



# Sustainability in Action

Task Force on Climate-related  
Financial Disclosures  
**2021 TCFD Report**



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# About this Report

In this document, Republic Services has reported in accordance with the TCFD recommendations for the period January 1, 2021 through December 31, 2021. Although we report in accordance with the TCFD recommendations, in many cases we provide disclosures and context that go beyond TCFD recommendations to share additional insights into our sustainability performance. This TCFD Report should be consulted alongside our other sustainability and ESG reporting, such as GRI and SASB, available at [RepublicServices.com/Sustainability](https://RepublicServices.com/Sustainability). We invite you to share your thoughts with us at [Sustainability@RepublicServices.com](mailto:Sustainability@RepublicServices.com).

Unless otherwise stated, all references in this 2021 TCFD Report to “Republic,” “the Company,” “we,” “us” and “our” refer to Republic Services, Inc. and its consolidated subsidiaries. Coverage of the Company’s publicly available economic, governance, environmental and social indicators is consolidated for all of our business operations where data is available, unless otherwise noted.

## Disclosure Regarding Forward-Looking Statements

This report contains certain forward-looking information about us that is intended to be covered by the safe harbor for “forward-looking statements” provided by the Private Securities Litigation Reform Act of 1995. Forward-looking statements are statements that are not historical facts. Words such as “guidance,” “expect,” “will,” “may,” “anticipate,” “plan,” “estimate,” “project,” “intend,” “should,” “can,” “likely,” “could,” “outlook” and similar expressions are intended to identify forward-looking statements. These statements include information about our sustainability targets, goals and programs in addition to our plans, strategies, expectations of future financial performance and prospects. Forward-looking statements are not guarantees of performance. You should not place undue reliance on any forward-looking statement. These statements are based upon the current beliefs and expectations of our management and are subject to significant risk and uncertainties that could cause actual results to differ materially from those expressed in, or implied or projected by, the forward-looking information and statements. Although we believe that the expectations reflected in the forward-looking statements are reasonable, we cannot assure you that the expectations will prove to be correct. The inclusion of information in this report should not be construed as a characterization regarding the materiality or financial impact of that information. More information on factors that could cause actual results or events to differ materially from those anticipated is included from time to time in our reports filed with the Securities and Exchange Commission, including our Annual Report on Form 10-K (“2021 10-K” or “10-K”) for the year ended December 31, 2021, particularly under Part I, Item 1A – Risk Factors, and in our Quarterly Reports on Form 10-Q. Additionally, new risk factors emerge from time to time and it is not possible for us to predict all such risk factors, or to assess the impact such risk factors might have on our business or sustainability programs and goals. We undertake no obligation to update publicly any forward-looking statements, whether as a result of new information, future events or otherwise, except as required by law.

# Executive Summary

Republic Services has long been a leader in environmental services and sustainability, with an ongoing commitment to transparency and disclosure. We recognize that continued emission of greenhouse gases will cause further warming of the planet, and that warming will have economic and social consequences. Climate-related risks and opportunities are shaping key aspects of our industry today and have even greater potential to do so in the future. We respect our stakeholders' interest in our continued assessment and management of these topics, which is why we're releasing our second annual report following the recommendations of the Task Force for Climate-related Financial Disclosures (TCFD).

Through multiple materiality assessments over the last eight years, we have developed three Climate Leadership goals that hold us accountable to making progress on the topics that matter most to our stakeholders. These goals, Science Based Target (GHG Reduction), Circularity and Renewable Energy, not only demonstrate our understanding of our risks and opportunities but our commitment to partnering with customers to create a more sustainable world. Through landfill and fleet innovations, renewable energy production and innovative recycling technology, we help our customers meet their sustainability goals.

“ It's imperative for us to reduce emissions and achieve greater circularity with the materials we handle for our customers to help preserve the environment now and for future generations.”

Jon Vander Ark, President and Chief Executive Officer



**CLIMATE  
LEADERSHIP**

## Science Based Target **35%**

Reduce absolute Scope 1 and 2 greenhouse gas emissions 35% by 2030 (2017 baseline year)

Approved by SBTi

**Interim target:**  
10% reduction by 2025

## Circular Economy **40%**

Increase recovery and circularity of key materials by 40% on a combined basis by 2030 (2017 baseline year)

## Renewable Energy **50%**

Increase beneficial reuse of biogas by 50% by 2030 (2017 baseline year)

# Key Points

## **Governance:** Disclose the organization's governance around climate-related risks and opportunities.

The Board receives quarterly updates from the Sustainability & Corporate Responsibility Committee of the Board. The Board, either through the Sustainability Committee or directly, oversees the enterprise risk management (ERM) program and Sustainability programs with respect to business resiliency, strategy and long-term value creation.

The ERM Council provides governance over the ERM program with overseeing program effectiveness and monitoring key enterprise risks and opportunities and their associated mitigation plans. The Council includes select executives and was established to support the strategic plan and objectives of the Company.

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## **Strategy:** Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material.

We identify several climate-related risks and opportunities in this report, with a deeper assessment of the following risks and opportunities:

- Transition, Policy & Legal: Price on carbon
- Physical, Chronic: Temperature change
- Physical, Chronic: Precipitation change
- Opportunity: Products & Services: Recycling and Organics
- Opportunity: Products & Services: Low-carbon fleet
- Opportunity: Products & Services: Community cleanup

These risks and opportunities have the potential to impact business decisions like resource and capital allocation. They also shape the company strategy, influencing our market position, operating model, and people and talent agenda.

To assess the resiliency of our business to risks, Republic analyzed both physical and transition risks across multiple scenarios and time horizons. We modeled the risk of carbon pricing using IEA World Energy Outlook data over short-term and medium- to long-term time horizons. The chronic physical risks were assessed across four future climate scenarios over a long-term time horizon.

## **Risk-Management:** Disclose how the organization identifies, assesses, and manages climate-related risks.

Climate-related risks are identified via business processes, such as interactions with our network of stakeholders, business unit operating reviews, and megatrend strategy sessions. These findings are then integrated into the ERM process for assessment and prioritization.

Our ERM team populates an ERM matrix with risks and opportunities from a variety of business impacts, including climate-related impacts. Climate-related risks and opportunities are assessed by the ERM team alongside other enterprise risks based on their impact to the strategy and organization. Once assessed, the ERM team determines the appropriate management approach, and a functional leader/owner is assigned. The functional leader is then responsible for reporting out on progress for the established mitigation plan.

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## **Metrics and Targets:** Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.

The transition risks highlighted in this report are assessed using our greenhouse gas emissions. Metrics used for assessing physical climate-related risks in this report include impact on employee safety, brand and reputation, and labor effectiveness. Opportunities are generally assessed using a traditional internal rate of return model.

Scope 1 – 3 greenhouse gas emissions can be found in [Exhibit M2](#) and in [GRI 305-1 through 305-3](#). We report our progress against our sustainability goals in our annual Sustainability Report. Our suite of sustainability reporting may be found at [RepublicServices.com/Sustainability](https://RepublicServices.com/Sustainability).

# Governance

*Disclose the organization's governance around climate-related risks and opportunities.*

## **A) Board's oversight of climate-related risks and opportunities.**

Our Board is directly involved in the oversight of Republic's sustainability initiatives and conducts a comprehensive review of the Company's sustainability performance on an annual basis. We believe the Board's role is to ensure that:

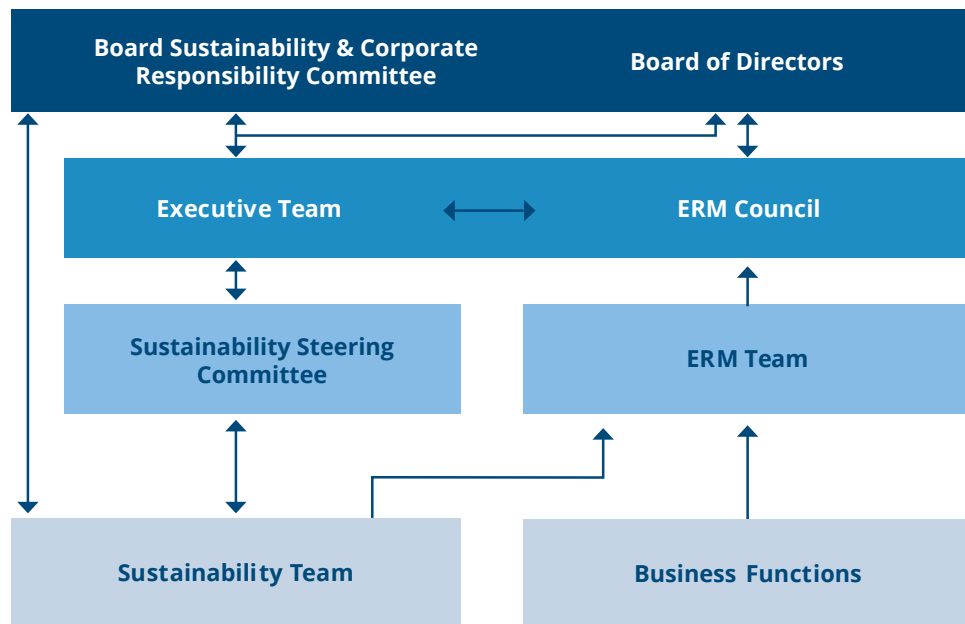
- The risk management processes designed and implemented by leadership are adapted to the overall corporate strategy, and those processes are functioning effectively.
- Management regularly communicates material risks to the Board or the appropriate Board committee.
- Actions are being taken to continue to foster a strong culture of compliance and risk-adjusted decision-making throughout the organization.
- The budget they approve reflects the strategy, for example, allocations to advancing the measurement of landfill greenhouse gas emissions, recycling infrastructure and electrification of our fleet.
- The executive compensation plans they approve incorporate the performance of our strategic initiatives and sustainability efforts, such as goals within our Climate Leadership element.

