Historical Data for 2010-2014 (NATIONAL UNIVERSITY OF COSTA RICA):

Year	SNM	CT	D	RSC	RS	PL	NEW
2010	**10**	**10**	**10**	**22**	**17**	**15**	**12**
2011	**15**	**21**	**21**	**30**	**30**	**30**	**18**
2012	**18**	**24**	**24**	**35**	**42**	**42**	**24**
2013	**30**	**30**	**30**	**48**	**48**	**48**	**30**
2014	**33**	**33**	**33**	**52**	**51**	**55**	**35**

S1.Number of Laboratories Performing Six Waste Minimization Practices (2015-2050)

Year	SNM	CT	D	RSC	RS	PL	NEW
2015	39.5	40.1	40.1	60.8	63.4	67.4	40.3
2016	45.6	45.6	45.6	68.6	72.0	77.2	45.6
2017	51.7	51.1	51.1	76.4	80.6	87.0	51.0
2018	57.8	56.6	56.6	84.2	89.2	96.8	56.3
2019	63.9	62.1	62.1	92.0	97.8	106.6	61.6
2020	70.0	67.6	67.6	99.8	106.4	116.4	66.9
2021	76.1	73.1	73.1	107.6	115.0	126.2	72.3
2022	82.2	78.6	78.6	115.4	123.6	136.0	77.6
2023	88.3	84.1	84.1	123.2	132.2	145.8	83.0

2024	94.4	89.6	89.6	131.0	140.8	155.6	88.3
2025	100.5	95.1	95.1	138.8	149.4	165.4	93.6
2026	106.6	100.6	100.6	146.6	158.0	175.2	98.9
2027	112.7	106.1	106.1	154.4	166.6	185.0	104.2
2028	118.8	111.6	111.6	162.2	175.2	194.8	109.5
2029	124.9	117.1	117.1	170.0	183.8	204.6	114.8
2030	131.0	122.6	122.6	177.8	192.4	214.4	120.1
2031	137.1	128.1	128.1	185.6	201.0	224.2	125.4
2032	143.2	133.6	133.6	193.4	209.6	234.0	130.7
2033	149.3	139.1	139.1	201.2	218.2	243.8	136.0
2034	155.4	144.6	144.6	209.0	226.8	253.6	141.3
2035	161.5	150.1	150.1	216.8	235.4	263.4	146.6
2036	167.6	155.6	155.6	224.6	244.0	273.2	151.9
2037	173.7	161.1	161.1	232.4	252.6	283.0	157.2
2038	179.8	166.6	166.6	240.2	261.2	292.8	162.5
2039	185.9	172.1	172.1	248.0	269.8	302.6	167.8
2040	192.0	177.6	177.6	255.8	278.4	312.4	173.1
2041	198.1	183.1	183.1	263.6	287.0	322.2	178.4
2042	204.2	188.6	188.6	271.4	295.6	332.0	183.7
2043	210.3	194.1	194.1	279.2	304.2	341.8	189.0

2044	216.4	199.6	199.6	287.0	312.8	351.6	194.3
2045	222.5	205.1	205.1	294.8	321.4	361.4	199.6
2046	228.6	210.6	210.6	302.6	330.0	371.2	204.9
2047	234.7	216.1	216.1	310.4	338.6	381.0	210.2
2048	240.8	221.6	221.6	318.2	347.2	390.8	215.5
2049	246.9	227.1	227.1	326.0	355.8	400.6	220.8
2050	253.0	232.6	232.6	333.8	364.4	410.4	226.1

S2.Number of Laboratories Performing Five Waste Minimization Practices (2015-2050)

Year	SNM	CT	D	RSC	RS	PL
2015	39.5	40.1	40.1	60.8	63.4	67.4
2016	45.6	45.6	45.6	68.6	72.0	77.2
2017	51.7	51.1	51.1	76.4	80.6	87.0
2018	57.8	56.6	56.6	84.2	89.2	96.8
2019	63.9	62.1	62.1	92.0	97.8	106.6
2020	70.0	67.6	67.6	99.8	106.4	116.4
2021	76.1	73.1	73.1	107.6	115.0	126.2
2022	82.2	78.6	78.6	115.4	123.6	136.0
2023	88.3	84.1	84.1	123.2	132.2	145.8
2024	94.4	89.6	89.6	131.0	140.8	155.6

