ECRANISTAN
MK-RS

HAM Scenario

ECRANISTAN

- Target: To reduce GHG Emissions (Direct + Indirect) for 50% in 2050
- Goal: To became EU Member

⇒ Implementation of EU Directives

Demand sector - Households

- Lighting:
  - Incandescent lights phase out by 2020 (Transposition of EU Directive)
  - LED share (80% in 2050),
- Space Heating
  - Fuel switch
    - LPG (Interpolation: 2017 – 30%, 2050 - 5%),
    - Heat pumps (Remainder),
    - Electricity direct (Interpolation: 2017 – 20%, 2050 – 5%),
  - Technology efficiency improvement
    - Efficient Wood pellets (Interpolation: 2017 – 55%, 2050 – 80%)
    - Natural gas (Interpolation: 2017 – 73%, 2050 – 80%)
  - Insulation (Transposition of EU Directive – Passive houses after 2020)
    - Useful Energy Intensity GJ/HH (Smooth: 2017 – 25, 2050 – 14.4)

Demand sector - Households

- Water Heating:
  - Fuel switch
    - LPG (Interpolation: 2017 – 30%, 2050 - 0%)
    - Natural Gas (Interpolation: 2017 – 30%, 2050 – 45%)
    - Electricity Direct (Interpolation: 2017 – 30%, 2050 – 20%)
    - Solar (Remainder)
- Cooking
  - Technology Switch
    - Electricity Induction (Interpolation: 2017 – 0%, 2050 – 25%)
    - Electricity Conduction (Remainder)
    - Natural Gas (Interpolation: 2017 – 30%, 2050 – 35%)
    - LPG (Interpolation : 2017 - 30%, 2050 – 20%)

Demand sector - Households

- Air Conditioning:
  - Existing (Remainder)
  - Ideal (Smooth: 2017 – 0%, 2030 - 50%, 2050 – 70%)
  - Final energy intensity: Existing - 400 kWh/HH, Ideal - 200 kWh/HH in 2050 (due to insulation)
- Refrigeration:
  - Existing (Remainder)
  - Ideal (Smooth: 2017 – 0%, 2030 - 30%, 2050 – 90%)
- Other
  - Existing (Remainder)
  - Ideal (Smooth: 2017 – 0%, 2030 – 20%, 2050 – 60%)

Demand sector - Agriculture

- Fuels – introduction of renewables and changes in shares
  - Electricity (Remainder)
  - Oil (Interpolation: 2017 – 39%, 2050 – 0%)
  - Coal (Interpolation: 2017 – 28%, 2050 – 0%)
  - Biofuels (Interpolation: 2017, – 0%, 2050 – 5%)
  - Solar (Interpolation: 2017 – 0%, 2050 – 15%)
  - Geothermal (Interpolation: 2017 - 0% , 2050- 10%)
  - Natural gas (Interpolation: 2017 – 0%, 2050 – 39%)

Demand sector - Services

- Changes in fuels share:
  - Coal
  - Oil
  - Electricity (Remiander)
  - Natural Gas
  - Solar (Interpolation: 2017 – 0%, 2050 – 10%)

Demand sector - Industry

- Chemical and Petrochemical
  - Technology efficiency improvement – BPT (Catalysts 20-40%)
    - Final energy intensity MJ/US$ (Smooth: 2017- BY, 2030 – BY*0.9, 2050 - BY*0.6)
  - Fuel switch
    - Coal (Interpolation: 2017 – 36%, 2050 – 0%)
    - Natural gas (Interpolation: 2017 – 11%, 2050 – 46.7%)
    - Oil (Interpolation: 2017 – 7%, 2050 – 4.2%)
    - Electricity (Remainder)
- Non-Ferrous Metals
  - Technology efficiency improvement – Global Aluminum Sustainable Initiative 10% reduction (1990-2010) - 0.5%/year
    - Final energy intensity MJ/US$ (Smooth: 2017- 12.58, 2030 – 11, 2050 – 8.5) (32% more efficient)

Demand sector - Industry

- Food & Tobacco

- Other
  - Fuel switch
    - Coal (Interpolation: 2017 – 25%, 2050 – 7.5%) (50% less in 2050 relative to BASE)
    - Natural gas (Interpolation: 2017 – 1%, 2050 – 25%)
    - Oil (Interpolation: 2017 – 40%, 2050 – 12%) (50% less in 2050 relative to BASE)
    - Electricity (Remainder)

Demand sector – Transport Passenger

- Road
  - Technology switch
    - Standard (Remainder)
    - Hybrid (Smooth: 2017 – 0%, 2020 – 4%, 2030 – 15%, 2050 – 45%)
    - Electric (Smooth: 2017 – 0%, 2020 – 1%, 2030 – 10%, 2050 – 30%)
    - CNG (Smooth: 2017-0%, 2020 – 1%, 2030 – 2%, 2050 – 5%) (EU Expert Group for new Fuels, 2011)
  - Introduction of biofuels (EU Directive 10% in 2020)
- Rail
  - Share in 2050- 35% same as 2012 (Baseline: 20% in 2050)