The Sustainability & Corporate Responsibility Committee of the Board was created in 2015 due to the depth of our initiatives, the unique nature of climate-related risks and opportunities, the complexity in quantifying impact, and our strong commitment to corporate responsibility. The Committee meets quarterly to receive reports from management on topics such as:

- Our sustainability strategy and progress toward our sustainability goals, including our Climate Leadership goals addressing greenhouse gas emissions, and low-carbon services in the form of renewable energy and circularity of key materials.
- Management and progress on social topics, including those that impact the Company's ability to meet goals related to climate change. An example is recycling education, which helps improve the durability of recycling.

The Board oversees our ERM program and receives updates from management on the results of the program, which includes assessment, prioritization and management of risks and opportunities, including those related to climate issues.

### Exhibit G1: Sustainability risk governance & management structure



- Oversee ERM and ESG Program and goals
  - Assess risks with respect to business resiliency, strategy and long-term value creation
  - Provide output to full board, as appropriate
- 
- Manage risk mitigation plans by function
  - Ensure ESG performance, which is incorporated into compensation goals
- 
- Govern ERM Program
  - Assess and monitor risks
  - Identify, define and prioritize risks and opportunities
  - Assign risk owners and oversee mitigation plans
  - Disclose ESG risk mitigation plans
- 
- Identify traditional and ESG risks and opportunities

### Exhibit G2: Board Oversight

Group	Overview
Board of Directors	The Board is actively involved in risk oversight, receiving regular reports from the Sustainability & Corporate Responsibility Committee as well as other Board committees and management on matters pertaining to risk oversight. The Board approves the annual budget, which includes funding for the Company's sustainability agenda and climate-related activities.
Sustainability & Corporate Responsibility Committee	The Committee fulfills certain aspects of the Board's oversight responsibility and advises Company management with respect to significant issues, strategic goals, objectives, policies and practices regarding Republic's sustainability risks and opportunities, including those related to climate change.



## B) Management’s role in assessing and managing climate-related risks and opportunities.

The ERM Council provides governance over the ERM program, overseeing program effectiveness and monitoring key enterprise risks and the associated mitigation plans. The ERM Council is staffed by members of our executive leadership team, including the Chief Legal Officer, Chief Operating Officer, Chief Development Officer, Chief Financial Officer, Chief Marketing Officer, Chief Human Resources Officer and the Chief Commercial Officer. The Council was established to support the strategic plan and objectives of the Company through the governance and oversight of enterprise risks and opportunities.

The ERM Team consists of key business leaders representing multiple functions including Engineering, Environmental Compliance, Finance Support, Operations Support and so on. These functional representatives provide risks and opportunities that are then aggregated, assessed and prioritized based on their impact to the strategy/organization. Outcomes of the ERM process, as described in the [Risk Management](#) section of this report and depicted in [Exhibit G1](#), are provided to the Executive Team. This process informs strategy development and ensures the resilience of our strategy, contributing to long-term value creation aligned with business objectives.

### Exhibit G3: Management Oversight

Group	Overview
Executive Team	Republic’s executive leadership team integrates ERM results, including climate-related topics, into strategic planning; reports findings of the ERM process to the Board; and manages risks and mitigation plans within each function.
ERM Council	Made up of select executives, the ERM Council monitors ERM program effectiveness, key climate-related risks and associated mitigation plans.
ERM Team	A cross-functional team made up of managers and executives leads the ERM process. This team identifies and defines emerging risks, assigns risk owners, tracks risk-mitigation activities and reports to the ERM Council. Climate-related risks and opportunities are managed via the ERM process.
Sustainability Steering Committee	A cross-functional team made up of select executives and functional leaders that provides strategic oversight and guidance to the Sustainability Team.
Sustainability Team	A functional team that develops business-wide sustainability strategy, including risk/opportunity identification, and manages environmental, social and governance reporting.

# Strategy

Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material.

## A) Describe the climate-related risks and opportunities the organization has identified over the short-, medium-, and long-term.

Below is a sample of risks and opportunities we've identified via the rigorous processes described in [Risk Management](#). Republic examined the following risks across short (0 – 5 years), medium (5 – 10 years), and long-term (10 – 40 years) horizons. More information on our various risks and opportunities can be found in our [2021 10-K](#) and our [FY2021 CDP Response](#).

### Risks

- **Transition, Policy & Legal: Price on carbon** (medium to long-term, see further discussion in [Strategy](#) and page 22 – 23 of 10-K)
- Transition, Policy & Legal: Permitting landfill expansion (short-term, see page 20 – 21 of 10-K)
- Transition, Technology: Costs associated with emerging recycling technologies (medium-term, see page 26 of 10-K)
- Transition, Market: Reduced revenue from landfill diversion (long-term, see page 21 of 10-K)
- Transition, Reputation: Inability to achieve sustainability goals (medium-term, see page 22 of 10-K)
- Physical, Acute: Storms, hurricanes, wildfires, floods (short-term, see further discussion in [Strategy](#) and page 20 of 10-K)
- **Physical, Chronic: Temperature change, Precipitation change**, sea level rise, chronic heat waves (long-term, see further discussion in [Strategy](#) and page 20 of 10-K)

### Opportunities

- Resource Efficiency: Landfill bioremediation (short- to medium-term)
- Energy Source: On-site solar (short-term)
- Energy Source: Landfill gas to energy (short-term, see more below)
- **Products & Services: Recycling and Organics** (short-term, see more throughout [Strategy](#))
- **Products & Services: Low-carbon fleet** (short to medium-term, see more throughout [Strategy](#))
- **Products & Services: Community cleanup** (short-term, see more throughout [Strategy](#))
- Markets: Environmental solutions (short-term)
- Markets: Mechanical recycling (short to medium-term)
- Resilience: Fleet electrification (medium-term)

In an effort to continue to build our transparency and accountability, we identified the seven risks and opportunities in bold above as being significantly of interest and therefore have described our analysis and their impacts in more detail throughout this report.

## Transition Risk: Policy and Legal: Price on Carbon

Policy and Legal risks stemming from pricing of GHG emissions (aka carbon tax) have the potential to be financially significant to our business and the potential to be enacted in more states within the U.S. The majority of our emissions come from our customers' waste decomposing in our landfills and from the tailpipes of our fleet. Many of our customers, including municipalities, are concerned about greenhouse gas emissions especially those from large, heavy-duty truck fleets, and some have responded with regulations and/or ordinances. In addition to setting a science-based target to keep us on track to reducing our GHG emissions, Republic has responded by heavily investing in landfill gas-to-energy systems, with an expected 116 projects by the end of 2027, and by pursuing a low carbon fleet with renewable natural gas (RNG) and electric vehicles. [Exhibit S1](#) describes the risk's impact and our associated goal.

### Exhibit S1: Overview of Transition Risk: Price on Carbon

Risk Type	Risk	Potential Financial Impact	Impact			Associated Metric
			Time Horizon			
			0 – 5 yrs	5 – 10 yrs	10 – 40+ yrs	
Transition: Policy and Legal	Fleet Fuel Emissions	Increased operating costs due to increased pricing of GHG emissions (carbon tax)	Medium	High	High	1. Science Based Target initiative (SBTi) approved goal to reduce fleet fuel emissions by 35% by 2030 (2017 baseline year) through: <ul style="list-style-type: none"> <li>• Renewable natural gas</li> <li>• Electric vehicles</li> </ul>
	Landfill Emissions	Increased operating costs due to increased pricing of GHG emissions (carbon tax)	Low	Medium	Medium	1. SBTi-approved goal to reduce landfill emissions by 35% by 2030 (2017 baseline year) through: <ul style="list-style-type: none"> <li>• Maximizing biogas collection (Goal)</li> <li>• Improving landfill diversion via recycling (Goal)</li> </ul>

## Physical Risks: Chronic

In 2022 Republic is focusing on analyzing chronic changing temperature and precipitation patterns to build an understanding of our exposure to physical climate risks. This analysis allows the Company to identify key locations that may need additional investment in adaptation and mitigation strategies and resources to support resiliency to climate change.

