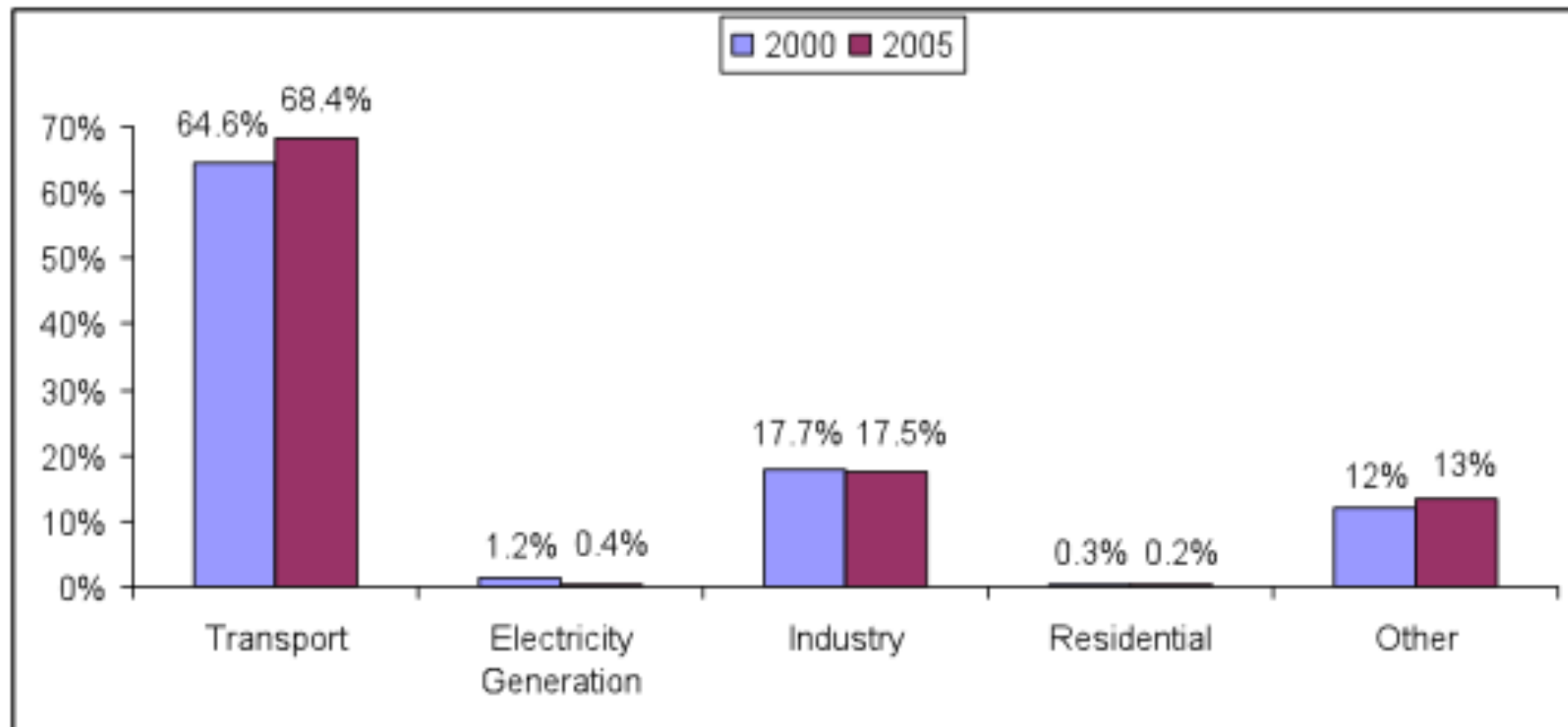




Options for Mitigation of Greenhouse Gas Emissions in Costa Rica: Towards Carbon Neutrality in 2021