Demand sector – Transport Freight

- Road
  - Fuel switch
    - Petroleum Products (Remainder)
    - Electricity (Smooth: 2017 – 0%, 2020 – 4%, 2030 – 15%, 2050 – 30%)
    - Biodiesel (Interpolation: 2017 – 0%, 2025 – 10%, 2050 – 10%) (EU Directive 10% in 2020)
    - CNG (Smooth: 2017-0%, 2020 – 4%, 2030 – 15%, 2050 – 20%) (EU Expert Group for new Fuels, 2011)
- Rail
  - Fuel switch
    - Petroleum Products (Remainder)
    - Electricity (Smooth: 2017 – 10%, 2050 – 30%)
    - Biofuels (Interpolation: 2017 – 0%, 2050 – 10%)

Transformation sector

- Electricity Generation
  - Change in Importance Factor

	Oil	New Natural Gas	Old Natural Gas	Old Coal	New Coal	Nuclear	Coal CCS	Solar	Wind	Hydro
Baseline	3	8	0	0	7	0	0	0.5	0.5	0.5
HAM	0	3	0	0	1	1	1.5	7	7	4

Transformation sector

- Electricity Generation
  - Introduction of alternative fuel to existing technologies
    - New Coal Technology -
      - Coal (Remainder)
      - Biomass (Interpolation: 2017 – 0%, 2050 10%)

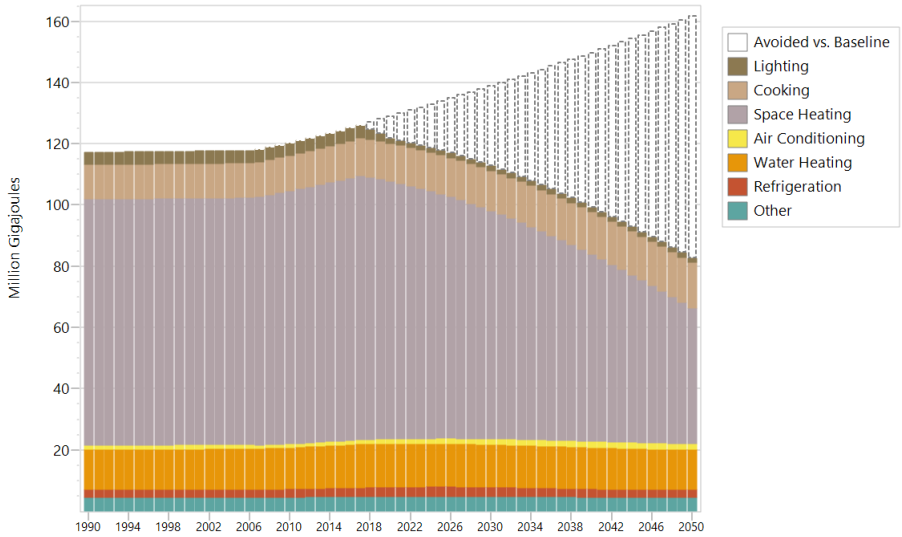
Transformation sector

- Transmission and Distribution
  - Electricity losses reduction:
    Baseline - Interpolation: 2006 - 18.7%, 2020 - 17.1%, 2030 - 15.6%, 2050 -12%
    HAM – Interpolation: 2017 – 18.7%, 2020 – 17.1%, 2030 – 14.5%, 2050 - 10%