To evaluate the potential implications of future climate change on our business, changing temperature and precipitation were modeled under four Intergovernmental Panel on Climate Change (IPCC) scenarios – the Representative Concentration Pathways (RCP) 2.6 (< 2°C), 4.5 (Lower end of a 2°C – 4°C world), 6.0 (Upper end of a 2°C – 4°C world) and 8.5 (> 4°C) in the 2040 – 2059 future climactic period. To read about the RCP analysis, see [Analysis](#). An overview of these risks' impacts and associated metrics are described below, in [Exhibit S2](#).

### Exhibit S2: Overview of Physical Chronic Risk: Changes in Precipitation and Rising temperatures

Risk Type	Risk	Potential Financial Impact	Impact	Associated Metric
			Time Horizon	
Physical: Chronic Events	Changes in Precipitation	Increased environmental regulations/ taxes around leachate from landfills, business interruption (inability to access service routes), damage to open air facilities, investments needed to build resilience	10+ years	Risks: <ul style="list-style-type: none"> <li>• Leachate cost (\$s) per inch of precipitation</li> <li>• Building repair (\$s) per square foot</li> </ul> Opportunities: <ul style="list-style-type: none"> <li>• Additional revenue and service opportunities from disaster cleanup</li> </ul>
	Rising Temperatures	Business interruption (employees unable to work during extreme heat conditions), impact on productivity (\$/pickup), investment needed to provide additional training and safety measures	10+ years	Risks: <ul style="list-style-type: none"> <li>• # of heat-related incidents or injuries</li> <li>• % of employees trained on '101 Days of Summer' safety program</li> </ul> Opportunities: <ul style="list-style-type: none"> <li>• Leverage existing trainings to build on employee safety education and trainings (enhancing resilience to heat stress and other health conditions)</li> </ul>

## Opportunities: Products and Services & Energy Source

To adapt to the transition to a low carbon economy, our customers will need to embrace and develop innovative solutions to address emerging issues and rising challenges, in particular those related to recycling and waste. Due to the nature of Republic's business, there is a key opportunity for Republic to contribute to products and services to support this transition through our low-carbon fleet, recycling and organics service, and community cleanup. See [Exhibit S3](#) for more details about these opportunities.

### Exhibit S3: Overview of Opportunities

Opportunity Type	Opportunity	Potential Financial Impact	Impact			Associated Metric
			Time Horizon			
			0 – 5 yrs	5 – 10 yrs	10 – 40+ yrs	
Products and Services & Energy Source	Low-carbon Fleet	Increased revenue serving customers that value a low-emissions offering. Reduced operating costs through lower total vehicle cost of ownership.	Low	Medium	High	<ul style="list-style-type: none"> <li>• SBTi goal: impacted by GHG emissions from fleet</li> <li>• % of fleet using renewable fuels (21% in 2021)</li> <li>• Vehicle total cost of ownership</li> <li>• Revenue (not easily correlated)</li> </ul>
Products and Services	Recycling & Organics Service	Increased revenue serving customers that value recycling and organics as a low-emissions offering.	High	High	High	<ul style="list-style-type: none"> <li>• Circular Economy goal: tons of key materials recovered</li> <li>• Revenue from recycling and organics collection (not separately tracked at present)</li> <li>• Revenue from recycling and organics processing</li> <li>• Revenue from tons sold</li> </ul>
Products and Services	Community Cleanup	Increased revenue serving customers and communities that need climate-related cleanup services.	Medium	High	High	<ul style="list-style-type: none"> <li>• Temporary industrial collection revenue</li> <li>• Associated disposal revenue</li> </ul>

## B) Impact of climate-related risks and opportunities on the organization's businesses, strategy and financial planning.

### Exhibit S4: Overview of Impact

Risk/Opportunity	Potential Impact On:		
	Businesses	Company Strategy	Financial Planning
<b>RISKS</b>			
Transition: Policy and Legal			
Price on Carbon: Fleet Fuel Emissions	<p>With over 16,000 collection vehicles, potential for increased operating costs due to increased pricing of GHG emissions (carbon tax).</p> <p>See <a href="#">Metrics &amp; Targets</a> for 2021 fleet emissions.</p>	<p>The potential for a price on fleet emissions has impacted our strategy by shifting our focus to electric fleet technology. This is a critical step toward reducing our environmental impact through lower fleet emissions, and we believe it will also improve our total cost of ownership while providing a competitive advantage in certain communities, see more on our Operating Model on page 5 of 10-K.</p> <p><i>Associated Sustainability Goal: Science Based Target (GHG Reduction)</i></p>	<ul style="list-style-type: none"> <li>• Capital planning for replacement vehicles and fueling infrastructure</li> <li>• Partnering with manufacturers of electric vehicle technology</li> <li>• Use of renewable fuel credits</li> </ul>
Price on Carbon: Landfill Emissions	<p>With 198 active landfills, potential for increased operating costs due to increased pricing of GHG emissions (carbon tax).</p> <p>See <a href="#">Metrics &amp; Targets</a> for 2021 landfill emissions.</p>	<p>The potential for a price on landfill emissions has impacted our strategy in several ways, namely, to reduce fugitive emissions by maximizing the amount of biogas captured and, in many cases, beneficially reused. We are rapidly expanding our landfill gas-to-energy projects through strategic partnerships under our Market Position element on page 2 of the 10-K.</p> <p><i>Associated Sustainability Goal: Science Based Target (GHG Reduction) and Renewable Energy</i></p>	<ul style="list-style-type: none"> <li>• Capital planning to ensure appropriate biogas collection and conversion systems (or partnerships) are in place</li> <li>• Operating expenses to fund daily, intermediate and final cover</li> </ul>

## Exhibit S4: Overview of Impact (Continued)

Risk/Opportunity	Potential Impact On:		
	Businesses	Company Strategy	Financial Planning
<b>RISKS</b>			
Physical: Chronic Events			
Changes in Precipitation	<ul style="list-style-type: none"> <li>Increased leachate at landfills</li> <li>Infrastructure damage, inability to access customers</li> <li>Damage to our facilities, esp. those near coast or rivers</li> <li>Damage to commodities to be sold, e.g., recycling material and compost</li> </ul>	<p>Damage to our facilities and delays in servicing customers impacts our ability to grow and operate safely, both are key aspects of our Market Position and Operating Model foundational elements, see more on page 2 of our 10-K.</p> <p><i>Associated Sustainability Goal: All our Climate Leadership goals are designed to combat climate change.</i></p>	<ul style="list-style-type: none"> <li>Using current data on leachate generation per inch of precipitation to quantify               <ul style="list-style-type: none"> <li>Capital required for leachate pre-treatment and/or additional third party processing</li> <li>Impacts from possible fines or violations</li> </ul> </li> <li>Estimating capital required to upgrade stormwater infrastructure</li> <li>Estimating expense for additional sorting and separation of damaged recycling commodities, e.g., wet fibers</li> <li>Business interruption assessment; as an essential service, interruptions are generally short-term delays, however assessment includes population migration due to climate change               <ul style="list-style-type: none"> <li>Damage costs incurred by facilities from increased precipitation events</li> <li>Duration of impact to service routes</li> </ul> </li> </ul>
Rising Temperatures	<p>Roughly 70% of Republic's workforce spends the majority of their day in a truck/equipment or in an open-air facility, providing essential services to our communities. Employees with outdoor exposure are among the most vulnerable to increased temperature. Extreme temperatures are potentially impactful to their health, safety and productivity.</p>	<p>Rising temperatures may impede our ability to service our customers and attract and retain talent. These impact our ability to grow, operate safely and keep our employees engaged, which touch all three of our foundational elements; Market Position, Operating Model and People and Talent Agenda, see more on page 2 of our 10-K.</p> <p><i>Associated Sustainability Goal: Engaged Workforce and all our Climate Leadership goals, which are designed to combat climate change.</i></p>	<p>Capturing the potential financial impact of increased temperatures on operations includes:</p> <ul style="list-style-type: none"> <li>Analyzing labor efficiency (\$ labor / service unit) against significant temperature change</li> <li>Analyzing safety metrics (TRIR, Safety Frequency) against significant temperature change</li> <li>Duration to complete service routes</li> <li>Number of days requiring alternative working hours/additional breaks</li> <li>Daily number of heat/cold related health incidents reported</li> </ul>

