WHITE PAPER

Leveraging Demand Analytics to Reach Sustainability Goals

Unlocking Profitability While Meeting Both Waste and Carbon Reduction Objectives

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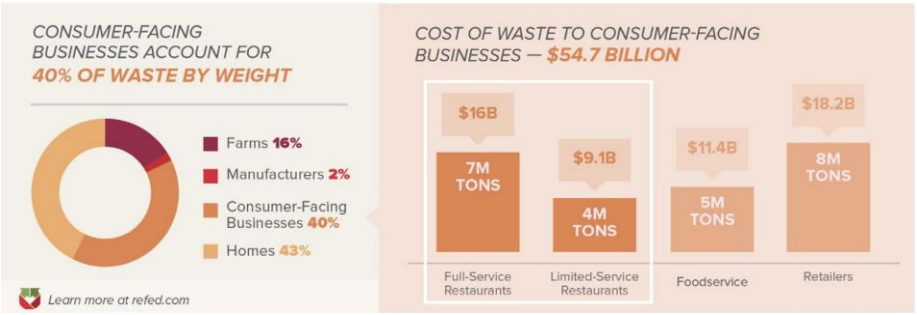
Food waste from grocers and restaurants emits nearly as much carbon dioxide as the entire airline and shipping industries combined.

The Issue: Food Waste and Carbon Footprints

Over 700 million people suffer from food insecurity – they do not know where their next meal will come from.[1] Each year, 9 million of these people die of hunger and related diseases. **Despite these staggering metrics, over 1/3 of food produced globally is wasted.**[2] Across industrial and developing nations alike, this waste epidemic stems from massive inefficiencies across the food life cycle. While waste does occur in the household and on the farm, recent studies have identified that nearly 40% of food waste occurs within the consumer retail supply chain: in grocery stores and restaurants.[3] Globally, over half a billion tons of food are wasted annually just within these retail systems.[4] This staggering quantity has generated immense attention and investment across the industry.

In addition to the more apparent issues of food inequality and malnutrition across the globe, food waste presents yet another global concern: greenhouse gas emissions. Food waste from consumer-facing retailers accounts for ~3% of global carbon emissions.[5] Totaling to nearly 1.8 billion tons of carbon dioxide equivalent (CO_2e) annually,[6] **food waste from grocers and restaurants emits nearly as much carbon dioxide as the entire airline and shipping industries combined**.[7] Addressing this sector of food waste would be equivalent to taking nearly 13 million cars off the road each year.[8] This vast impact stems from the fact that spoiled food wastes not only the carbon in the food itself, but also avoidable



[1] "Global Issues: Food." United *Nations*, United Nations, 2021, www.un.org/en/global-issues/food#:~:text=Current%20estimates%20are%20that%20nearly,are%20still%20found%20in%20Asia. Accessed 12 August 2021.

[2] "Worldwide Food Waste". United Nations Environmental Programme, 2020, https://www.unep.org/thinkeatsave/get-informed/worldwide-food-waste. Accessed 12 August 2021.

[3] Oakes, Kelly, "How Cutting Your Food Waste can Help the Climate". BBC Future, 25th February 2020, https://www.bbc.com/future/article/20200224-how-cutting-your-food-waste-can-help-the-climate . Accessed 12 August 2021.

[4] "Worldwide Food Waste"

[5] Oakes, Kelly, "How Cutting Your Food Waste can Help the Climate"

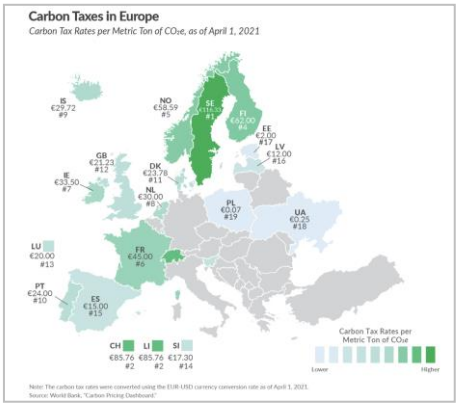
[6] ibid

[7] Ritchie, Hannah, "Sector by Sector: Where do Global Greenhouse Gas Emissions Come From?". Our World in Data, 18th September 2020, https://ourworldindata.org/ghg-emissions-by-sector. Accessed 12 August 2021.