Distribution of Emissions within the Energy Sector

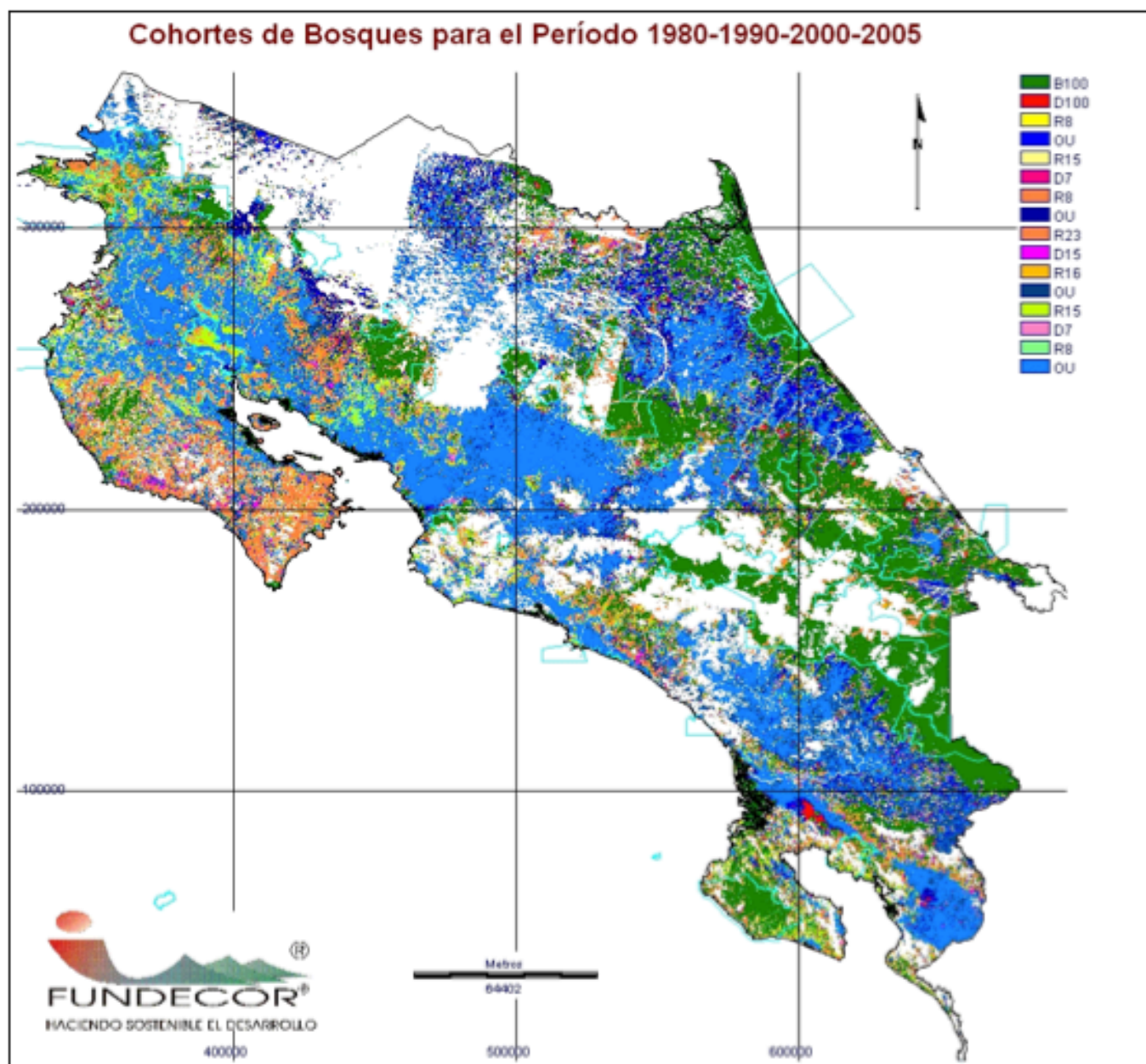


Source: Based on data from [MINAET](#) and IMN (2009).

Greenhouse Gas Emissions (Gg CO₂e)

Source	2000	2005
Energy	4,805.6	5,688.6
Industrial Processes	449.8	672.5
Agriculture	4,608.6	4,603.9
Land Use Change	-3,160.5	-3,506.7
Waste Management	1,236.9	1,320.9
Total	7,940.5	8,779.2

Source: MINAET and IMN (2009).