## Exhibit S4: Overview of Impact (Continued)

Risk/Opportunity	Potential Impact On:		
	Businesses	Company Strategy	Financial Planning
<b>OPPORTUNITIES</b>			
Products and Services & Energy Source			
Low Carbon Fleet	With over 16,000 collection vehicles, and customer/municipal interest in low-carbon solutions, especially related to fleet emissions, renewable fuel vehicles have impacted our business operationally, financially and reputationally.	See “Price on Carbon: Fleet Fuel Emissions” on page 14.  <i>Associated Sustainability Goal: Science Based Target (GHG Reduction)</i>	<ul style="list-style-type: none"> <li>• See “Price on Carbon: Fleet Fuel Emissions” on page 14</li> <li>• Consideration for mandates for low-carbon fleet in municipal contracts/RFPs</li> </ul>
Recycling & Organics Service	With longstanding customer/municipal diversion goals and newer organics diversion laws (e.g., SB1383), recycling growth is core to our business strategy.	Expansion of recycling (and organics) capabilities is part of our Market Position, see page 2 of 10-K. We surely expect that demand to grow over the long-term and we continue to look for further opportunities to help our customers achieve their sustainability goals related to sound waste practices.  <i>Associated Sustainability Goal: Circular Economy</i>	<ul style="list-style-type: none"> <li>• Capital planning for investment in recycling and organics processing infrastructure</li> <li>• Developing the business case, including revenue projections, for entering new markets</li> <li>• Considerations for recycling-related policies, (e.g., phasing requirement, fines for non-compliance, etc.)</li> </ul>
Community Cleanup	Given our national presence, capacity and ability to deploy resources quickly, our customers have increasingly come to us for post-disaster event cleanup services. Thus, we have created a deployment team called “SOS” to assemble quickly and deploy labor and assets to collect and cleanup debris after climate-related disasters.	This opportunity aligns with the volume growth and public-private partnership aspects of our Market Position fundamental elements, see page 2 of 10-K.  <i>Associated Sustainability Goal: Charitable Giving</i>	<ul style="list-style-type: none"> <li>• Asset planning to assure assets (e.g., industrial boxes and trucks) are available when needed and processes to transport are in place</li> <li>• Labor capacity planning to assure employees are available and processes to transport are in place</li> </ul>



## Business Implications & Mitigation Plans

As Republic identifies and assesses these risks and opportunities across future climate worlds, the implications of the changes in climate are important for the Company to fully understand in order to best manage them. If we can effectively adapt to changes and mitigate the impacts, there are key opportunities for our business.

### Rising Temperatures

The occupational risks of heat stress may include restricted physical functions and capabilities, work capacity and productivity. Increasing temperatures is widely cited in literature as a primary driver of employee productivity loss. To understand potential future impacts of increasing heat, Republic examined the impacts of historical heat waves such as the 2020 Pacific Northwest heat wave and did not find a noticeable correlation between heat and productivity loss or employee turnover. However, Republic understands that the past exposure may not be indicative of future impacts. Compounding implications may arise from an overall increase in baseline temperatures. Therefore, to quantify the potential impacts of rising temperatures on our operations, Republic will use published studies to assume a percent decrease in productivity based on regional-specificity and scenario analysis data. Based on those assumptions, Republic's internal teams can analyze a labor effectiveness value (\$ labor / unit of service) and the corresponding total potential enterprise-wide financial impact for specific productivity declines. In addition to labor effectiveness and productivity, Republic values and publicly reports our employee engagement score. Employee engagement is another indication of the health and satisfaction of our workforce and is a potential risk with rising temperatures. This best practice metric allows us to better understand our risk exposure and to adjust our programs should we see a corresponding decline in employee engagement scores.

To address and mitigate the potential implications of extreme temperatures on our employees, Republic implemented a Summer Safety Plan including our annual '101 Days of Summer' program, which aims to educate and set actions and expectations to ensure a safe and successful summer season. This includes protocols for ensuring truck A/Cs are properly functioning months prior to the season, employees are adequately hydrated while enroute and cooling PPE products are provided to outdoor workforce. More about our program can be found in the [Risk Management B\) Mitigation Activities](#).

A secondary impact on our operations from rising mean temperatures is increased building cooling and energy costs. As temperatures rise, demand for cooling will increase, impacting the prices and reliability of power to facilities. Republic relies on the ability to cool our facilities as we often operate in conditions exposed to the elements. To quantify this implication, historical energy data is used to identify any correlations between peak pricing and extreme temperatures or heat waves. From this, we determine what percentage of energy per facility goes towards cooling. To forecast these implications into future timeframes, such as 2030 and 2050, the International Energy Agency (IEA) has published energy cost and demand projections which are then applied to our specific facilities.

## Precipitation Change

We estimate that our largest business implication from increased precipitation comes from the potential for increased landfill leachate. Leachate can be costly to manage properly because of the level of treatment required before it can be discharged back into a water system. Some wastewater treatment plants require pretreatment or are increasing their rates for incoming leachate. In addition to leachate at landfills, a significant increase in precipitation could generate an increase in cost to stormwater management protocol. This could be in the form of upsizing existing infrastructure, increased costs related to permitting, or liabilities from unmanaged stormwater due to large storm events. For these reasons, identifying facilities that may need additional resiliency measures to mitigate this exposure is a priority for Republic. Republic consistently tracks the correlation between precipitation and leachate and the implications to our operations. From this data, Republic can tie the data on changes in precipitation and resulting leachate to the current dollar per gallon of precipitation data to quantify the overall expected implications to our operations.

The secondary driver of business implications from precipitation increase is attributed to a delay in service either through building damages or transportation infrastructure damages from flooding. A key thing to note is that for Republic, this is not likely to result in revenue loss as Republic has long-standing relationships and contracts with our customers but would rather be a delay in revenue as the service will continue once operations are running.

## Opportunities

If more precipitation brings additional storm damage through hurricanes, flooding and other extreme weather events, Republic is well positioned to manage the increased inflow of cleanup requirements. A key part of our business strategy is to be a reliable cleanup resource. From our experience with past events, we have proven that we are a dependable and trusted solution for the communities we serve.

## C) Resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2° C or lower scenario.

Through scenario analysis, we gathered the quantitative information necessary to assess the adaptive capacity of our most impacted facilities and functions to climate risks and further invest in strategic initiatives to enhance resilience within our operations.

### Modeling and Company Resiliency

#### Price on Carbon – Landfill Emissions

To assess the financial impact associated with a price on carbon, we focused on 2025 and 2040 using the following from the International Energy Agency's World Energy Outlook 2020 (IEA WEO 2020):

- Stated Policies Scenario (STEPS) – For the purpose of this report, this is our business as usual. We projected our Scope 1 (fleet and landfill) carbon emissions out to 2025 and 2040 using current policies, no price on carbon, and assumed no additional GHG reduction activities taken by the business beyond those included in the five-year plan as of 2017 (the baseline year for our science-based target).
- Sustainable Development Scenario (SDS) – For the purpose of this report, this is our pathway to achieving our SBTi-approved goal of a 35% reduction by 2030. For this analysis, we assumed that we would stay on our science-based target trajectory through 2040.

In order to achieve our SBTi-approved goal, we must reduce emissions from our landfills, thereby reducing our risk in a scenario in which governments impose carbon-reduction regulations. Based on current carbon tax or cap-and-trade programs implemented in other countries, these policies typically do not directly levy a carbon tax at landfills. Policies are most often targeted on upstream waste generators. This approach is seen in several U.S. states today as a landfill diversion target that applies a fee to customers (businesses and/or municipalities) that do not meet diversion mandates. We anticipate this type of policy as opposed to a direct landfill carbon tax. Although the impact to operating costs due to this type of policy is difficult to model, we can discuss the actions we are taking to continue to build resiliency in the face of this type of policy. Examples of our mitigation and resiliency tactics include:

- Maximizing the amount of gas collected at each site. By safely collecting the maximum amount, we minimize gas escaping as fugitive emissions. The collected landfill gas is either converted into renewable energy or combusted in a flare. As of December 31, 2021, Republic was engaged in 69 landfill gas-to-energy projects that beneficially reuse biogas, and we expect to have 116 projects by the end of 2027.
- Advancing our recycling and organics service offerings. Consumer demand for recycling services continues to increase in an effort to divert emissions-generating materials away from the landfill, and we have responded by integrating recycling components into our array of service offerings. Our goal is to provide a complete waste stream management solution to our customers in a vertically integrated, environmentally sustainable way.
- Investing in proven technologies to control costs and to simplify and streamline recycling for our customers. For example, robotics and advanced sorting equipment, such as disk screens, magnets and optical sorters, identify and separate different kinds of paper, metals, plastics and other materials to increase efficiency and maximize our recycling efforts.