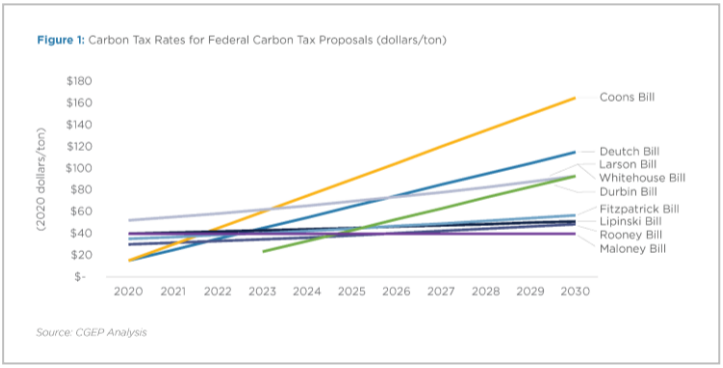
[8] "Fight climate change by preventing food waste". World Wildlife Fund, 2021, https://www.worldwildlife.org/stories/fight-climate-change-by-preventing-food-waste. Accessed 12 August 2021.

emissions from its transportation, refrigeration, and packaging. In addition, food waste makes up the fourth largest material thrown in landfills.[9] Here, the organic waste produces methane, a dangerous chemical that contributes heavily to climate change. Food waste is much more than just detritus; it is killing our environment. Accordingly, many sustainability departments across the retail space have recognized this holistic view of food waste emissions and begun to invest in tracking and decreasing their waste.

Taxes and Regulation



In addition to the environmental toll of carbon emissions, another impetus for large retail chains to decrease their emissions is the imminent increase in carbon taxation globally. Currently, the European Union(EU) is in a position where carbon taxes are more widely accepted and present with 18 nations having carbon emission taxes ranging from €0.07 per ton of CO2e in Poland to €116.33 in Sweden. On average, the tax rate is €35.91 per ton of CO2e; however, these taxes only cover 34% of emissions in each country.[10] Moreover, the EU also recently implemented a carbon import tax which shows movement towards making a more universal carbon tax. On the other hand, the US currently has a cap and trade system in place in which companies are given an allotment for carbon credits which they can buy or sell from other companies. However, there are currently nine proposed bills in the US Congress for carbon taxes with immediate tax rates ranging from just under $20 to roughly $50 per ton of CO2e and tax rates increasing to $30-$160 by 2030.[11] Although similar to the EU, these carbon tax proposals will not cover all emissions. The International Monetary Fund (IMF) currently advocates for an increase in the global carbon tax. The current global average price per ton of CO2e is $3.00. If the average global tax rose to $50, the consumer facing retailers in the food



[9] "National Overview: Facts and Figures on Materials, Wastes and Recycling". United States Environmental Protection Agency, 2021, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials. Accessed 12 August 2021.

[10] Asen, Elke, "Carbon Taxes in Europe". Tax Foundation, 8th October 2020, https://taxfoundation.org/carbon-taxes-in-europe-2020/. Accessed 12 August 2021.

[11] "What You Need to Know About a Federal Carbon Tax in the United States". Center on Global Energy Policy at Columbia, 2019, https://www.energypolicy.columbia.edu/what-you-need-know-about-federal-carbon-tax-united-states. Accessed 12 August 2021.

space would face $75 billion in carbon taxes annually.[12] For an individual mid-sized retailer, carbon taxes from food waste alone could cost nearly $25 million annually. This is quickly becoming a new, growing cost that retailers will have to account for. Accordingly, investing in tools to decrease waste and thus reduce carbon emissions has become commonplace as the market continues to grow.