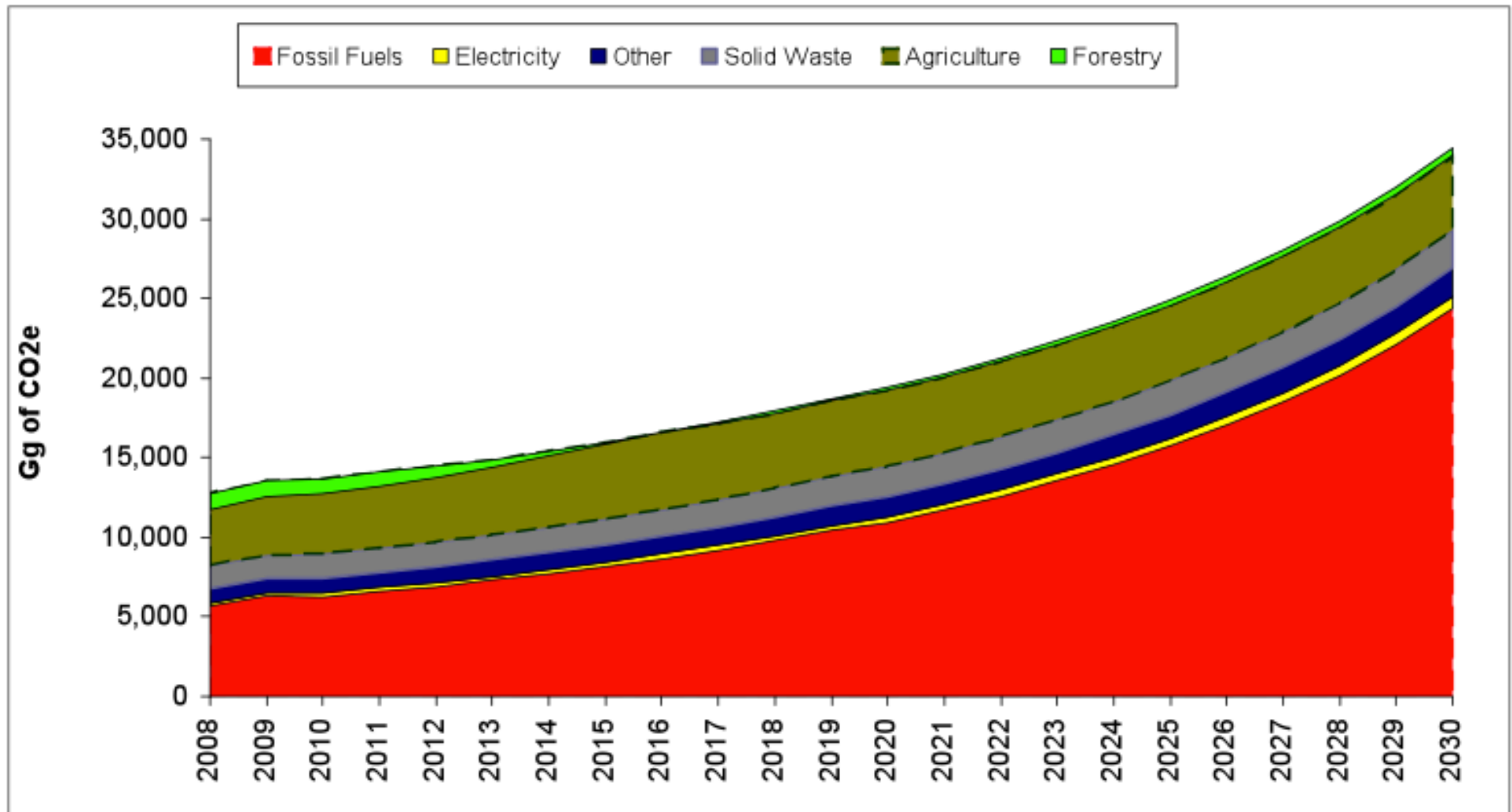
Source: Own elaboration with data from IMN and FONAFIFO.

Composition of Emissions Changes due to Fossil Fuel Use

Change (Distribution %)	1980-1990	1990-2000	2000-2007
Carbon intensity (of energy)	-55.6%	-16.8%	28.9%
Energy intensity (of GDP)	29.5%	32.8%	-46.8%
Per capita GDP	-19.5%	50.3%	75.1%
Population	145.6%	33.8%	42.9%
Emissions due to fossil fuel use (millions of tCO ₂)	+0.47	+2.27	+1.82