Results

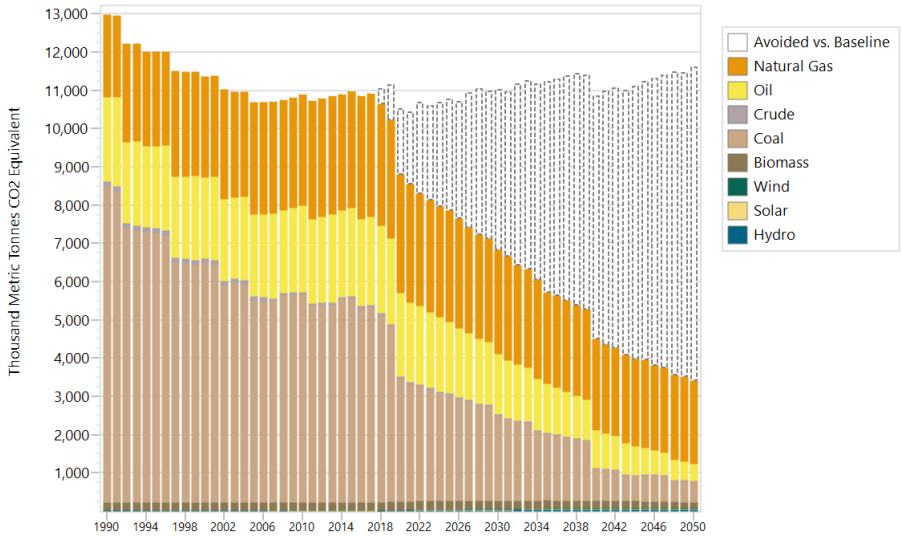
Households Energy Demand Final Units

HAM Scenario Avoided vs. Baseline, All Fuels



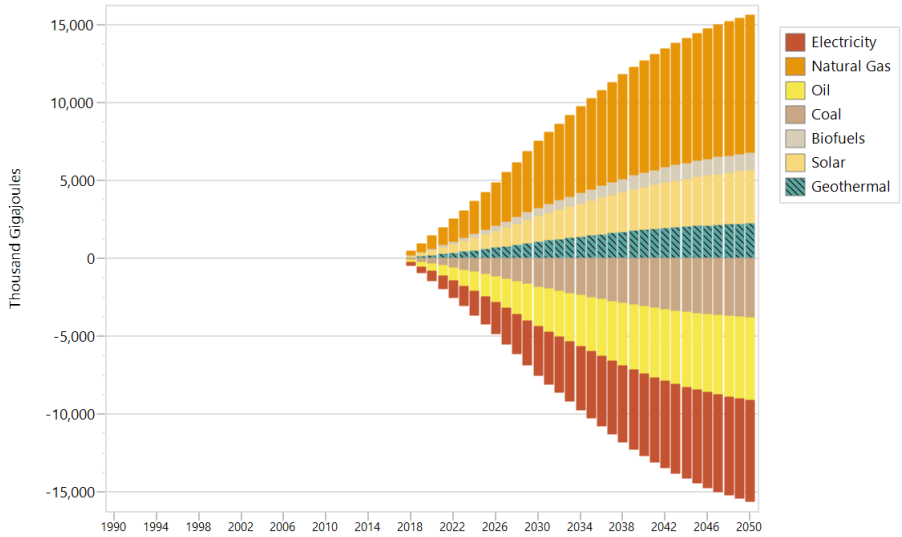
Households One_Hundred Year GWP Direct and Indirect Allocated to Demands

HAM Scenario Avoided vs. Baseline, All GHGs



Agriculture Energy Demand Final Units

HAM Scenario Differences vs. Baseline



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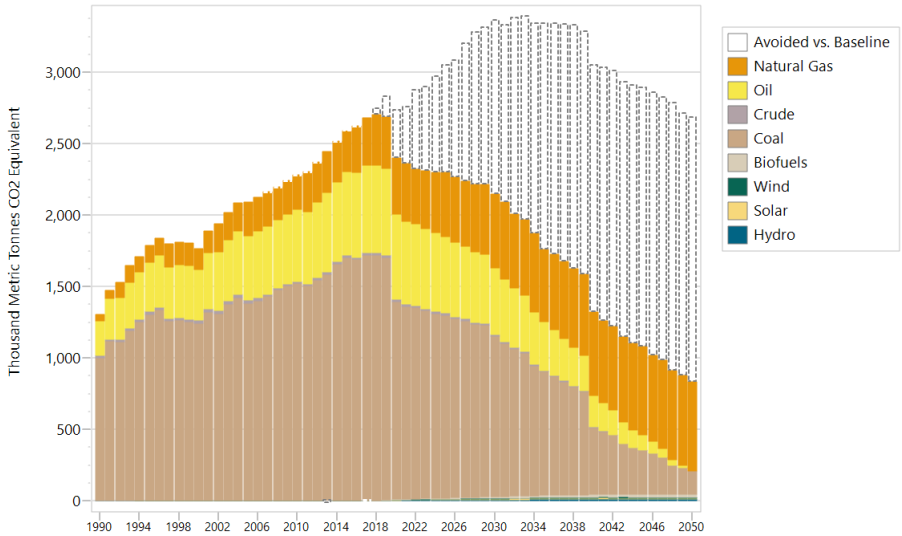
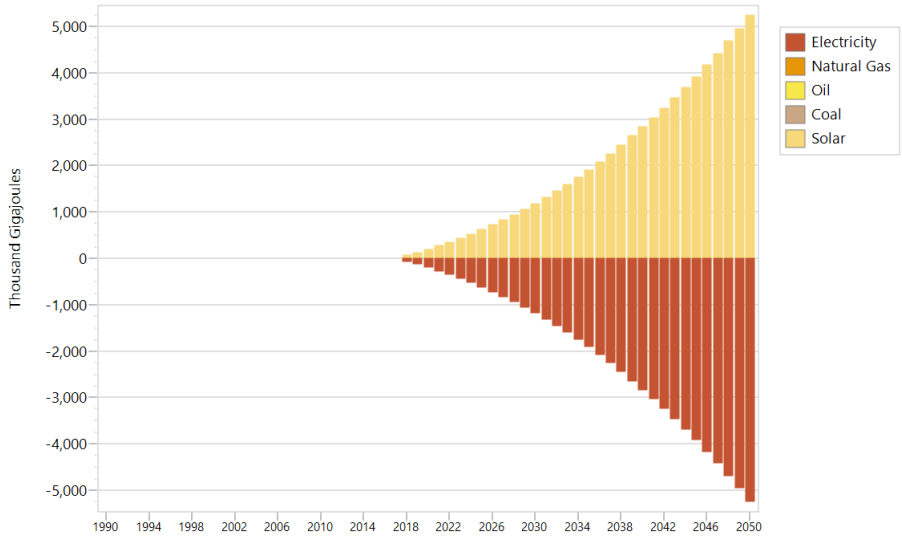
HAM Scenario Avoided vs. Baseline, All GHGs