### Price on Carbon – Fleet Fuel Emissions

Under STEPS, or business as usual, we would not expect a price to be set on carbon. However, carbon emissions pricing under SDS is shown on the header row of [Exhibit S5](#) below.

We used the carbon tax estimates provided by the IEA WEO 2020 analysis in 2025 and 2040 to develop an estimate of the incremental costs to the business of a carbon tax under both the STEPS and SDS scenarios mentioned above. We reviewed a variety of calculations to set a carbon tax, including governments, corporations and NGOs, and we chose the calculations in the IEA WEO 2020 analysis because they are part of widely accepted climate scenarios. We then modeled our risk-management strategy, reflecting GHG reductions aligned with our SBTi-approved goal, and have reflected the potential range of resulting net income impacts shown in [Exhibit S5](#).

In order to achieve our SBTi-approved goal, we must reduce emissions from our fleet, thereby reducing our risk in a scenario in which governments impose carbon-reduction regulations. At current consumption levels, the addition of a \$63/ton carbon tax, corresponding to the 2025 SDS scenario, would result in an increase in our fuel expenses as shown [Exhibit S5](#). However, we are deploying processes and investments to bolster our resiliency to a potential price on carbon from fleet vehicles:

- We would expect to offset the majority of a carbon tax via a fuel recovery fee.
- Powering our fleet with alternative fuels, specifically renewable natural gas (RNG) and electricity, allows us to lower our emissions. With one of the largest vocational fleets in the country, using innovative technology to reduce emissions is vital. In 2021, 21% of our fleet was powered by renewable natural gas and we added four electric trucks, bringing the number of vehicles running on renewable fuels to more than 3,300. Our new electric and RNG-powered trucks replace older, diesel-powered vehicles, and help decrease emissions and reduce unwanted noise. We believe using electric and RNG provide us a competitive advantage in communities with strict clean emissions initiatives that focus on protecting the environment. Although upfront capital costs are higher, using electric and RNG reduces our overall fleet operating costs through lower fuel expenses.

We chose to use a carbon tax as an example of a regulatory device that could impact our business because it is a very specific type of policy lever that is readily modeled using scenarios to determine financial impact and demonstrate the resilience of our strategy. The estimated fleet fuel emissions cost impact shown in [Exhibit S5](#) is presented for illustrative purposes only, is based on numerous assumptions and estimates, is subject to numerous uncertainties, and does not necessarily reflect or predict the actual impact on the Company's fleet fuel emissions costs in the years shown.

## Exhibit S5: Price on carbon scenario analysis

Name	Scenario		2025 Carbon Emissions Estimate (MMTCO <sub>2</sub> e) <sup>1</sup>	2040 Carbon Emissions Estimate (MMTCO <sub>2</sub> e) <sup>1</sup>	2025 \$63 / ton Carbon Tax <sup>2</sup>	2040 \$140 / ton Carbon Tax <sup>2</sup>
Stated Policies Scenario (STEPS) (Aka business as usual)	IEA WEO 2020	Fleet	1.06	0.55	N/A	N/A
		Landfill	11.07	8.44	N/A	N/A
Sustainable Development Scenario (SDS) (Aka 35% reduction)	IEA WEO 2020	Fleet	1.14	0.78	\$71.95M	\$109.37M
		Landfill	10.75	7.36	N/A	N/A

<sup>1</sup>See [GRI 305](#) for updates to methodology in 2021

<sup>2</sup>Per [IEA WEO 2020 Table 2.3 CO<sub>2</sub> prices for Advanced Economies](#)

### Physical Risks

To assess the physical risks associated with a future changing climate, we examined physical climate risk in four future climate models, the Representative Concentration Pathways (RCP) 2.6 (< 2°C), 4.5 (Lower end of a 2°C – 4°C world), 6.0 (Upper end of a 2°C – 4°C world) and 8.5 (> 4°C), to evaluate the various climate impacts in long-term (2040 – 2059) horizons. Each of the four climate scenarios are driven by a varying number of climate models to further account for the variability and uncertainty in climate projections. Understanding climactic changes against multiple future climate worlds equips Republic to begin to track the agility and resilience of our management methods and strategy at these locations.

Across the RCPs, future temperatures and precipitation amounts at Republic facilities increase in magnitude as the RCPs increase in severity. Quantifying the range of temperature and precipitation changes that may occur allows Republic to build a meaningful and resilient strategy. The analysis found:

- Our facilities in the Midwest, Southwest and Heartland areas are likely to experience higher and longer-lived rising temperature conditions to a degree that has not been felt in the past. A similar storyline developed across both precipitation scenarios, where material recovery, hauling and recycling were the facility types likely to have the greatest portion of sites that had higher than a 50mm increase in precipitation. Our employee Summer Safety Plan, including the 101 Days of Summer program, are the foundational elements for which we consistently build upon our resilience to these expected rising temperature conditions; more information is found in [Strategy B](#)) under Business Implications & Mitigation Plans.
- From our precipitation analysis it was found that the East Coast area is likely to experience the greatest percent increase in precipitation across the future scenarios. And across both temperature scenarios, it was clear that recycling, landfills and hauling would be key facility types to continue to support with adaptive management capacity, such as on-site leachate systems and stormwater retention basins, as they had the greatest portion of sites that had a higher temperature increase.

For more information on our precipitation and temperature RCP analyses, see [Analysis](#).

# Risk Management

*Disclose how the organization identifies, assesses and manages climate-related risks.*

## A) Describe the organization's processes for identifying and assessing climate-related risks.

Climate-related risks are identified via two separate methods, then integrated into the ERM process for assessment and prioritization. These methods are via a) traditional business processes and b) dedicated climate-risk tracking as part of the sustainability function; see [Exhibit G1](#).

- Traditional business processes include presentations from field and corporate teams, such as quarterly business reviews and annual operating reviews. Local teams and area reviews tend to focus on short-term risks, within a 0 – 5 year time frame; however, long-term investments such as recycling facilities or landfills are also addressed.
- The sustainability team uses processes such as the Materiality Assessment to gather risks and opportunities from relevant stakeholders. This team focuses on risks across all time frames and topics across the organization, including but not limited to, climate-related topics. The process for identifying material topics includes review of key internal and external documentation, an analysis of sustainability standards and frameworks, stakeholder interviews, peer benchmarking and media analysis.

Risks and opportunities identified through these processes cover topics that are directly linked to climate change, such as fuel and electricity consumption, our recycling business, fleet emissions, landfill emissions and impacts of adverse weather.

Once identified and aggregated, risks are assessed for severity and prioritization within existing ERM processes using a ranking that includes financial, legal/regulatory/compliance, operational and brand/reputational impacts. Each risk is scored by impact, resulting in a negligible, minor, moderate, major or catastrophic risk categorization. The likelihood and probability are then estimated, and the risks are plotted into a matrix that facilitates discussions about risk management. For the purposes of assessing climate-related risks, these analyses consider financial impacts at or above \$1M. Risks at this level are included in the risk matrix.

## B) Describe the organization's processes for managing climate-related risks.

### Process Overview

The process for managing business risks and opportunities, including those that are climate-related, is handled by the ERM team and the appropriate functional owners throughout the organization. The ERM team determines the management approach and assigns a functional leader/owner. The functional leader creates a mitigation plan and is responsible for reporting out on progress. This process is completed at least once a year, or more often if new risks emerge or the nature or severity of a risk changes, which requires an adjustment to the previously developed management approach.

## Process Overview (Continued)

Any risks that fall into the high significance and/or high likelihood categories, and that are likely to impact the business in the short-term (1 – 5 years), are monitored and managed in the following ongoing forums. It is at these forums that these teams develop mitigation plans such as our Summer Safety Program and our Stormwater Management Plans.

- Monthly and as-needed Sustainability Steering Committee meetings
- Area operating reviews with the Executive Team
- Monthly CEO staff meetings
- Quarterly corporate operating reviews
- Quarterly Board meetings
- Annual reviews of risks identified in Form 10-K
- Periodic interviews with Senior Management
- Day-to-day oversight of risks by functional leaders throughout the organization

## Mitigation Activities

### Physical Risks: Rising Temperatures

Our Safety department manages the mitigation plan for rising temperatures. They update the company Summer Safety Plan and develop training for our most safety-sensitive employees. Our plan also implements California OSHA's (Cal/OSHA) most recent Heat Illness Prevention requirements in every location to ensure we are applying the most rigorous protocols across all our sites.