2025	100.5	95.1	95.1	138.8	149.4	165.4
2026	106.6	100.6	100.6	146.6	158.0	175.2
2027	112.7	106.1	106.1	154.4	166.6	185.0
2028	118.8	111.6	111.6	162.2	175.2	194.8
2029	124.9	117.1	117.1	170.0	183.8	204.6
2030	131.0	122.6	122.6	177.8	192.4	214.4
2031	137.1	128.1	128.1	185.6	201.0	224.2
2032	143.2	133.6	133.6	193.4	209.6	234.0
2033	149.3	139.1	139.1	201.2	218.2	243.8
2034	155.4	144.6	144.6	209.0	226.8	253.6
2035	161.5	150.1	150.1	216.8	235.4	263.4
2036	167.6	155.6	155.6	224.6	244.0	273.2
2037	173.7	161.1	161.1	232.4	252.6	283.0
2038	179.8	166.6	166.6	240.2	261.2	292.8
2039	185.9	172.1	172.1	248.0	269.8	302.6
2040	192.0	177.6	177.6	255.8	278.4	312.4
2041	198.1	183.1	183.1	263.6	287.0	322.2
2042	204.2	188.6	188.6	271.4	295.6	332.0
2043	210.3	194.1	194.1	279.2	304.2	341.8
2044	216.4	199.6	199.6	287.0	312.8	351.6

2045	222.5	205.1	205.1	294.8	321.4	361.4
2046	228.6	210.6	210.6	302.6	330.0	371.2
2047	234.7	216.1	216.1	310.4	338.6	381.0
2048	240.8	221.6	221.6	318.2	347.2	390.8
2049	246.9	227.1	227.1	326.0	355.8	400.6
2050	253.0	232.6	232.6	333.8	364.4	410.4

S3.Annual Percentage Variation for Six Waste Minimization Practices (2015-2050)

Year	SNM (%)	CT (%)	D (%)	RSC (%)	RS (%)	PL (%)
2015	19.7	21.5	21.5	16.9	24.3	22.5
2016	15.4	13.7	13.7	12.8	13.6	14.5
2017	13.4	12.1	12.1	11.4	11.9	12.7
2018	11.8	10.8	10.8	10.2	10.7	11.3
2019	10.6	9.7	9.7	9.3	9.6	10.1
2020	9.5	8.9	8.9	8.5	8.8	9.2
2021	8.7	8.1	8.1	7.8	8.1	8.4
2022	8.0	7.5	7.5	7.2	7.5	7.8
2023	7.4	7.0	7.0	6.8	7.0	7.2
2024	6.9	6.5	6.5	6.3	6.5	6.7
2025	6.5	6.1	6.1	6.0	6.1	6.3

2026	6.1	5.8	5.8	5.6	5.8	5.9
2027	5.7	5.5	5.5	5.3	5.4	5.6
2028	5.4	5.2	5.2	5.1	5.2	5.3
2029	5.1	4.9	4.9	4.8	4.9	5.0
2030	4.9	4.7	4.7	4.6	4.7	4.8
2031	4.7	4.5	4.5	4.4	4.5	4.6
2032	4.4	4.3	4.3	4.2	4.3	4.4
2033	4.3	4.1	4.1	4.0	4.1	4.2
2034	4.1	4.0	4.0	3.9	3.9	4.0
2035	3.9	3.8	3.8	3.7	3.8	3.9
2036	3.8	3.7	3.7	3.6	3.7	3.7
2037	3.6	3.5	3.5	3.5	3.5	3.6
2038	3.5	3.4	3.4	3.4	3.4	3.5
2039	3.4	3.3	3.3	3.2	3.3	3.3
2040	3.3	3.2	3.2	3.1	3.2	3.2
2041	3.2	3.1	3.1	3.0	3.1	3.1
2042	3.1	3.0	3.0	3.0	3.0	3.0
2043	3.0	2.9	2.9	2.9	2.9	3.0
2044	2.9	2.8	2.8	2.8	2.8	2.9
2045	2.8	2.8	2.8	2.7	2.7	2.8