Industry Awareness

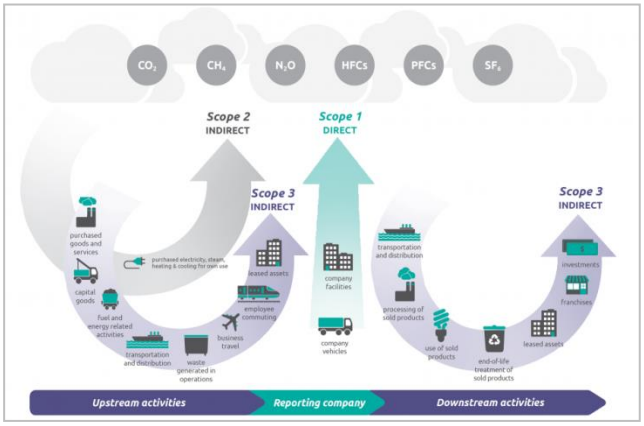
Whether motivated by the food waste epidemic, climate change, or the impending carbon taxes, food retailers and manufacturers are becoming more and more interested in setting goals for reducing their food waste and carbon footprints. Many of these companies are not only setting goals for carbon reduction, but are also reporting their own carbon emissions in Environmental, Social, and Governance (ESG) and sustainability reports. European companies seem to be the most pressed to reduce their emissions as the EU aims to be climate neutral by 2050 and to reduce emissions by at least 55% by 2030.[13] In addition to companies aiming towards eliminating their carbon emissions, many in the food retail space have also set sustainability goals of reducing their waste. This interest is mirrored with investment: multiple retailers across the food and grocery sector are investing upwards of $1 billion in order to meet their ESG targets in the coming years.

"Sustainability is no longer about staying ahead, but about not getting left behind"

— Women's Wear Daily

The Solution Space

There are various ways in which a business can reduce its emissions in order to meet its ESG goals. One of the most popular frameworks for analyzing emissions is the Greenhouse Gas (GHG) protocol. The GHG protocol breaks carbon emissions into 3 dimensions Scope 1 emissions are "direct emissions from sources that are owned or controlled by the Agency." Scope 2 emissions are "indirect emissions from sources that are owned or controlled by the Agency." Scope 3 emissions are all other GHG emissions not covered by scopes 1 or 2. While Scopes



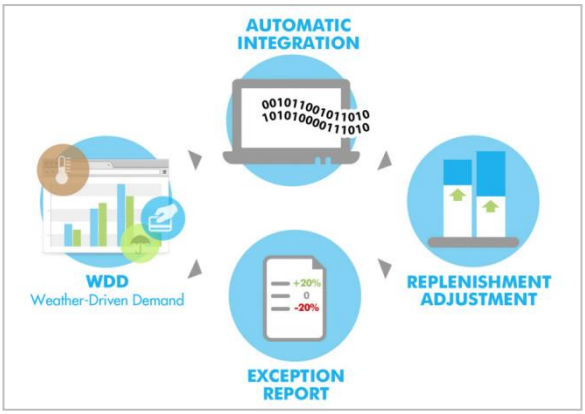
[12] Parry, Ian, "Proposal for an International Carbon Price Floor Among Large Emitters". International Monetary Fund, 18th June 2021, https://www.imf.org/en/Publications/staff-climate-notes/Issues/2021/06/15/Proposal-for-an-International-Carbon-Price-Floor-Among-Large-Emitters-460468. Accessed 12 August 2021.

[13] "2030 Climate Target Plan". European Commission on Climate Action, 2021, https://ec.europa.eu/clima/policies/eu-climate-action/2030_ctp_en. Accessed 12 August 2021.

1 and 2 are easily quantifiable and measurable, Scope 3 is broad and indistinct with 15 subcategories of emission sources.[14] Companies have instituted a variety of initiatives to decrease Scope 3 emissions, such as redirecting waste to recycling plants, replacing product packaging, or investing in new refrigeration and greener transportation. However, many of these initiatives are time-intensive, necessitate heavy upfront investments, and require staff and clients to change their behaviors. Despite the challenges, there are simple, effective, scalable, and repeatable activities that food retailers can employ to reduce their scope 3 emissions in multiple categories such as waste generated in operations, transportation, and purchased goods and services all without time-intensive, capital heavy investment.

