OPPORTUNITIES FOR 1.5˚C CONSISTENT BLACK CARBON MITIGATION

Key Messages

- Under current policy scenarios, global anthropogenic emissions of black carbon are expected to decrease slightly (~3%) over the next decade.
- To be consistent with 1.5C scenarios, by 2030 global black carbon emissions should be reduced by **35% (10% - 66%)** compared to 2010 levels.
- Maximum technically feasible mitigation could achieve a **70% reduction** compared to 2010 levels by 2030. This exceeds the mitigation range implicated by the 1.5°C scenarios (*see* Figure 2).

Black Carbon Global Emissions Trends

- Anthropogenic black carbon emissions in 2010 were about 6620 KT. The majority of these emissions came from the household energy sector (52%), and transport sector (25%), and the remainder from the industry and fossil fuel sector (12%), open burning of agriculture residue and municipal waste (10%).
- Global anthropogenic black carbon emissions have been decreasing steadily since 2010. They decreased by nearly 7% between 2010 and 2015 and are expected to continue to decrease under current policies through 2030.

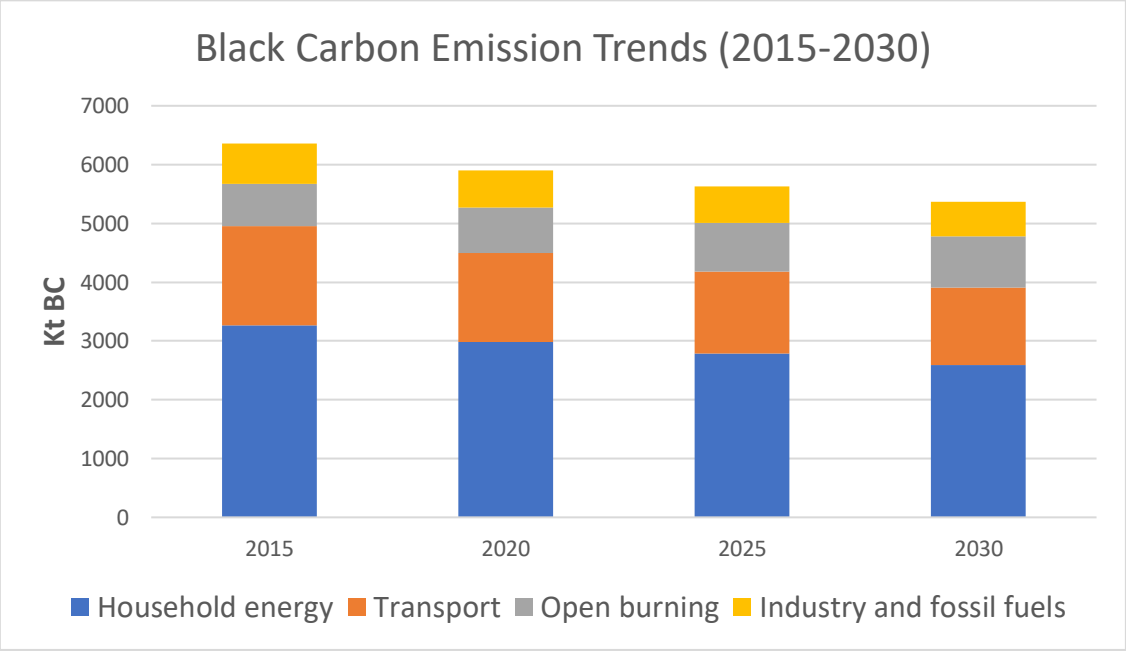

Figure 1 – Current policy scenario global Black Carbon emissions trends, broken down by sector. (scenario provided by IIASA GAINS)

Black Carbon Mitigation Consistent with 1.5°C

- To be consistent with 1.5°C scenarios, by 2030 global black carbon emissions should be reduced by 35% (10% - 66%) compared to 2010 levels.
- Under current policies, in 2030 global black carbon emissions will be 20% lower than 2010, indicating that current policies will just achieve mitigation consistent with the lowest levels consistent with 1.5°C scenarios.
- However, achieving Maximum Technically Feasible mitigation will be 70% lower than 2010 levels, which would exceed the mitigation range of the 1.5°C scenarios (*see* Figure 2).