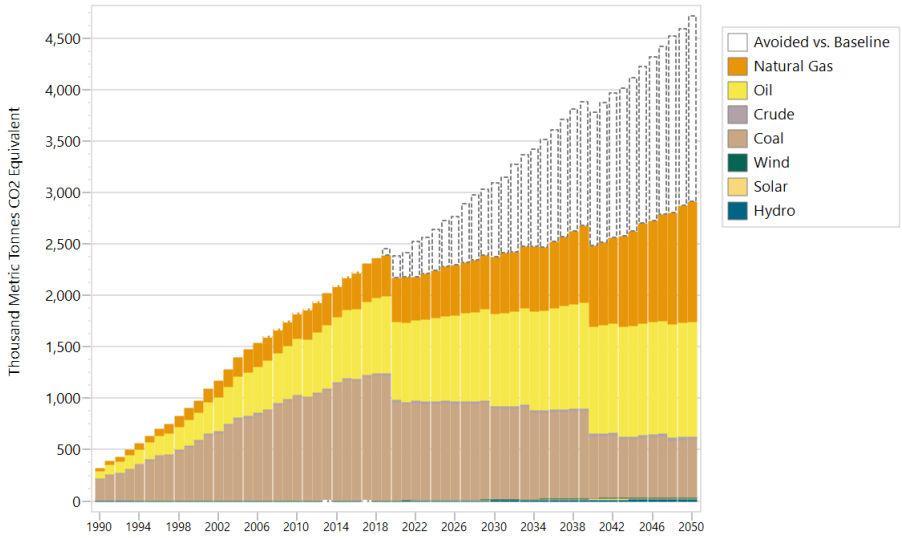
Services Energy Demand Final Units

HAM Scenario Differences vs. Baseline



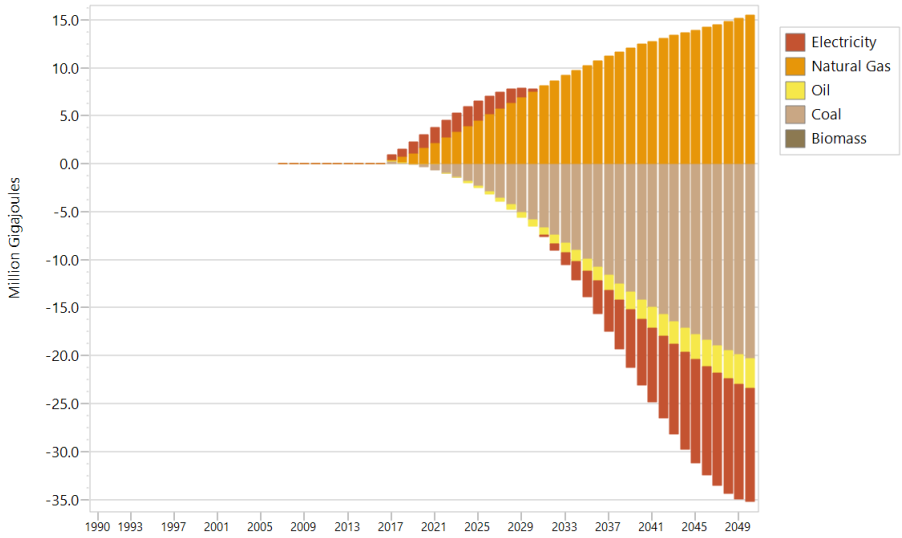
Services One_Hundred Year GWP Direct and Indirect Allocated to Demands