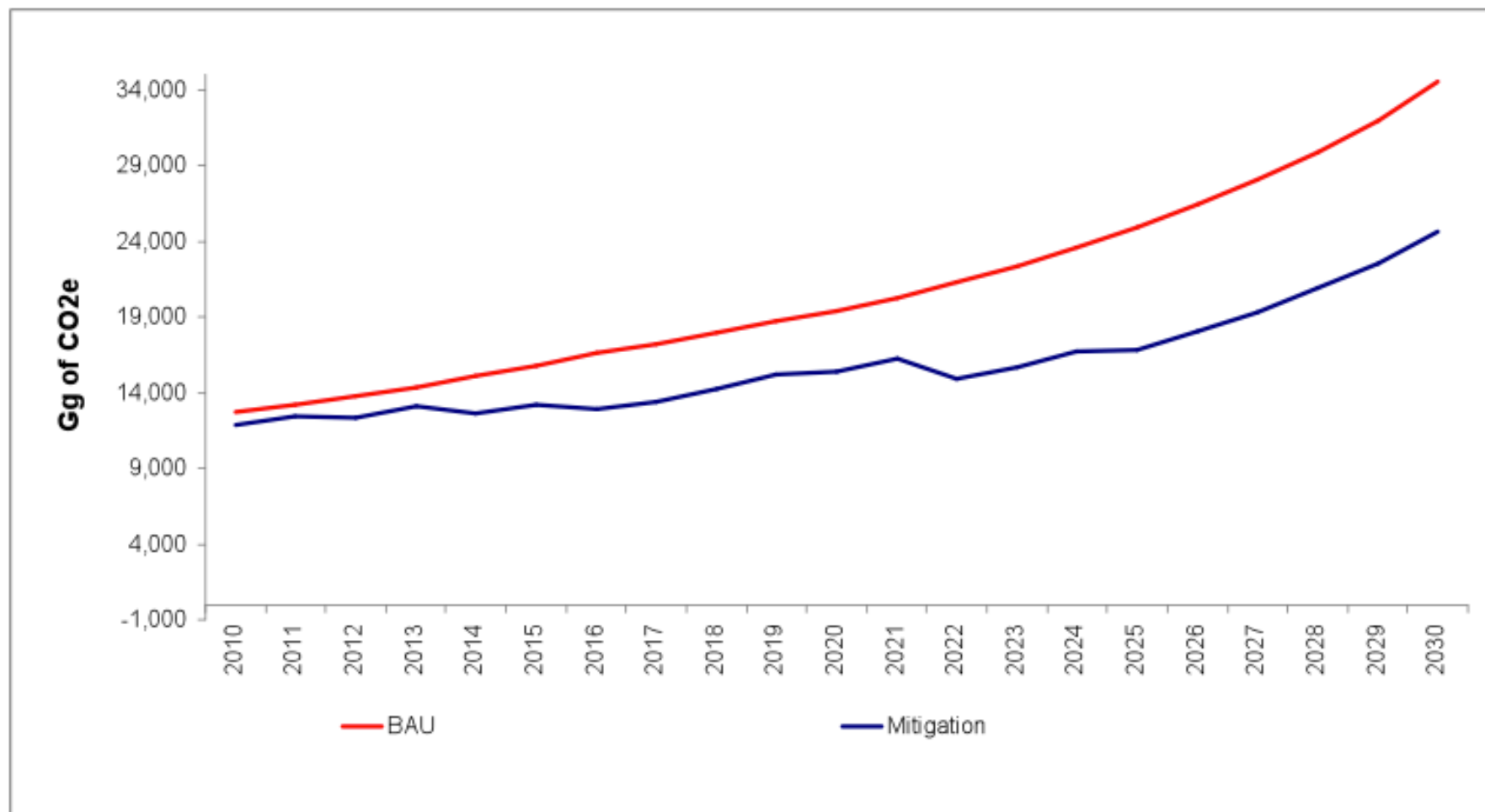
Source: Own elaboration with data from the U.S. Energy Information Administration, based on Bacon and Bhattacharya (2007).