- Extreme Heat Procedures
- Availability to Shade
- Availability and Replenishment of Water
- Heat Index Monitoring and Communication
- Weather Acclimatization
- Pre-season A/C and Cooling Inspection and Repairs
- Sun Exposure
- PPE (hats, cooling towels, sunscreen, etc.)
- Working Hours Adjustment



## Mitigation Activities (Continued)

### Physical Risks: Increased Precipitation

We employ various strategies to mitigate impacts from increased precipitation. We believe that one of the largest impacts would be the increased leachate, but we also plan for excessive stormwater and facility damage. To mitigate negative impacts, we employ practices including

- Leachate management (e.g., depth and type of cover, landfill density)
- On-site leachate treatment
- Mandatory, site-specific Emergency Response Plans
  - Relocation of moveable assets (e.g., trucks, equipment) to higher ground
  - Securement of open facilities (e.g., roll-up doors at MRFs) and exposed materials (e.g., relocated material at transfer stations)
- Stormwater management best practices (e.g., retention ponds, drywells, swales, etc.)
- Storm and flooding design
  - Overlaying analysis of at-risk facilities with flood plain zones and sea level rise impacts to understand potential damage

## C) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.

Our ERM process is designed to identify, assess, prioritize, respond to and monitor risks and opportunities across the business. It is a formalized framework that is embedded into and fed by our current processes, which creates greater insight and durability. The steps of the process are shown in [Exhibit R1](#).

As described earlier, the ERM matrix is populated with risks and opportunities from a variety of business functions and processes. These risks include those originating from climate-related issues. Aggregated risks and opportunities are then assessed and prioritized based on their impact to the strategy and organization by the ERM Team, which consists of multiple functional representatives. This group, which leads the ERM process, also identifies and defines emerging risks, assigns risk owners, tracks risk-mitigation activities and reports to the ERM Council. The ERM Team is led by the Deputy General Counsel.

### Exhibit R1: Enterprise Risk Management process





# Metrics & Targets

TCFD guidance: Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities.

## A) Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk-management process.

Climate-related risks and opportunities are evaluated against a number of criteria, including employee safety, cost/benefit, brand and reputation, business continuity impacts or other factors specific to the risk. Free cash flow generation, internal rate of return and return on invested capital are key metrics that are used consistently across the business.

Transition risks to the organization due to policy and legal actions are also evaluated in this process. The Company accounts for its direct greenhouse gas emissions each year and projects those emissions into the future using a blended growth rate for the business. These projected emissions are used to calculate the potential operating cost impacts from a USD/ton carbon tax in 2025 and 2040.

Opportunities are evaluated using a traditional internal rate of return model for each initiative.

### Exhibit M1: Sample of Metrics and Targets

Category	Metric	Targets
Safety	<ul style="list-style-type: none"> <li># of Heat-Related Incidents</li> <li># of Inclement Weather Days</li> <li>TRIR</li> </ul>	<ul style="list-style-type: none"> <li>TRIR <math>\leq</math> 2.0 by 2030</li> <li>Zero Employee Fatalities</li> </ul>
Financials	<ul style="list-style-type: none"> <li>Revenue; by market vertical, Area, etc.</li> <li>Operating Expenses</li> <li>Free Cash Flow</li> <li>IRR</li> <li>ROIC</li> </ul>	<ul style="list-style-type: none"> <li>Not published</li> </ul>
Climate	<ul style="list-style-type: none"> <li>GHGs; Scope 1, 2, 3</li> <li>Biogas recovered (scf)</li> <li>Recycling and Organics (tons sold, processed, collected, etc.)</li> </ul>	(2030 Goals w/ 2017 baseline) <ul style="list-style-type: none"> <li>35% Scope 1+2 Reduction (SBTi Approved)</li> <li>50% Increase in Beneficial Reuse of Biogas</li> <li>40% Increase in Circularity of Key Materials</li> </ul>

## B) Disclose Scope 1, Scope 2 and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks.

### Exhibit M2: 2021 Greenhouse Gas Emissions<sup>1</sup>

Scope	Metric Tons CO <sub>2</sub> e	Related Risks & Opportunities
Gross global Scope 1 emissions	13,643,797	<ul style="list-style-type: none"> <li>• Transition Risk: Policy &amp; Legal: Price on Carbon</li> <li>• Physical Risk: Acute: Storms, hurricanes, floods</li> <li>• Physical Risk: Chronic: Temperature change, Increased Precipitation</li> </ul>
Scope 1: Landfill	11,944,825	
Scope 1: Fleet & Heavy Equipment	1,450,957	
Scope 1: Facilities	248,016	
Gross global Scope 2 (location-based)	218,286	
Gross global Scope 3	3,572,266	

<sup>1</sup>See [GRI 305](#) for historical GHG inventories and description of our methodology

## C) Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.

Our 2030 Sustainability Goals were born from risk and opportunity assessments, like our Materiality Assessments and the ERM process. Our Climate Leadership targets, as shown in [Exhibit M3](#) below, were specifically developed to manage climate-related risks and opportunities our company faces and to hold us accountable to making progress.

- Transition Risks – by committing to:
  - reduce Scope 1 and 2 greenhouse gas emissions 35% by 2030, our science-based target reduces our exposure to potential future carbon regulations. With less carbon emitted from our operations, the cost of compliance to a future requirement will be substantially hedged.
- Transition Opportunities – by committing to:
  - increase beneficial reuse of biogas from landfills 50% by 2030, we are growing our stake in the renewable energy market as a provider of low-carbon fuel. Demand for such energy sources is rising and will continue to rise as the economy transitions away from fossil fuels.
  - increase recovery and circularity of key materials 40% by 2030, we are presenting ourselves as a leader in providing the materials for a circular economy. CPGs and other manufacturers already demand post-consumer recycled content at a rate higher than the market can deliver, and we are establishing ourselves as a reliable partner to help those manufacturers avoid use of higher-carbon virgin materials.
- Physical Risks – by committing to:
  - protect our employees with Safety Amplified and Incident Reduction targets, we hold ourselves accountable to best-in-class safety practices. As the climate changes, we will already have systems in place to prevent heat-related illness and incidents, among others.
- Physical Opportunities – through our strategy to:
  - generate profitable growth by sustainably managing our customers’ needs, we are positioned to respond quickly with post-disaster cleanup service to our customers and municipalities when they need us the most.

### Exhibit M3: Climate-related Goals



#### SAFETY

##### Safety Amplified

**0**

Zero employee fatalities

##### Incident Reduction

**<2.0**

Reduce our OSHA Total Recordable Incident Rate (TRIR) to 2.0 or less by 2030



#### CLIMATE LEADERSHIP

##### Science Based Target

**35%**

Reduce absolute Scope 1 and 2 greenhouse gas emissions 35% by 2030 (2017 baseline year)  
Approved by SBTi

Interim target: 10% reduction by 2025

##### Circular Economy

**40%**

Increase recovery and circularity of key materials by 40% on a combined basis by 2030 (2017 baseline year)

##### Renewable Energy

**50%**

Increase beneficial reuse of biogas by 50% by 2030 (2017 baseline year)

# Analysis

## Representative Concentration Pathway (RCP) Methodology

The data for this RCP analysis used ArcGIS spatial layers for annual projected temperature and precipitation anomalies from a global climate model (CMIP5 multi-model) consisting of an ensemble of 10 climate models. This specific model evaluates a group of climatic models to quantify the variability of simulation data and account for the inherent uncertainty presented by climate models. Quantifying the magnitude of changes in physical risk metrics allows Republic to understand the implications of the changing climate on Republic's operations. Overlaying this data with historical information from past events provides Republic with a more accurate representation of the likelihood of these scenarios coming to fruition. This analysis was also the basis used for identifying the key business implications driving rising temperature and precipitation change.

While a wide range of future scenarios was analyzed ([Exhibit A1](#)), to assess and understand the implications on Republic's operations, we focused on two of the more plausible scenarios representing a broad range of impact, RCP 4.5 and 8.5. As outlined in [Exhibit A1](#), RCP 4.5 assumes a moderate increase in temperatures (2°C – 4°C) which will require a moderate level of adaptation with an associated moderate level of cost in order to respond to the impacts of climate change. RCP 8.5 represents much greater temperature increases which will require more severe and costly adaptation. Including this extreme warming scenario (RCP 8.5) in our analysis establishes what the worst-case scenario could be for operations. Mitigation measures will likely be based on a mix between the RCP 4.5 and RCP 8.5 scenarios, first focusing on sites impacted more severely in the RCP 4.5 scenario and then incorporating any additional sites that fall in the most impacted category in RCP 8.5 to streamline efforts.