2046	2.7	2.7	2.7	2.6	2.7	2.7
2047	2.7	2.6	2.6	2.6	2.6	2.6
2048	2.6	2.5	2.5	2.5	2.5	2.6
2049	2.5	2.5	2.5	2.5	2.5	2.5
2050	2.5	2.4	2.4	2.4	2.4	2.4

S4.Annual Percentage Variation for Five Waste Minimization Practices (2015-2050)

Year	SNM (%)	CT (%)	D (%)	RSC (%)	RS (%)	PL (%)
2016	**15.44**	**13.88**	**13.88**	**12.86**	**13.49**	**14.56**
2017	**13.38**	**11.95**	**11.95**	**11.31**	**11.86**	**12.48**
2018	**11.67**	**10.74**	**10.74**	**10.21**	**10.66**	**11.25**
2019	**10.57**	**9.63**	**9.63**	**8.71**	**8.83**	**10.02**
2020	**9.67**	**8.85**	**8.85**	**8.54**	**8.79**	**9.17**
2021	**8.78**	**8.06**	**8.06**	**7.84**	**7.99**	**8.55**
2022	**8.12**	**7.61**	**7.61**	**7.23**	**7.52**	**7.74**
2023	**7.56**	**7.01**	**7.01**	**6.82**	**6.93**	**6.88**
2024	**6.60**	**6.64**	**6.64**	**6.45**	**6.60**	**6.71**
2025	**6.37**	**5.99**	**5.99**	**5.82**	**5.91**	**5.94**
2026	**5.87**	**5.70**	**5.70**	**5.58**	**5.77**	**5.77**
2027	**5.70**	**5.27**	**5.27**	**5.23**	**5.08**	**5.51**

2028	**5.39**	**5.23**	**5.23**	**5.17**	**5.16**	**5.35**
2029	**5.22**	**5.00**	**5.00**	**4.74**	**4.83**	**5.18**
2030	**5.38**	**4.77**	**4.77**	**4.45**	**4.85**	**5.11**
2031	**5.22**	**4.69**	**4.69**	**4.44**	**4.61**	**4.76**
2032	**5.21**	**4.49**	**4.49**	**4.29**	**4.48**	**4.47**
2033	**5.13**	**4.48**	**4.48**	**4.27**	**4.25**	**4.09**
2034	**5.42**	**4.52**	**4.52**	**4.16**	**4.27**	**3.72**
2035	**5.00**	**4.55**	**4.55**	**4.10**	**3.75**	**3.58**
2036	**5.24**	**4.59**	**4.59**	**3.82**	**3.57**	**3.32**
2037	**4.86**	**4.64**	**4.64**	**3.98**	**3.37**	**3.09**
2038	**4.53**	**4.69**	**4.69**	**3.65**	**3.21**	**2.95**
2039	**4.62**	**4.55**	**4.55**	**3.52**	**3.15**	**2.90**
2040	**4.47**	**4.53**	**4.53**	**3.58**	**3.07**	**2.86**
2041	**4.44**	**4.41**	**4.41**	**3.61**	**2.95**	**2.76**
2042	**4.46**	**4.31**	**4.31**	**3.63**	**2.92**	**2.71**
2043	**4.30**	**4.27**	**4.27**	**3.62**	**2.84**	**2.68**
2044	**4.29**	**4.18**	**4.18**	**3.55**	**2.77**	**2.68**
2045	**4.24**	**4.14**	**4.14**	**3.50**	**2.72**	**2.62**
2046	**4.25**	**4.10**	**4.10**	**3.48**	**2.69**	**2.60**
2047	**4.23**	**4.09**	**4.09**	**3.48**	**2.67**	**2.60**

2048	**4.09**	**4.05**	**4.05**	**3.44**	**2.63**	**2.58**
2049	**4.01**	**4.02**	**4.02**	**3.37**	**2.57**	**2.56**
2050	**3.95**	**4.02**	**4.02**	**3.35**	**2.53**	**2.53**