Demand Analytics Reduce Waste

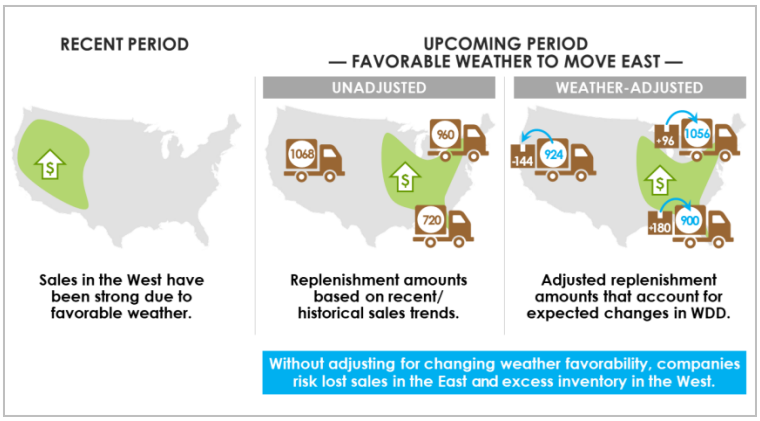
While there exist many methods to decrease waste and cut emissions across a company's supply chain, very few solutions focus on decreasing waste before it ever occurs. A highly controllable sector of sustainability, companies that can more accurately predict consumer demand and adjust their replenishment systems accordingly can reduce waste before ever needing to recycle or compost. Moreover, more accurate demand planning is highly profitable as it also increases on-shelf availability and lowers inventory costs. Improving demand analytics is a sustainability solution that unlocks new profitability, all without the need to change hardware, overhaul existing systems, or alter the habits of clients and workers.



Identifying and proactively managing the factors that drive demand fluctuations is a powerful way for companies to improve performance and reduce waste. Planalytics helps businesses do this by developing demand models from historical sales data and the most impactful external environmental driver of demand — the weather. Planalytics precisely measures this hidden component that directly and frequently influences the consumer's needs, wants, and purchasing mindset while factoring in how demand responses vary for people across different locations, times of the year, demographic groups, as well as, commercial factors such as price and promotions.The resultant weather-driven demand analytics quantifies the specific influence of weather on demand, providing a preventative solution in waste management. Weather-driven demand analytics specificies the impacts of weather on individual products and locations, and does so at scale. A common benefit realized is improvement to demand forecast accuracy, typically up to 30% annually for individual categories. Moreover, these demand analytics are designed to seamlessly integrate into existing Enterprise Resource Planning (ERP) systems which results in significant waste reduction and a decrease in carbon emissions.

[14] "Greenhouse Gases at EPA". United States Environmental Protection Agency, 2021, https://www.epa.gov/greeningepa/greenhouse-gases-epa. Accessed 12 August 2021.

Demand planning is an inexact science. Most retailers lean heavily on recent sell rates to determine how much to replenish in different regions or individual stores. While the recent sales trend is important, it is distorted by the weather conditions that have occurred and it is not factoring in how upcoming weather conditions are going to change sales volumes. Weather and its effects on sales can change significantly from product-to-product, day-to-day and from store-to-store, retailers often end up understocked in some locations and overstocked in others. This is where Planalytics derives our unique value for large retail chains. Through an analysis of historical sales data,Planalytics creates our Weather-Driven Demand (WDD) metrics. These proprietary WDDs isolate and quantify the impact of the weather alone on demand and are delivered as easy to action percent- or unit-based adjustments. These business-friendly analytics allow a company to understand true impacts of weather-the second largest driver of consumer behavior-as well as account for weather impact in financial reporting. However, the most potent ROI from our WDDs occurs when Planalytics seamlessly integrates our analytics directly into a grocers' existing replenishment solution or enables exception reporting to flag products and locations that have the largest weather-driven demand variations and need to be reviewed for manual overrides. Done effortlessly at scale, this type of integration enables more efficient, purposeful replenishment across every individual SKU.



Within 180 days, businesses that use weather-driven demand analytics to tune replenishment quantities will realize benefits including improved on-shelf availability, increased sales, lower inventory costs, and enhanced customer satisfaction and loyalty. In addition, from a sustainability perspective, improved replenishment forecasts will lead to measurable and meaningful waste reduction across the entire company. Without replacing hardware or changing habits, sustainability officers can smoothly drive waste and emissions reduction. Planalytics clients employing this simple yet effective approach have achieved waste reductions of up to 35% across all categories. As many sustainability initiatives are focused on halving or eliminating food waste, the power of weather analytics will begin to realize sustainability goals rapidly. Moreover, we can decrease carbon footprints by over 2%. Improvements from weather analytics catapult a company toward its sustainability goals, capable of completing over half of most ten year plans within a matter of months.