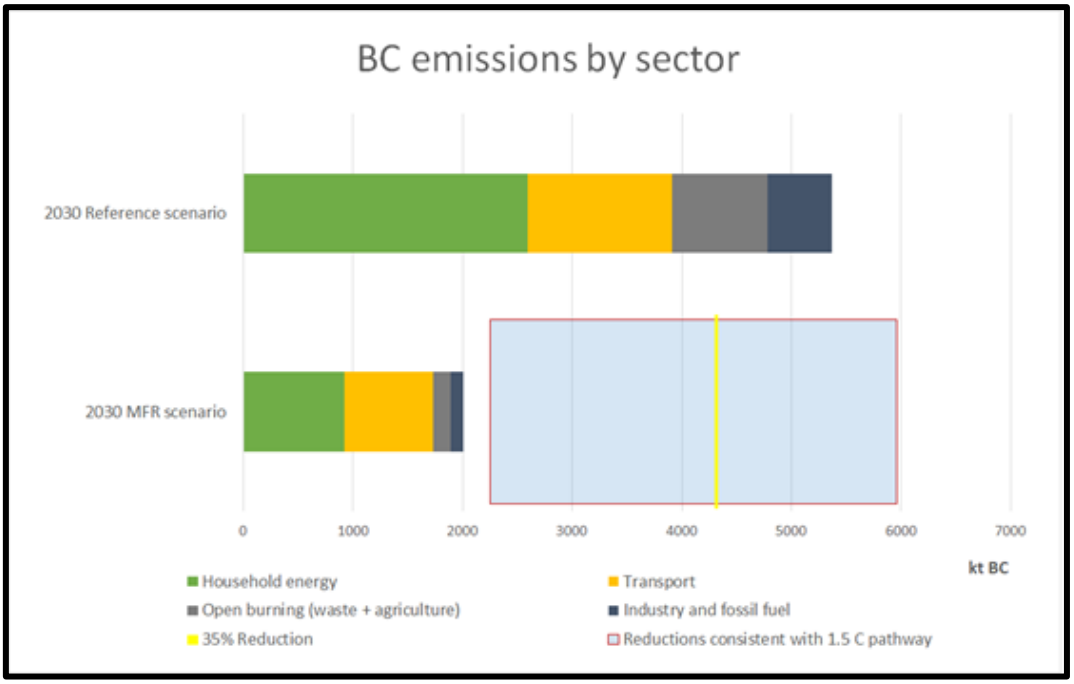

Figure 2: The upper bar shows the projected 2030 black carbon emissions if current policies are maintained. The lower bar shows projected 2030 methane emissions after maximum technically feasible reductions. The yellow line illustrates the average 2030 black carbon reduction in 1.5˚C consistent scenarios reported in the IPCC 1.5˚C Special Report (2018). (Reference and MTF scenarios provided by IIASA GAINS).

Household energy sector **(Key message)**

- The household energy sector was responsible for approximately 52% of anthropogenic black carbon emissions in 2010 (~3437 kt).
- Emissions are expected to decrease by nearly 15%, to 2590 kt, by 2030.
- Maximum technically feasible mitigation could reduce emissions in this sector by 64%, to 1665 kt, by 2030 with the largest reductions coming from biomass cookstoves (1226 Kt)

Transport sector **(Key message)**

- The transport sector was responsible for approximately 25% of anthropogenic black carbon emissions in 2010 (~1693 kt).

- Emissions are expected to decrease by 12%, to 1,319 kt, by 2030.
- Maximum technically feasible mitigation could reduce emissions in this sector by 52%, to 805 kt, by 2030.

Open burning **(Key message)**

- The open burning of agricultural residue and municipal waste was responsible for approximately 10% of anthropogenic black carbon emissions in 2010 (~674 kt).
- Emissions are expected to increase to 873 Kt in 2030 if there is no further control.
- Maximum technically feasible mitigation could reduce emissions in this sector by 77%, to 158 kt, by 2030.

Industry and fossil fuel sector **(Key message)**

- The industry and fossil fuel sector was responsible for approximately 12% of anthropogenic black carbon emissions in 2010 (~816 kt).
- Emissions are expected to decrease to 583 Kt in 2030.
- Maximum technically feasible mitigation could reduce emissions in this sector by more than 85% by 2030. The largest reductions come from oil and gas production (152 Kt), coke production (126 Kt) and large scale combustion (123 Kt)

Table 1 – Anthropogenic Black Carbon Sources, Mitigation Potentials and Key Co-Emissions

Source	Emissions in 2030 under current policies (kt)	Emissions after Maximum Technically Feasible abatement in 2030 (kt)	Main Co-emissions	% reduction in 2030 compared to 2010
Household energy (All)	2589	925		-73%
Biomass cookstoves	1709	482	CO, CH_4, NMVOC, NOx, SOx, $PM_{2.5}$, PM_{10}, OC	-72%
Biomass heating stoves	325	151	CO, CH_4, NMVOC, NOx, SOx, $PM_{2.5}$, PM_{10}, OC	-64%
Coal stoves	251	125	CO, CH_4, NMVOC, NOx, SOx, $PM_{2.5}$, PM_{10}, OC	-80%
Other residential combustion	304	167	CO, CH_4, NMVOC, NOx, SOx, $PM_{2.5}$, PM_{10}, OC, NH_3	-74%
Transport (All)	1319	805		-52%
Transport	994	805	CO, NMVOC, NOx, SOx, $PM_{2.5}$, PM_{10}, OC	-41%
Transport – high emitters	325	0	CO, NMVOC, NOx, SOx, $PM_{2.5}$, PM_{10}, OC	-100%
Open burning (All)	873	158		-77%
Open burning of municipal waste	371	29	CO, NOx, NMVOC, $PM_{2.5}$, PM_{10}, OC	-87%
Open burning of agricultural residue	502	129	CO, CH_4, NOx, $PM_{2.5}$, PM_{10}, OC, NH_3	-71%
Industry (All)	394	86		-85.7%
Large scale combustion	129	6	CO, CH_4, NMVOC, NOx, SOx, $PM_{2.5}$, PM_{10}, OC	-96%
Brick production	115	74	CO, CH_4, NMVOC, NOx, $PM_{2.5}$, PM_{10}, OC	-59%
Coke production	132	6	CO, CH_4, NMVOC, NOx, SOx, $PM_{2.5}$, PM_{10}, OC	-98%
Other	18	0.1	CO, CH_4, NMVOC, NOx, SOx, $PM_{2.5}$, PM_{10}, OC	-99%
Fossil Fuels (All)	209	28		-87%
Oil and gas production incl. flaring	193	18	CH_4, NOx, CO, NMVOC, SOx, $PM_{2.5}$, PM_{10}	-91%
Long distance gas distribution	16	10	NA	-36%