Total Projected Emissions Period 2008-2030 – BAU (High Growth) Scenario



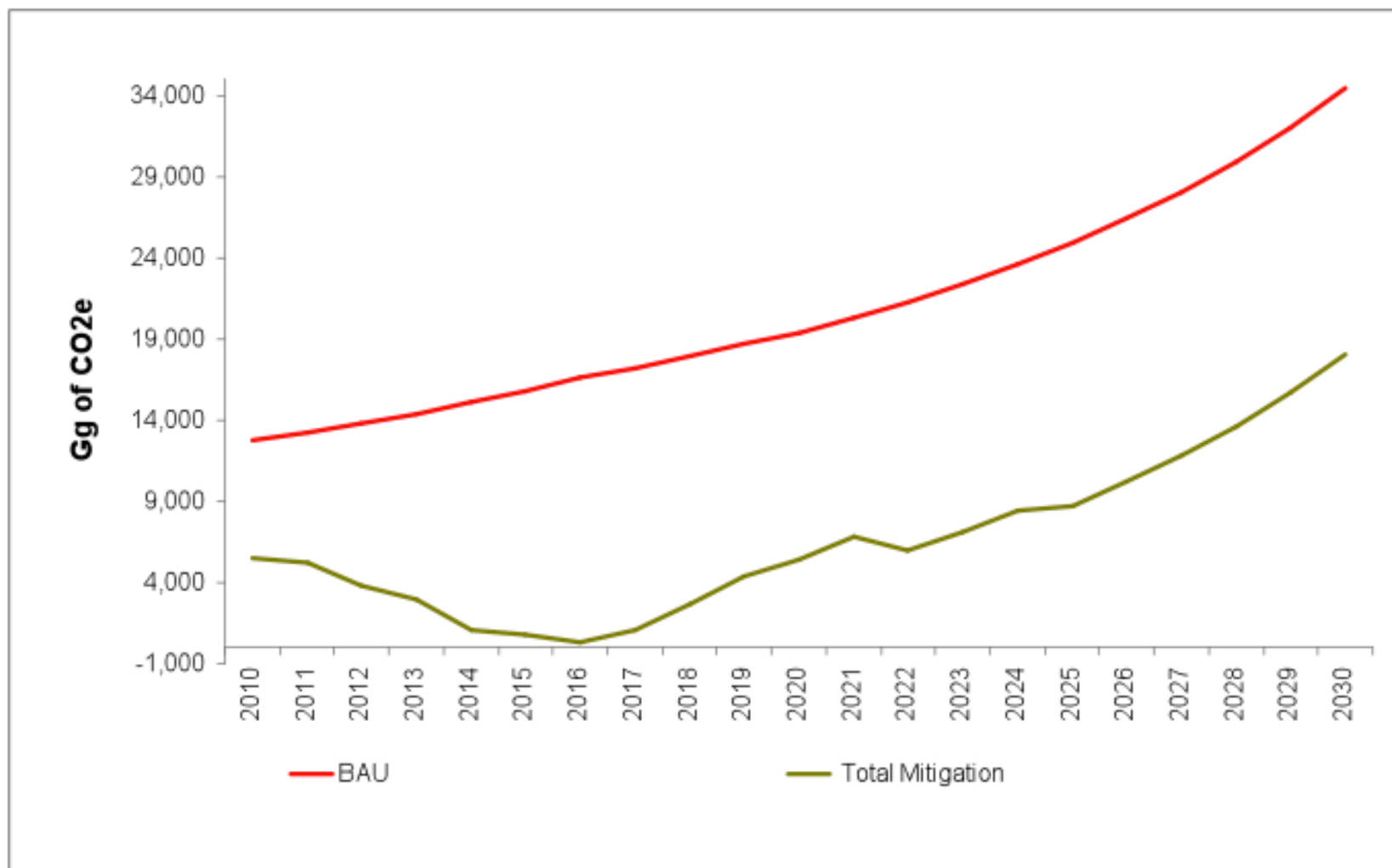
Source: Own estimation with data from ICE, DSE, MINAET, MIDEPLAN, FONAFIFO, IMN, CATIE and DIGECA (2009).

Emissions under BAU (High-Growth) Scenario and with Mitigation Measures in Energy Use and Solid Waste Management Sectors (2010-2030)



Source: Own elaboration with data and proposals of DSE, ICE, PRUGAM, MOPT, and MINAET, and own estimations.

Emissions under BAU (High-Growth) Scenario and with Total Mitigation Measures (2010-2030)



Source: Own elaboration with data and proposals of DSE, ICE, PRUGAM, MOPT, MINAET, FUNDECOR, and own estimations.