Weather-driven demand analytics reduces food waste before it ever occurs. Instead of overhauling disposal methods to redirect waste from landfill or replacing trucks with more expensive electric vehicles, invest in our Planalytics solution: an effortless, easy software integration that will propel your company toward achieving your sustainability goals.

The Impact of Weather-Driven Demand Analytics

Weather is the second largest driver of consumer behaviour. Planalytics uses a proprietary weather impact analysis to estimate the potential benefits our technology can have on individual categories and across entire companies. Below is a graphic that demonstrates these potential impacts for a variety of grocers in both the United States and Europe. Weather demand analytics, once integrated with existing ERP systems, has the potential to reduce waste by an average of 11.6%. This sharp decrease in waste corresponds to an average of over 4% in decreased emissions. Decreasing waste and emissions helps reach sustainability goals, but also has real financial implications. Included in the graphic to the right are the potential tax savings from the decreased carbon emissions. In the UK, the carbon tax is roughly $25 per ton of CO_2 emissions. The chart below displays the carbon tax savings calculated by multiplying the total emissions that Planalytics can save various British grocery retailers multiplied by $25. As taxation and regulation around ESG reporting continues to grow, these costs will continue to increase. In these ways, Planalytics technology drives sustainability progress while simultaneously unlocking new profitability opportunities.

Company Name	Dollar Savings ($)	Waste Savings (US tons)	**Waste Savings %**	Carbon Savings (Metric Tons)	**Carbon Savings %**
Kroger	$98,990,000	43,417	15.0%	170,039	2.12%
Ahold Delhaize	$78,360,000	34,369	10.2%	118,134	0.16%
Sprouts Markets	$10,310,000	4,522	11.1%	16,365	3.37%
United Natural Foods	$7,600,000	3,333	23.2%	12,834	1.85%

Tying Reduced Food Waste with Decreased Carbon Emissions

Planalytics' demand analytics identifies the impact of weather on an individual location and product basis which allows retailers to improve forecasts and decrease waste. Especially for grocers and restaurants, this waste savings in food translates directly into carbon reduction as unsold food spoils and immediately goes to waste. To accurately assess the impact of these demand analytics, Planalytics has identified embodied carbon metrics as meaningful, holistic conversion factors that translate the benefits from waste savings to a carbon footprint reduction.

Embodied Carbon metrics are powerful tools that account for the total carbon footprint of a variety of foods. The metrics convert kilograms (kg) of food into kg of carbon by assessing the comprehensive carbon impact across the life cycle of each food type. The emissions factor for a product includes not only the emissions from production to the farm gate, but also emissions from the transportation,

processing, packaging, storage, and store operations associated with each food type. These calculations draw on the methodologies of the GHG protocol, a widely respected organization focused on quantifying carbon impact, as well as a range of secondary scientific articles. The study being referenced, "Mitigating the greenhouse gas emissions embodied in food through realistic consumer choices," analyzes 66 different product categories which facilitates a bottom-up analysis of carbon emissions.[15] Additionally, to perform an initial carbon impact assessment, the methodology utilizes an average across all the food categories of 4.69 kg of CO_2 per kg of food. This embodied carbon average allows for the translation of food waste savings into carbon emissions savings. .

In addition to the embodied carbon metrics, Planalytics methodology accounts for common recycling and diversion rates. The approach focuses on the core principle that sustainable disposal, such as composting, incineration, donation, or conversion to animal feed reclaims some of the carbon used in the production of each food. Meanwhile, unsustainable disposal methods, such as landfilling, add to the carbon footprint of food as landfilling releases methane, a dangerous greenhouse gas. Using this philosophy, we account for each company's diversion rate, or percentage of food waste that is not landfilled. Our calculations for this approach are centered around another scientific article entitled "Greenhouse Gas Emissions of Food Waste Disposal Options for UK Retailers."[16] In this article, the authors again utilize a holistic approach to disposal options by accounting for various transportation, processing, and energy reclamation effects. For our conversions, we categorize waste disposal into landfill or recycling. For landfilled waste, we add an additional .58 kg CO_2 per kg food to account for methane emissions in landfill. Simultaneously, for sustainable disposal such as recycling or composting, we subtract 1.266 kg CO_2 from the embodied carbon number to account for the "reclaimed" carbon in recycling.