HAM Scenario Differences vs. Baseline, All GHGs



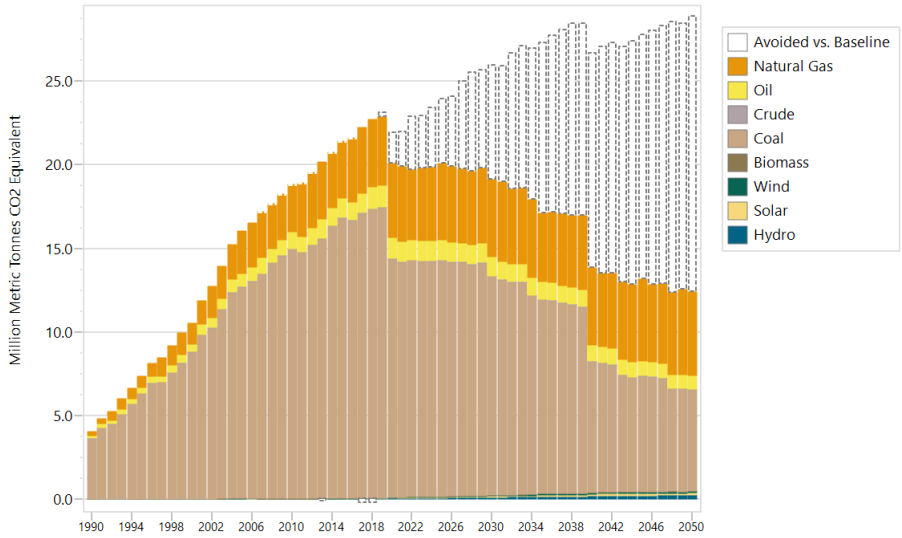
Industry Energy Demand Final Units

HAM Scenario Avoided vs. Baseline



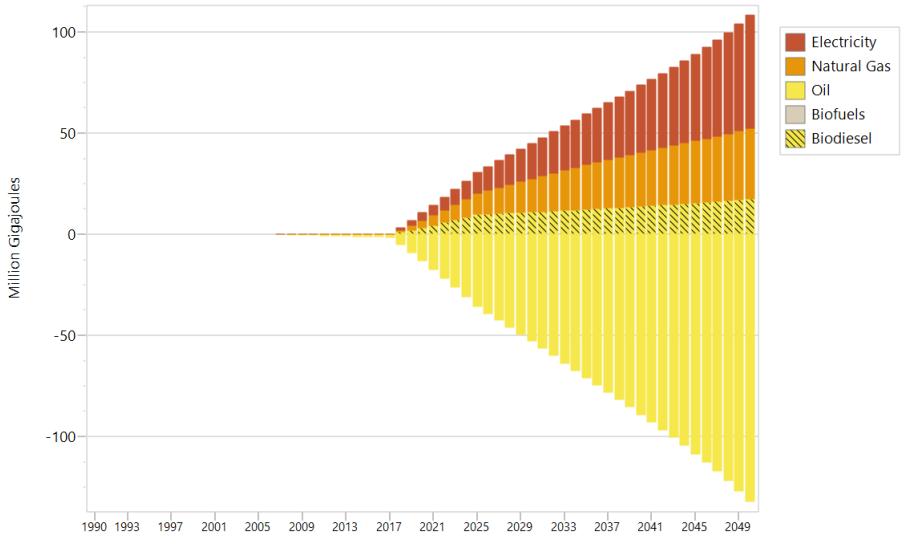
Industry One_Hundred Year GWP Direct and Indirect Allocated to Demands