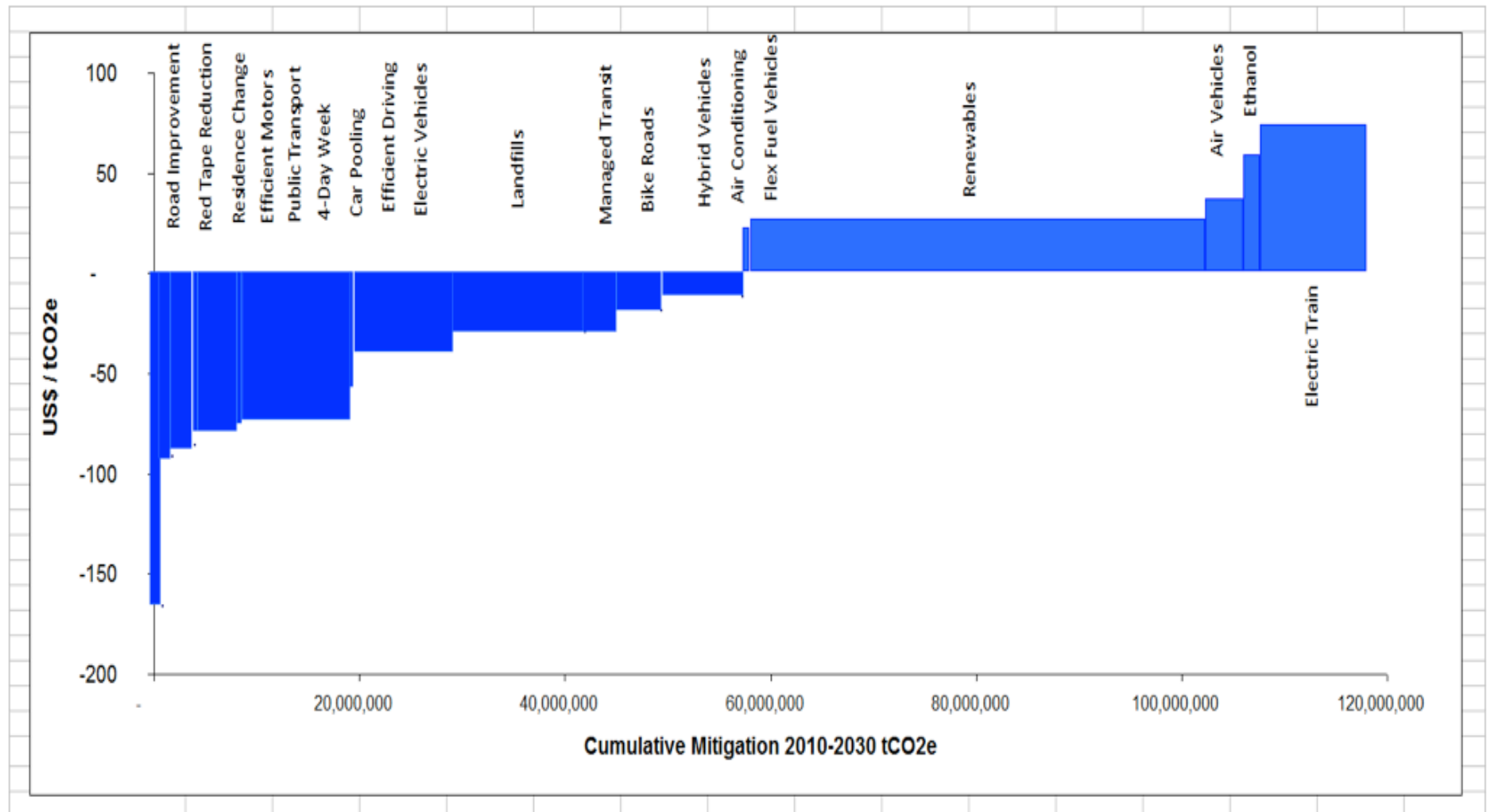
Table 17 Mitigation Options – Costs and Abatement Potential (2010-2030)