Formula to Convert Dollar Savings into Waste Savings (US Tons)

$$Waste = Dollars * \frac{1}{1.14} * \frac{1}{2000}$$

$$= Dollars * 4.386 * 10^{-4}$$

Formula to Convert Dollar Savings into Carbon Emission Savings (Metric Tons)

$$= Dollars * (\frac{1}{1.14}) * (.45) * (\frac{1}{1000}) * ((1 - DR) * (4.69 + .58)) + DR * (4.69 - 1.266))$$

$$= Dollars * 3.947 * 10^{-4} * (5.27 - 1.836 * DR)$$

Dollars: Waste Savings and Inventory Write Off Reduction (Medium) from Level 2 Analysis

DR: Diversion Rate (A company's reported percentage of waste that does NOT end up in landfill)

Planalytics methodology combines the information and results of both of these studies to create a conversion factor. Alongside a company's published diversion rate, the methodology can employ common industry standards and metrics. Using this data, we create a potential low, medium, and high impact on waste and carbon emissions for each company. These goals directly correlate with the sustainability goals for each business. For example, Sprouts grocers is a mid-sized US grocer that employs 35,000 workers and operates more than 340 stores in 23 states. Planalytics estimates that our replenishment module can be installed within 180 days and would decrease Sprouts' food waste by 40,651 Tons. This represents over an 11% reduction when compared to their reported 2020 food

[15] C. Hoolohan, M. Berners-Lee, J. McKinstry-West, C.N. Hewitt, "Mitigating the greenhouse gas emissions embodied in food through realistic consumer choices", Energy Policy, Volume 63, 2013, Pages 1065-1074, (https://www.sciencedirect.com/science/article/pii/S0301421513009701)

[16] J.A. Moult, S.R. Allan, C.N. Hewitt, M. Berners-Lee, "Greenhouse gas emissions of food waste disposal options for UK retailers", Food Policy, Volume 77, 2018, Pages 50-58,ISSN 0306-9192.(https://www.sciencedirect.com/science/article/pii/S0306919217309168)

waste. Additionally, this type of reduction would eliminate over 16,365 mTons of carbon annually. These savings represent over 3% of the company's reported emissions from 2020. These types of improvements will instantly catapult Sprouts towards their goals of becoming a Zero Waste and Net Zero Carbon company without the need to change systems or replace expensive hardware.

Getting Started

We are surrounded by crises. Whether hunger, pollution, or climate change, it has become incumbent on corporations of all sizes to take steps to ensure the sustainability of our planet and people. Of these initiatives, waste and carbon footprints have risen to the forefront as powerful, qualitative KPIs. These metrics have attracted not only the attention of consumers and investors, but also those of many legislative bodies. Increased taxation and regulation in ESG reporting have begun a new era in sustainability-one mired in economic and political incentives. Regardless of the motivation, it has become clear that reducing waste and carbon footprints have become critical to business operations. While there exists a variety of solutions in recycling programs and sustainable sourcing, very few focus on stemming waste before it ever occurs. Planalytics demand analytics has the unique ability to isolate the impact of weather on consumer purchasing. Leveraging quantitative metrics to adjust replenishment systems in a scalable and sustainable manner, business will quickly see meaningful results including increased sales, improved on-shelf availability, and significantly decreased waste. This waste reduction, both financially and environmentally friendly, will immediately propel companies of all sizes and locales toward their sustainability goals. To take the next steps in reaching your climate and waste goals, contact us at www.planalytics.com or 800.882.5881.

About Planalytics®

Planalytics, www.planalytics.com, is a global leader in predictive demand analytics that enable retailers to understand the customer context driving buying decisions and take action at scale.

Consumer behavior is complex, often chaotic, making it essential for companies to systematically factor in key influencers of purchasing in order to anticipate demand, increase customer satisfaction, and improve financial performance. Planalytics' integration-ready metrics make it possible for retailers to leverage existing technologies to operationalize product-specific, localized demand insights across the entire enterprise or product range.

Planalytics applies advanced statistical methods and machine learning, mountains of sales data, years of unmatched retail demand expertise to the most omnipresent external influencer of purchasing – the weather — to provide businesses with a proven and measurable return on investment. The resource-light, automated demand analytics make a company's existing systems smarter immediately with full payback typically captured within 180 days.

Powerful. Scalable. Frictionless. Seriously Profitable.
Demand More.

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