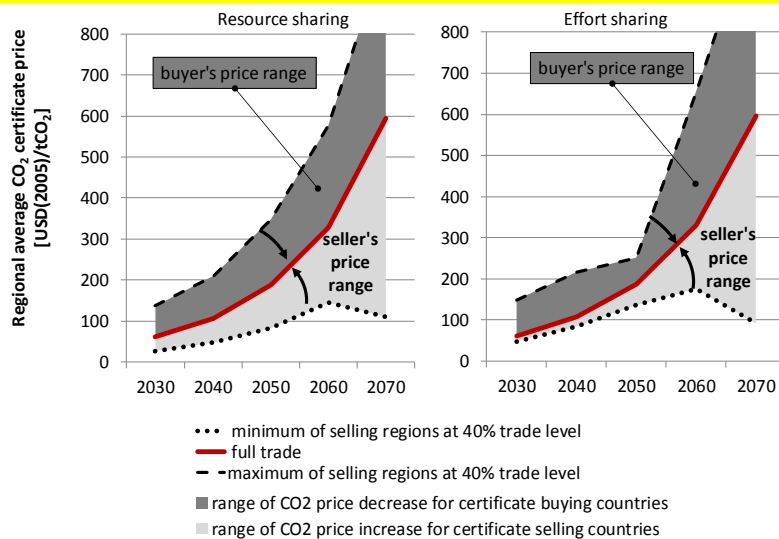




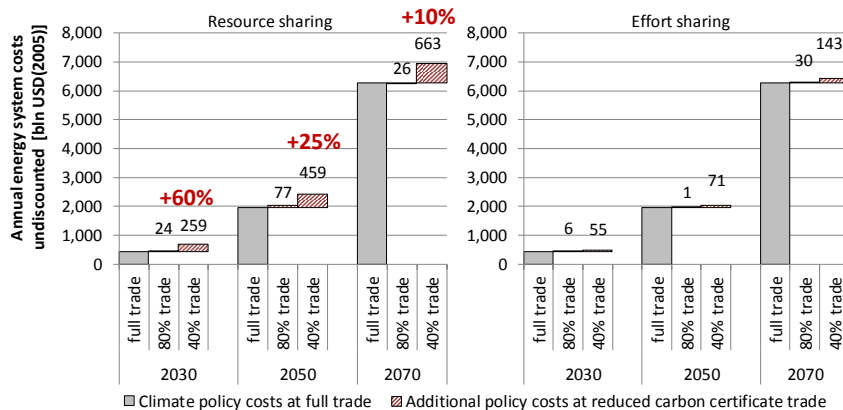
## Effort sharing scheme with limited certificate trade



## Certificate price effects



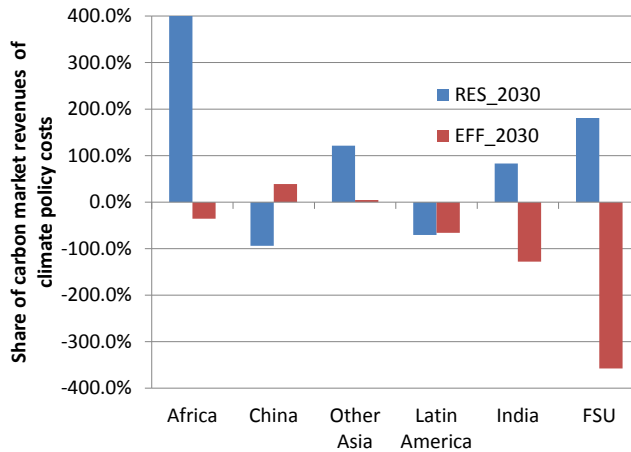
## Effects on policy costs



## Conclusions

- Different burden sharing schemes allocation lead to compensation of different regions
- Less trade of certificates under effort sharing (GDP related) than under resource sharing scheme (population related)
- Resource sharing scheme compensates regions with good potential to for net negative GHG emissions (biomass CCS)
- Appropriate certificate trading mechanisms required, otherwise additional policy costs to reach climate target up to +60% of policy costs in the mid-term (2030)
- Certificate trade levels influence carbon certificate price in selling and buying regions (2050: up to 100 USD/t CO<sub>2</sub>)

## Carbon market capital flow vs. policy costs in 2030



Thank you!

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- UNFCCC / Doha – 2012 / **Work programme on long-term finance**

*The Conference of the Parties...*

*Decides to extend the work programme on long-term finance for one year to the end of 2013, with the aim of informing developed country Parties in their efforts to identify pathways for mobilizing the scaling up of climate finance to USD 100 billion per year by 2020 from public, private and alternative sources in the context of meaningful mitigation actions ...*