HAM Scenario Differences vs. Baseline, All GHGs



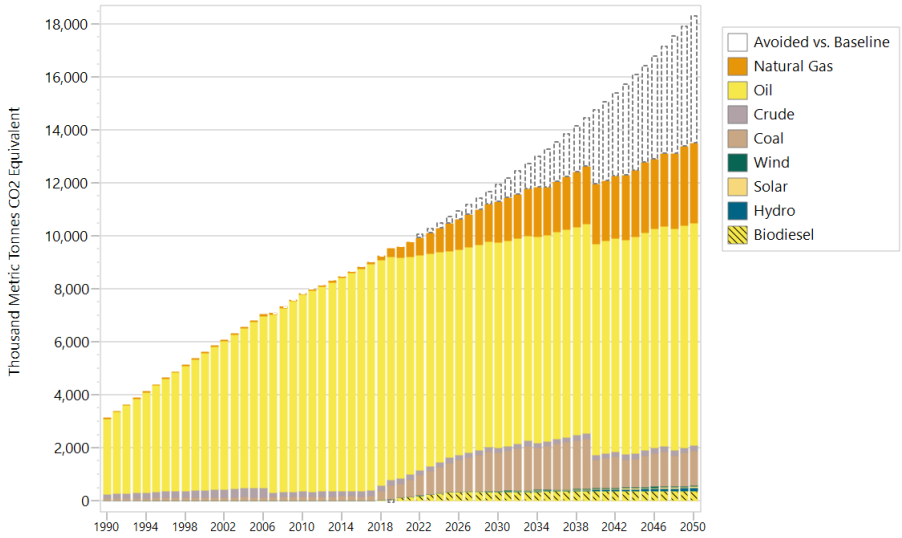
Transport Energy Demand Final Units

HAM Scenario Avoided vs. Baseline



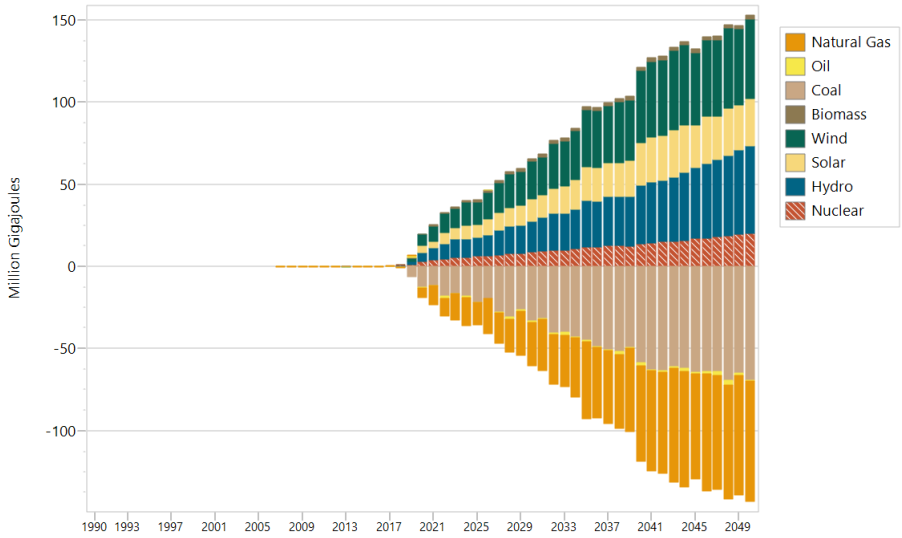
One_Hundred Year GWP Direct and Indirect Allocated to Demands

HAM Scenario Differences vs. Baseline, All GHGs



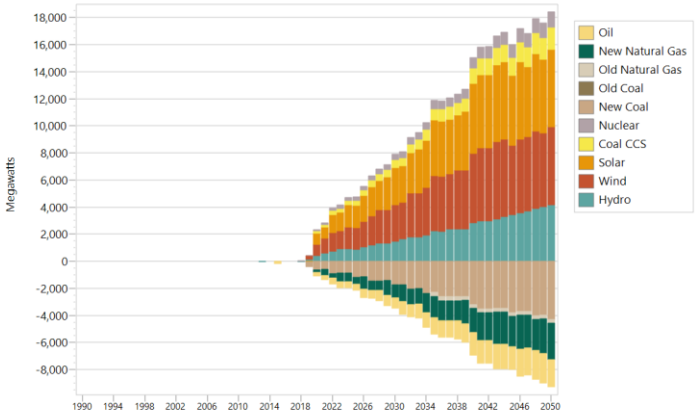
Electricity generation Outputs by Feedstock Fuel

HAM Scenario Differences vs. Baseline, All Output types



Installed Capacities

HAM Scenario Differences vs. Baseline, All Capacities

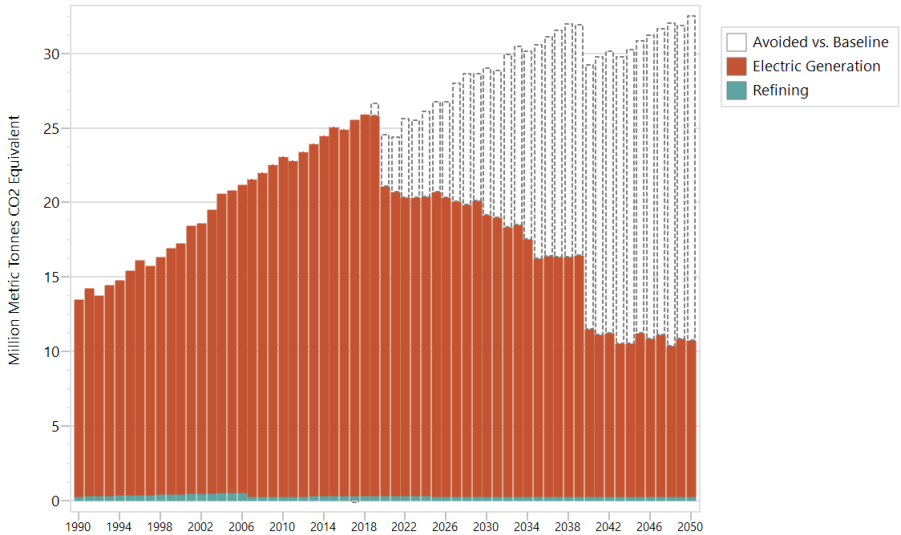


Branches	2030	2040	2050
Oil	0.92	0.45	0.30
New Natural Gas	2.74	3.15	3.06
Old Natural Gas	0.30	-	-
Old Coal	1.05	-	-
New Coal	2.20	1.85	1.46
Nuclear	0.41	0.78	1.14
Coal CCS	0.61	1.16	1.65
Solar	2.91	5.43	6.00
Wind	2.91	5.43	6.00
Hydro	2.06	3.53	4.95
Total	16.11	21.78	24.57