### Exhibit A1. Description of Climate Scenarios

Representative Concentration Pathways	Description	Radiative Forcing Levels	Likelihood
RCP 2.6 Below 2°C	Low emissions "Peak and decline" scenario	Radiative forcing levels peak both prior to and decline to 2.6W/m <sup>2</sup> by 2100	Scenario 2.6 is no longer considered a realistic probability given most recent reports and lagging climate commitments
RCP 4.5 Lower end of a 2°C – 4°C world	Moderate emissions "Stabilization" scenario	Radiative forcing levels stabilize without exceeding 4.5 W/m <sup>2</sup> by 2100	Scenario 4.5 is considered realistic if action is taken immediately to curb emissions
RCP 6.0 Upper end of a 2°C – 4°C world	High emissions "Stabilization" scenario	Radiative forcing levels stabilize without exceeding 6.0 W/m <sup>2</sup> by 2100	Scenario 6.0 is considered to be a realistic probability
RCP 8.5 Above 4°C world	Very high emissions "Extreme" scenario	Radiative forcing levels will reach 9.5 W/m <sup>2</sup> by 2100	Scenario 8.5 assumes high levels of population growth and continued lower incomes in developing countries. While it is the most extreme scenario, it is now considered very likely.

## RCP Analysis (Physical Risk)

Republic is one of the largest providers of environmental services in the United States. We provide critical recycling, waste and other environmental services to our residential, commercial and industrial customers. We included all our sites in our analysis, ranging greatly in function and exposure to physical risk. [Exhibit A2](#) below provides a brief description of our sites' function and a breakdown of their proportions by count.

### Exhibit A2: Republic's Facilities

Facility Type	Physical Description	Proportion of Portfolio
Hauling	Truck parking, fueling stations, maintenance shop, office space	37%
Landfill	Active and/or closed cells, construction space, scale house, office trailers, heavy equipment, stormwater management, energy infrastructure	18%
Material Recovery	Industrial building with large industrial processing equipment, piles of materials, office space	9%
Organics	Open air piles, heavy equipment, infrastructure	1%
Recycling	Recycling drop-off centers aka convenience centers – typically open-air industrial site with roll-off boxes, compactors, heavy equipment, parking	13%
Transfer Station	Industrial building, piles of material, heavy equipment, office	23%

#### Chronic Physical Risk: Rising Temperatures

##### *Relevance of risk to Republic:*

Roughly 70% of Republic's workforce spends the majority of their day in a truck/equipment or in an open-air facility (e.g., a recycling facility, maintenance shop or transfer station), providing essential services to our communities. Rising temperatures will increase these employees' exposure, with outdoor employees being among the most vulnerable, potentially impacting the health, safety and productivity of Republic's outdoor workforce. Additionally, higher outdoor temperatures may make it challenging to both retain and attract an outdoor workforce. Thus, we first sought to understand regional changes in temperatures and which Republic locations (and thus employees) may be exposed to the greatest potential risk or vulnerabilities from climate change.

**Description of risk level:**

For the purposes of this analysis, to illustrate the magnitude of impact on our facilities, we separated temperature increases into four main categories; see [Exhibit A3](#). Republic categorized a “high” and “extremely high” increase as the threshold for future impacted locations. However, it is difficult to apply this categorization across the organization, as the impact to the business varies vastly depending on the location and the type of operation; for example, some operations may not be materially impacted by a 3°C change in temperature.

From our analysis, it was found that there is a substantial increase in “extremely high increase” facilities between RCP 4.5 and RCP 8.5, see final column in [Exhibit A3](#). This observation is consistent with general trends in climate and temperature data based on varying emissions pathways.

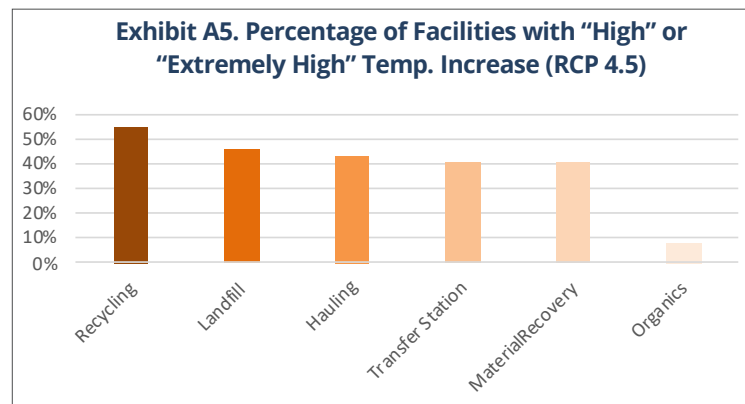
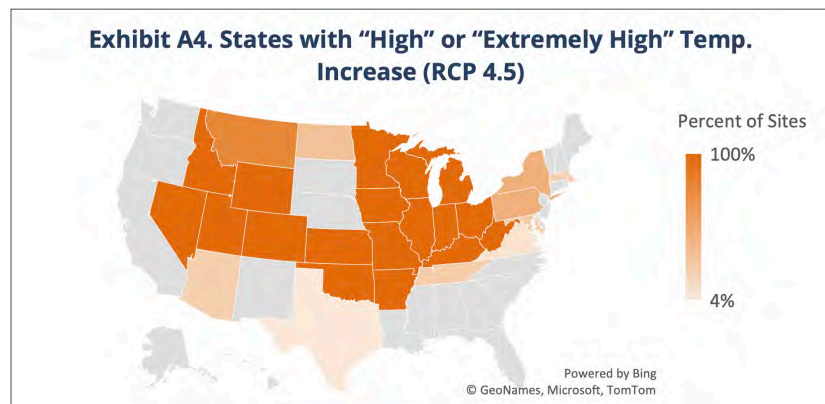
**Exhibit A3. Facilities by Temperature Increase under RCP 4.5 and RCP 8.5**

Temperature Increase Category	Temperature Increase range	% of Facilities RCP 4.5	% of Facilities RCP 8.5	% Change of Facilities RCP 4.5 – RCP 8.5
Low Increase	(0 – 1.25°C)	0%	0%	-
Moderate Increase	(1.25 – 1.75°C)	7%	3%	-55%
High Increase	(1.75 – 2.5°C)	90%	21%	-77%
Extremely High Increase	(2.5 – 3.25°C)	2%	75%	3,924%

**Temperature RCP 4.5 Results**

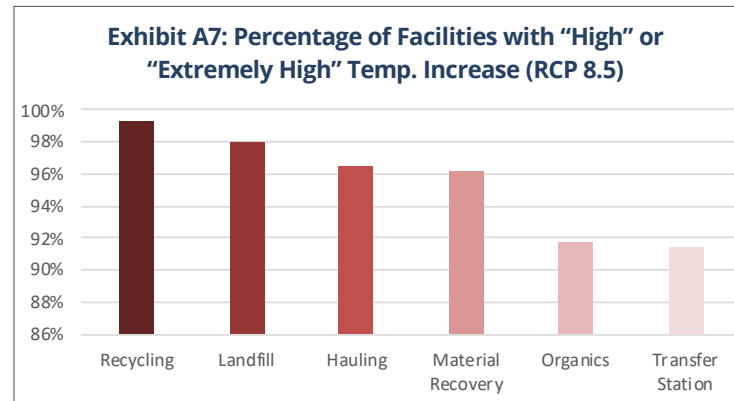
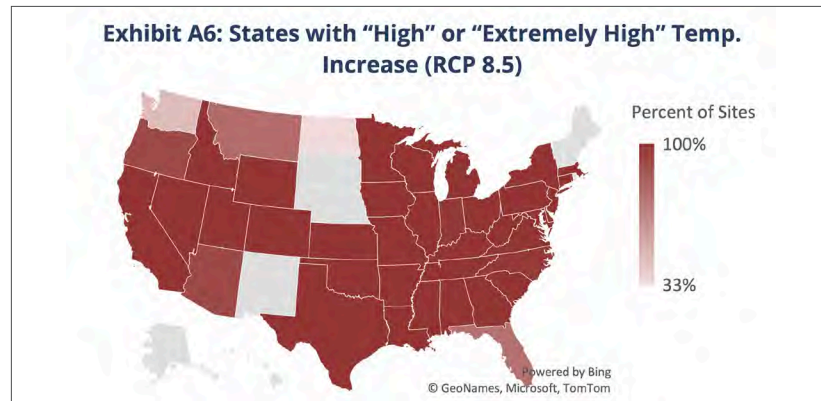
The majority of facilities (92%) under the RCP 4.5 scenario are likely to fall within the “high” or “extremely high” increase range of 1.75°C to 3.25°C, see [Exhibit A3](#). Average temperatures are rising by at least 1°C, with Minnesota and Wisconsin likely to experience the greatest temperature increase from their baseline conditions (2.5 – 2.7°C). The Midwest, Great Lakes and Heartland are the areas where the greatest percentage of sites fall in a “high” or “extremely high” temperature increase threshold, see [Exhibit A4](#).