S6: Waste Management Innovation Index Table

Country	Technological Advancements	Policy Innovation	Public Engagement	Infrastructure Development	Sustainability Impact	Overall Index Score
Germany	High: Advanced WtE facilities, extensive recycling technologies.	High: Strong regulations, Pfand system for containers, Green Dot system.	High: High public involvement, effective waste separation practices ingrained in daily life.	High: Comprehensive infrastructure for recycling, WtE, and landfill management.	High: Leading sustainability outcomes, significant reduction in landfill use, high recycling rate (67%).	9/10
United States	Moderate: Variability in technological adoption across states, limited WtE use.	Moderate: Mixed policy landscape with strong state-level variations, EPR in some areas.	Moderate: Public engagement varies significantly by region, with strong recycling culture in some states and weak participation in others.	Moderate: Developed infrastructure, but significant state-level disparities in recycling and waste management capabilities.	Moderate: Mixed sustainability outcomes due to high landfill dependency and uneven adoption of advanced practices, recycling rate of 21%.	6/10

Japan	High: Advanced waste sorting and incineration technologies, focus on reducing landfill use.	High: Robust policy frameworks, 3R (Reduce, Reuse, Recycle) initiative, strict waste separation laws.	High: Strong cultural norms around meticulous waste sorting, high public participation in recycling.	Moderate: Strong incineration infrastructure, but limited space for landfills and recycling facilities.	Moderate: High incineration rates with some sustainability concerns, but effective waste management with a recycling rate of 19.6%.	8/10
Brazil	Low: Limited adoption of advanced technologies, reliance on informal sector for recycling.	Low: Weak policy enforcement, limited formal infrastructure, heavy reliance on informal waste pickers.	Low: Low public engagement, with most recycling driven by the informal sector, and limited government-led initiatives.	Low: Inadequate infrastructure, especially in rural areas, leading to significant environmental issues like open dumps.	Low: Poor sustainability outcomes with a recycling rate of 4%, significant challenges in waste management and environmental health.	3/10
South Korea	High: Advanced waste sorting systems, extensive use of WtE technologies.	High: Strong policy support, pay-as-you-throw (PAYT) system, rigorous enforcement of recycling regulations.	High: High public involvement, strong cultural norms around waste reduction and recycling.	High: Well-developed infrastructure with a focus on minimizing landfill use, comprehensive recycling facilities.	High: Significant sustainability outcomes, high recycling rate of 69%, and reduced landfill dependency.	9/10
Sweden	High: High integration of WtE technologies, focus on reducing landfill use to near zero.	High: Progressive policies encouraging recycling, strong enforcement of environmental regulations.	High: Strong public engagement, with a cultural focus on sustainability and recycling as a norm.	High: Advanced infrastructure with extensive WtE facilities and well-established recycling systems.	High: Exceptional sustainability outcomes, recycling rate of 50%, minimal landfill use, and significant contributions to renewable energy.	9/10

Costa Rica	Low: Emerging composting and recycling initiatives, minimal adoption of WtE technologies.	Moderate: Strong legal framework with the Law for Integrated Waste Management, but challenges in enforcement and practical implementation .	Moderate: Growing public awareness and participation in recycling efforts, but infrastructure limitations hinder effectiveness.	Low: Inadequate infrastructure, with 93% of waste ending up in landfills, and limited selective collection programs.	Low: Recent efforts like the National Plan for Integrated Waste Management show potential, but effectiveness is yet to be seen; recycling rate at 7%.	4/10

References: Germany: Federal Ministry for the Environment, Nature Conservation, Nuclear Safety, and Consumer Protection (BMUV). (2023). *Waste management in Germany 2023: Facts, data, figures*. BMUV. Retrieved from BMUV website.

Eighmy, T. T., & Kosson, D. S. (1996). *U.S.A. National overview on waste management*. Waste Management, 16(5-6), 361-366. https://doi.org/10.1016/S0956-053X(96)00080-3

Lino, F. A. M., Ismail, K. A. R., & Castañeda-Ayarza, J. A. (2023). *Municipal solid waste treatment in Brazil: A comprehensive review*. Energy Nexus, 11, 100232. https://doi.org/10.1016/j.nexus.2023.100232

Kwon, Y., Lee, S., Bae, J., Park, S., Moon, H., Lee, T., Kim, K., Kang, J., & Jeon, T. (2024). *Evaluation of incinerator performance and policy framework for effective waste management and energy recovery: A case study of South Korea*. Sustainability, 16(1), 448. https://doi.org/10.3390/su16010448