- Solar PV and Wind (Goal: In 2050 to have similar installed capacity per capita like Germany in 2014)
- Phase out of the Old Natural Gas after 2030-2035

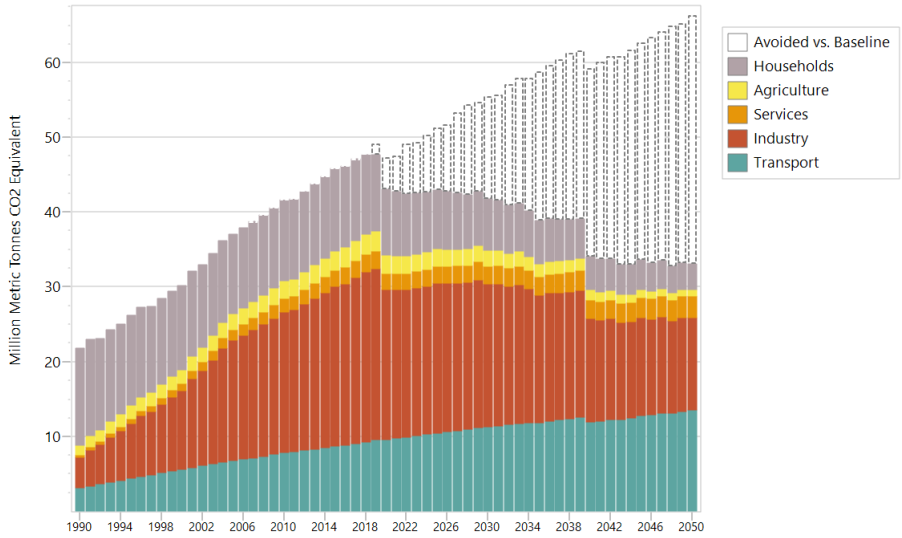
One_Hundred Year GWP Direct At Point of Emissions

HAM Scenario Avoided vs. Baseline, All Fuels, All GHGs



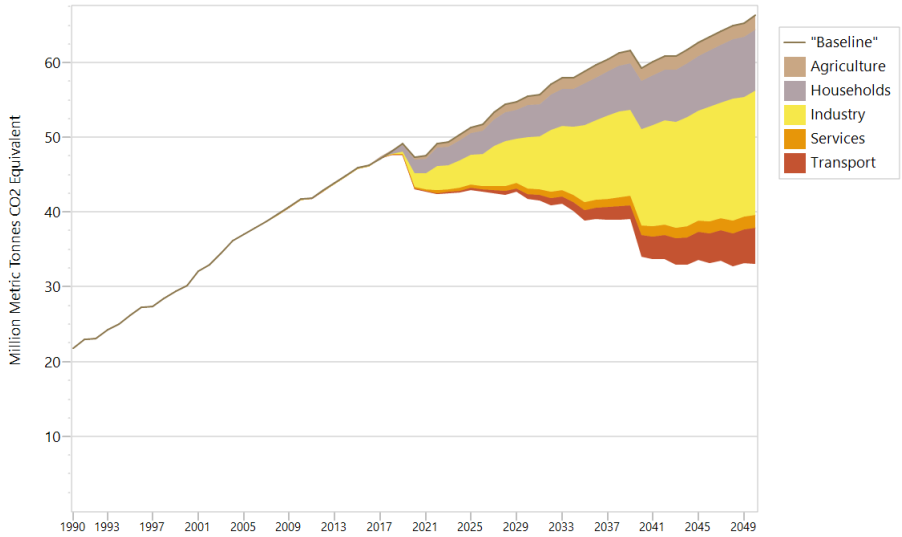
One_Hundred Year GWP Direct and Indirect Allocated to Demands