Intervention	Description	US\$ per tCO ₂ e reduced	Mitigation tCO ₂ e	Accumulated mitigation tCO ₂ e	Average annual mitigation tCO ₂ e
Low-income housing	Building of houses accessible to low-income families. Houses built with wood and materials with lower energy footprint (mainly substitutes for cement and steel)	-1,968.4	299,403	299,403	14,970.2
Education of households	Campaign to educate and create domestic energy conservation skills, promote energy efficiency and acquisition of energy efficient kitchen equipment	-832.0	230,861	530,264	11,543.0
Fluorescent light bulbs (households)	Substitution of traditional light bulbs with compact fluorescent ones in offices and factories that require more than five hours daily of artificial lighting	-819.6	80,075	610,339	4,003.7
Energy efficiency (industry)	Training in energy conservation, energy efficiency and adoption of efficient technologies and improved production standards in companies	-784.7	330,752	941,091	16,537.6
Fluorescent light bulbs (industry)	Replacement of traditional light bulbs with compact fluorescent ones in households	-705.3	15,581	956,672	779.0
Decongesting roads	Series of measures to reduce traffic congestion in metropolitan area, including infrastructural improvements, engineering solutions, and changes to public transport system	-317.1	3,685,342	4,642,014	184,267.1
PRUGAM (improvements to road infrastructure)	Implementation of five infrastructural development projects on San José ring road. Diversification of alternative routes and improved connections between commercial and residential areas	-165.9	867,111	5,509,125	43,355.6
Streamlining procedures	Substitution of conventional procedures in government institutions with digital ones	-91.2	917,666	6,426,791	45,883.3
Moving house	Urban planning and incentives to re-locate near workplace	-85.7	2,182,574	8,609,365	109,128.7
Efficient motors	Substitution of 50% of fossil fuel industrial motors with efficient technologies	-77.8	15,826	8,625,192	791.3
Public transport	Integration of public transport routes to reduce inefficiencies	-77.8	3,685,342	12,310,534	184,267.1
Four-day week	Civil servants working from home one day a week	-73.1	401,670	12,712,204	20,083.5
Car pooling	Promotion of car pooling (12% of vehicles in metropolitan area)	-72.6	10,429,920	23,142,124	521,496

Intervention	Description	US\$ per tCO ₂ e reduced	Mitigation tCO ₂ e	Accumulated mitigation tCO ₂ e	Average annual mitigation tCO ₂ e
Efficient driving	Training of truck and bus drivers in improved driving techniques and vehicle maintenance	-56.6	226,249	23,368,373	11,312.5
Electric vehicles	Use of electric vehicles (10% of total fleet)	-38.2	9,081,852	32,450,225	454,092.6
Landfills	Capture and use of methane for electricity generation in five of the main rubbish dumps	-29.2	14,126,206	46,576,431	706,310.3
Vehicle restrictions	Vehicle restrictions one day a week	-29.0	3,025,631	49,602,061	151,281.5
Cycle paths	Building of cycle paths	-18.5	4,383,263	53,985,324	219,163.1
Hybrid vehicles	Use of hybrid vehicles (10% of total fleet)	-11.4	7,921,688	61,907,012	396,084.4
Air conditioning	Use of efficient air conditioners in industry and commerce	-8.8	4,855	61,911,867	242.7
Flex-fuel vehicles	Use of flex-fuel vehicles (5% of total fleet)	19.5	452,772	62,364,639	22,638.6
ICE renewable sources expansion plan	Electricity generation from renewable sources (92%) until 2025	26.2	44,500,000	106,864,639	2,225,000
Compressed-air vehicles	Use of compressed air vehicles (15% of fleet of compact vehicles)	35.1	3,766,978	110,631,617	188,348.9
Ethanol	Mix of ethanol with fuel	57.7	1,393,907	112,025,524	69,695.3
Electric trains	Use of electric trains for transport in metropolitan area and inter-oceanic freight	73.2	10,188,960	122,214,484	509,448
Solar heaters	Use of solar heaters in industry	248.2	4,603	122,219,088	230.2
Biofuels	Bio fuel mix (15% of diesel).	819.9	266,905	122,485,993	13,345.3
Timers on water heaters	Timers on water heaters in households	1,206.3	10,046	122,496,039	502.3
Industrial boilers	Use of efficient boilers in industry	2,004.9	48,286	122,544,324	2,414.3
Forestry sector	Upkeep and improvement of national system of conservation areas. Expansion of the PES program	7.0	185,000,000	307,544,324	9,250,000
Agricultural sector	Reduction of GHGs through improved pastures, agropastoral systems, and reduced use of synthetic fertilizers and agrochemicals	25.0	8,000,000	315,544,324	400,000

Source: Own elaboration with data and proposals of DSE, ICE, PRUGAM, MOPT, MINAET, Fundecor, and own estimations.

Marginal Abatement Costs Energy, Industrial, Residential and Solid Waste Sectors



Where from here?

- Clear economic rationale
 - More efficient economy
 - Improved economic balances reducing fossil
- Political logic is different
 - Lack of public resources
 - Need for multiple ministerial engagement
- Many important changes involve land use patterns in a chaotic metro area
 - Residential patterns and transport needs
 - Inertia of urban growth
- Market forces? PMR with World Bank

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