Sandhi, A., & Rosenlund, J. (2024). *Municipal solid waste management in Scandinavia and key factors for improved waste segregation: A review*. Cleaner Waste Systems, 8, 100144. https://doi.org/10.1016/j.clwas.2024.100144

Arias. (2024). **Challenges and opportunities in waste management: Perspectives from Costa Rica for the world recycling day**. Arias Knowledge Center. Retrieved from https://ariasknowledgecenter.com

ESTADO DE LA NACION

S7:Generación de Gases con efecto invernadero asociados al sector residuos sólidos
(Miles de Toneladas CO2 e)

Año	Rellenos Sanitarios	Reciclaje

2010	**1.195,3**	**-17,5**
2011	**1.209,6**	**-17,7**
2012	**1.224,1**	**-17,9**
2013	**1.238,9**	**-18,1**
2014	**1.253,8**	**-18,4**
2015	**1.268,8**	**-18,6**
2016	**1.284,1**	**-18,8**
2017	**1.299,5**	**-19,0**
2018	**1.315,0**	**-19,2**
2019	**1.330,6**	**-19,4**
2020	**1.346,2**	**-19,6**
2021	**1.361,8**	**-19,8**
2022	**1.377,4**	**-20,0**
2023	**1.393,0**	**-20,2**
2024	**1.408,7**	**-20,4**
2025	**1.424,3**	**-20,6**
2026	**1.440,0**	**-20,8**
2027	**1.455,7**	**-21,0**
2028	**1.471,4**	**-21,2**
2029	**1.487,0**	**-21,4**

2030	**1.502,7**	**-21,6**

CONTINUES…

S8:Linear Regression Forecast (2031-2050)

Year	Prediction (Thousand Tonnes CO2e)
2031	**-21.80**
2032	**-22.00**
2033	**-22.20**
2034	**-22.40**
2035	**-22.60**
2036	**-22.80**
2037	**-23.00**
2038	**-23.20**
2039	**-23.40**

2040	**-23.60**
2041	**-23.80**
2042	**-24.00**
2043	**-24.20**
2044	**-24.40**
2045	**-24.60**
2046	**-24.80**
2047	**-25.00**
2048	**-25.20**
2049	**-25.40**
2050	**-25.60**

S9:ARIMA Forecast (2031-2050)

Year	ARIMA Forecast (Thousand Tonnes CO2e)	Lo 95 (Thousand Tonnes CO2e)	Hi 95 (Thousand Tonnes CO2e)
2031	**-21.80**	**-21.90**	**-21.70**
2032	**-22.00**	**-22.20**	**-21.80**
2033	**-22.20**	**-22.50**	**-21.90**
2034	**-22.40**	**-22.80**	**-22.00**
2035	**-22.60**	**-23.10**	**-22.10**

2036	**-22.80**	**-23.40**	**-22.20**
2037	**-23.00**	**-23.70**	**-22.30**
2038	**-23.20**	**-24.00**	**-22.40**
2039	**-23.40**	**-24.30**	**-22.50**
2040	**-23.60**	**-24.60**	**-22.60**
2041	**-23.80**	**-24.90**	**-22.70**
2042	**-24.00**	**-25.20**	**-22.80**
2043	**-24.20**	**-25.50**	**-22.90**
2044	**-24.40**	**-25.80**	**-23.00**
2045	**-24.60**	**-26.10**	**-23.10**
2046	**-24.80**	**-26.40**	**-23.20**
2047	**-25.00**	**-26.70**	**-23.30**
2048	**-25.20**	**-27.00**	**-23.40**
2049	**-25.40**	**-27.30**	**-23.50**
2050	**-25.60**	**-27.60**	**-23.60**

S10:Projected Remaining Waste (Million Tonnes) Under Different Scenarios (2021-2050)

Year	Baseline (Mt)	Extreme Recycling (Mt)	Extreme WtE (Mt)	Extreme Combined (Mt)
2030	**1.24**	**1.37**	**0.62**	**0.69**
2040	**1.44**	**1.59**	**0.72**	**0.80**

2050	**1.67**	**1.85**	**0.84**	**0.92**