All site types, except for Organics, are likely to have more than a third of their sites fall within “high” or “extremely high” temperature increase thresholds, see [Exhibit A5](#).



### Temperature RCP 8.5 Results

The majority of facilities (96%) are likely to fall within the “high” or “extremely high” increase range of 1.75°C to 3.25°C under the RCP 8.5 scenario, see [Exhibit A3](#). Almost all Republic sites are exposed to chronic temperature increases in this scenario. Average temperatures are rising by at least 1.5°C, with Minnesota, West Virginia and Virginia likely to experience the greatest temperature increase from their baseline conditions (3.0 – 3.1°C), see [Exhibit A6](#).



Within all site type categories, we are likely to have more than 90% of facilities experience “high” or “extremely high” temperature increases, see [Exhibit A7](#).

### Chronic Physical Risk: Precipitation Change

#### Relevance of risk to Republic:

Changes in precipitation could result in changes in rainfall patterns, increased flooding, more frequent and severe droughts, decreased water quality and increased water stress in some locations. Increased disruption to supporting infrastructure from increased flooding from surface water could cause impacts to on-site operations, such as gas and leachate collection systems. For Republic, the implications from precipitation increase were deemed more material than a decrease in precipitation. Additional leachate and stormwater runoff could have cost impacts for our operations. Additionally, in the event of a storm, Republic typically experiences an increase in service demand and urgency to help with cleanup, see more about this scenario as an opportunity in [Strategy A](#). If there is transportation infrastructure damage from these types of events, this could impact our ability to conduct service. By analyzing changing precipitation conditions, Republic is able to identify locations that are most likely to experience future impacts and invest in efforts to bolster resilience to anticipated impacts.

#### Description of risk level:

For the purposes of this analysis, to illustrate the magnitude of impact on our facilities, we separated precipitation change into nine main categories, see [Exhibit A8](#). Republic categorized a “high” and “extremely high” increase as the threshold for future impacted locations. However, it is difficult to apply this categorization across the organization, as the impact to the business varies vastly depending on the location and the type of operation, for example, some locations regularly experience more than a 125mm precipitation change year to year.

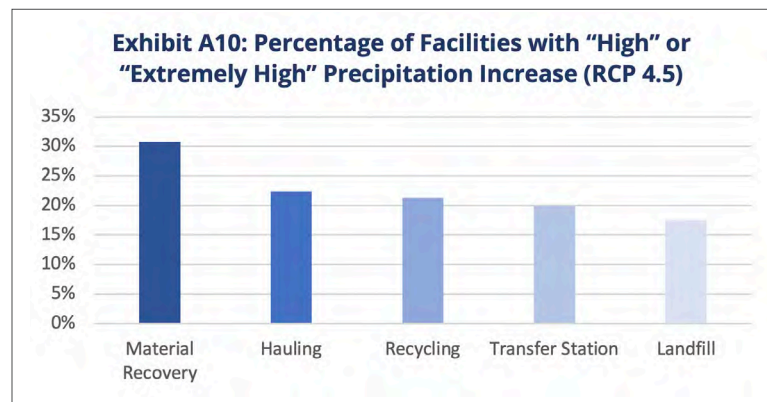
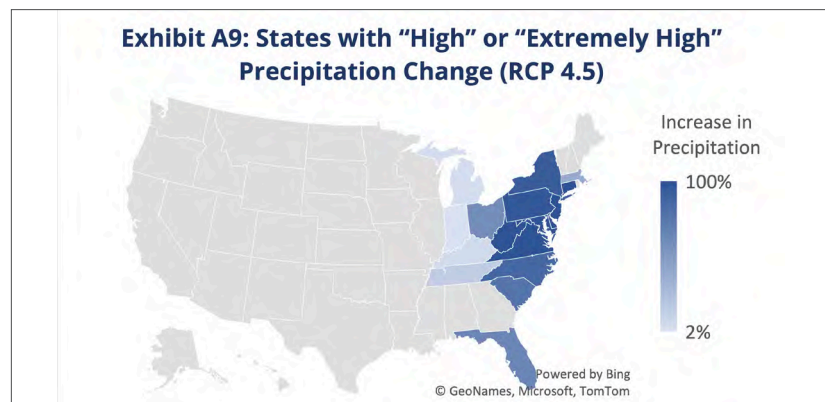
### Exhibit A8. Percent of Facilities by Precipitation Change under RCP 4.5 and RCP 8.5

Precipitation Change Category	Precipitation Change Range	% of Facilities (RCP 4.5)	% of Facilities (RCP 8.5)
Extremely High Decrease	(-125mm) – (-100mm)	0%	0.1%
High Decrease	(-100mm) – (-75mm)	1%	0.4%
Moderate Decrease	(-50mm) – (-25mm)	18%	0.1%
Low Decrease	(-25mm) – 0mm		12%
Low Increase	0mm – 25mm	60%	14%
Moderate Increase	25mm – 50mm		32%
High Increase	50mm – 75mm	22%	25%
High – Extremely High Increase	75mm – 100mm		16%
Extremely High Increase	100mm – 125mm	0%	0.4%

**Precipitation RCP 4.5 Results:**

Under the RCP 4.5 scenario, most facilities (60%) are likely to fall within the “low” to “moderate” increase range of 0 – 50mm of precipitation, see [Exhibit A8](#). Over 20% of the facilities under this scenario are likely to fall under the “high” to “extremely high” increase range of 50 – 100 mm of precipitation.

The Northeast and Mid-Atlantic are the top two regions that are likely to experience the greatest portion of sites that fall within the “high” to “extremely high” precipitation increase thresholds (~85% of their sites), see [Exhibit A9](#).

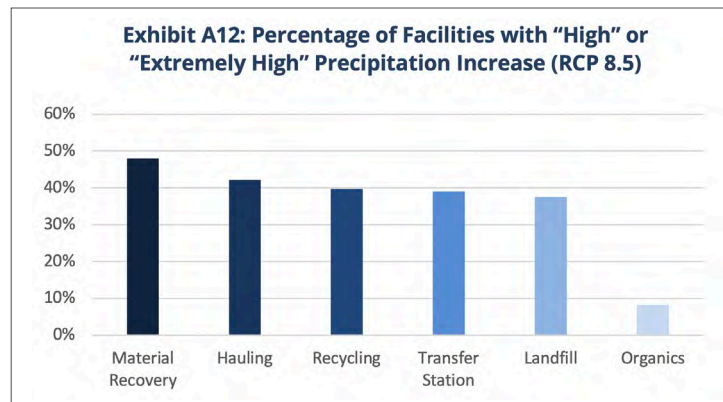
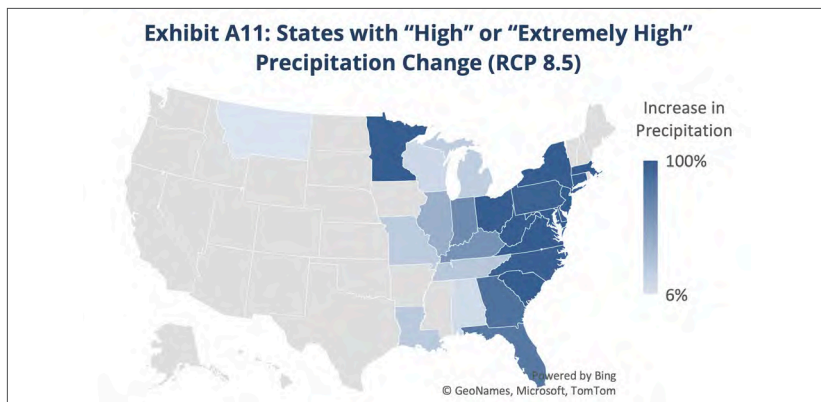




The portion of sites for each site type that fall within the “high” to “extremely high” increase in precipitation is fairly uniform, with Material Recovery having the greatest portion of sites (31%); see [Exhibit A10](#). Republic uses this information to identify which site types might need the greatest investment in resiliency methods.

**Precipitation RCP 8.5 Results:**

Over 40% of facilities under the RCP 8.5 scenario are likely to fall within the “high”, “high to extremely high” and “extremely high” increase range of 50 – 125 mm of precipitation see [Exhibit A8](#).



The Southeast and Mid-Atlantic are the top two areas that are likely to have the greatest portion of sites fall within “high” to “extremely high” precipitation increase (~100% of their sites); see [Exhibit A11](#). Similar to the results from rising precipitation for RCP 4.5, materials recovery is the top site type that is likely to have the greatest portion of sites falling in the “high” to “extremely high” thresholds (~50%), followed by hauling (42%) and recycling (40%), see [Exhibit A12](#).



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For information on how Republic Services can help you achieve your sustainability goals, reach out to **[Sustainability@RepublicServices.com](mailto:Sustainability@RepublicServices.com)**

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