HAM Scenario Avoided vs. Baseline, All Fuels, All GHGs



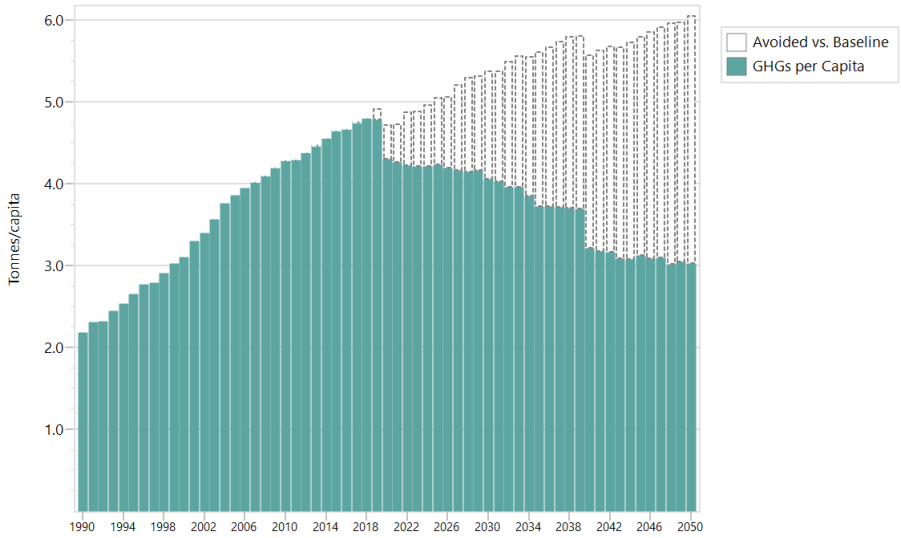
One_Hundred Year GWP Direct and Indirect Allocated to Demands

HAM Scenario Differences vs. Baseline, All Fuels, All GHGs



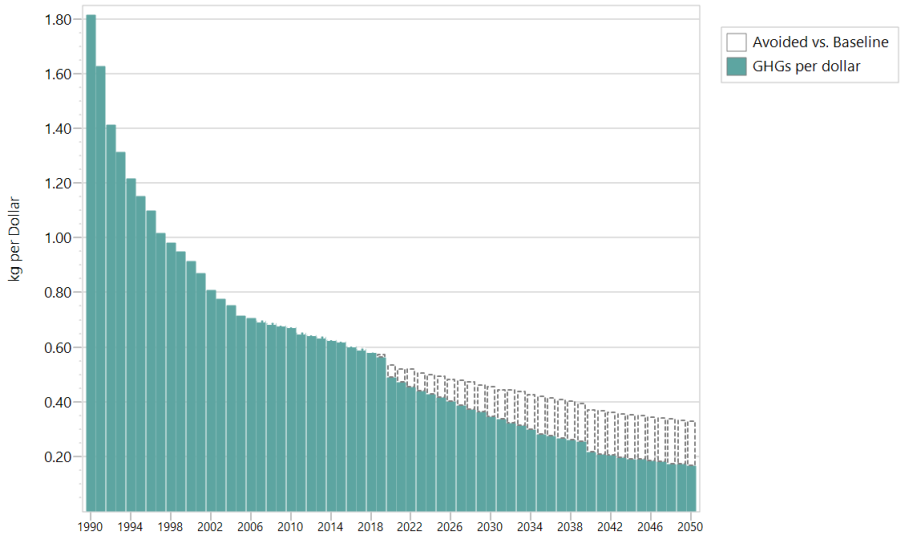
GHGs per Capita

HAM Scenario Avoided vs. Baseline



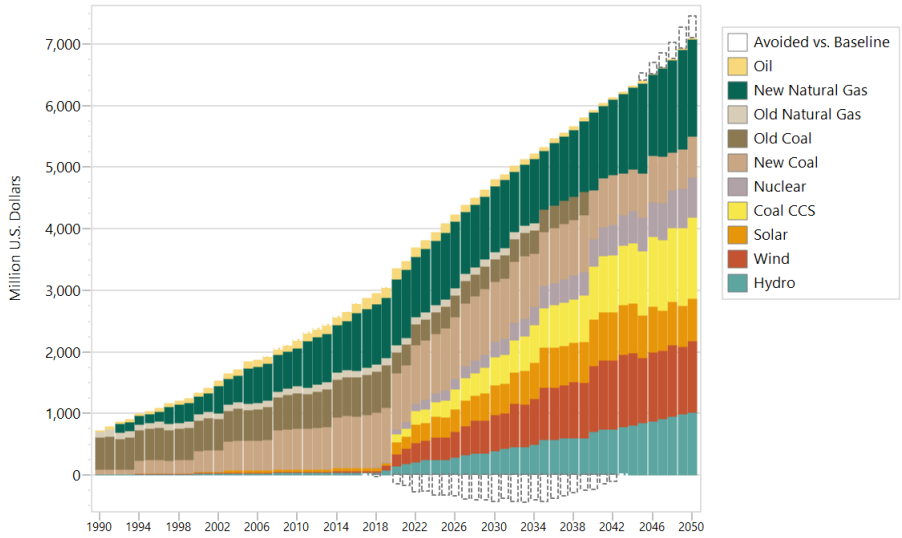
GHGs per dollar

HAM Scenario Avoided vs. Baseline



Cost of Production

HAM Scenario Avoided vs. HAM, All Module cost categories



Social Costs

HAM Scenario No Comparison, All Costs