Overview of Assessment Methodology

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Zero Foodprint operates under a guiding principle: that restaurants and diners can lead the fight against climate change. The first step in this fight is to understand how restaurants and diners individually contribute to climate change – after all, knowing is half the battle. Analyzing a restaurant's carbon footprint will identify the contributing factors that add up to a restaurant's impact on climate change, and Zero Foodprint will work with restaurants to take action to reduce that foodprint.

With this in mind, Zero Foodprint developed a program to quantify a restaurant's *foodprint* using a standard assessment methodology. We define a *foodprint* as the total greenhouse gas emissions resulting from the preparation and serving of meals from a restaurant's operation over the span of a year, including life-cycle emissions from the production and procurement of ingredients.

Life cycle assessment (LCA) investigates and evaluates impacts all the way from extraction of basic materials from nature, through processing, packaging, distribution, warehouse refrigeration, product use, and end-of-life. So, for example, the life-cycle emissions from milk start with the inputs into feed for the cows all the way through the delivery to your restaurant. An LCA study for a single ingredient is a complex process, and typically evaluates impacts in addition to carbon. We do not conduct our own LCA studies, but rather we pull CO_2 emissions factors from publicly available LCA studies of ingredients.

> An emission factor is the average emission rate of CO_2 for a given source, relative to units of activity or measure.

The *foodprint* we calculate is comprised of the following categories: energy use, transportation, waste, and life cycle emissions of the ingredients. Whether a rigorous estimate based on an ingredient inventory will be performed or the simplified questionnaire approach, the first step is to gather information. An inventory of purchased foods by weight, records of utility bills, and details about the restaurant's waste characteristics are the kinds of information typically collected. Other information we gather often includes restaurant square-footage, days closed for holidays etc., whether there are any special international shipments, and the number of covers per week.

Energy Use and Transportation

Onsite energy use generally consists of electricity to run the building and natural gas for kitchen equipment. Some kitchens might even use propane, charcoal or wood. All of this energy use is captured in the *foodprint*, as well as any offsite energy usage directly related to the restaurant operations such as laundry services or any cooking that occurs at a neighboring facility.

Transportation emissions include deliveries of ingredients to the restaurant and take-out or catering deliveries to customers, whether with employee vehicles or a restaurant-owned fleet. Upstream transportation of ingredients, such as from the farm to a wholesale warehouse will be captured in the life cycle emissions discussed below in the ingredients section.

To quantify greenhouse gas emissions from energy use and transportation, we follow internationally accepted guidelines. The Greenhouse Gas Protocol, published by World Resources Institute and the World Business Council for Sustainable Development (WRI/WBCSD), provides the methodology and default emission factors for the quantity of pollutants released to the atmosphere due to various fuel combustion activities. However, as we understand the recordkeeping of each organization will vary, we strive to work with a variety of data inputs. For example if the electricity purchases are unavailable, we would estimate the electricity consumption based on square footage and turn to energy intensity factors for restaurants published in the federal Commercial Buildings Energy Consumption Survey. Similarly, if take-out deliveries are applicable for the *foodprint*, fuel records of the fleet would be the ideal data source but more likely we would estimate mileage based on the number of deliveries made each week or the weekly miles driven by each vehicle or driver. For any offsite energy consumption we estimate based on best available information (i.e. frequency of pickup as a proxy for laundry services).

The transportation emissions of foods can be estimated in a number of ways. Our preferred method is to use the general LCA emissions figures for transportation from the farm or packing facility all the way to the wholesaler, and use vendor-specific distances to calculate emissions from the wholesaler to the restaurant. This last part relies on the weight of goods shipped and the distance from each of the vendors to the restaurant along with WRI emission factors for freight transport.

While the emission factors from natural gas, diesel, and other fuels generally do not change, the emission factors from electricity do vary from region-to-region and year-to-year as the specific fuel sources for power plants change. We use the latest published emission factors for the relevant electric utility provider, if available, or else turn to the Emissions & Generation Resource Integrated Database (eGRID) for regional electricity emission factors.

Waste

Food waste contributes emissions to the *foodprint* in two ways: waste hauling and waste decomposition. Emissions arising from the hauling all waste streams (garbage, recycling, composting and used oil) are quantified based on the number of pickups and the respective bin sizes, the hauling distance, along with the appropriate WRI emission factor. We allocate the hauling trucks' emissions to the restaurant based on their total garbage bin capacity relative to that of the hauling truck.

Waste decomposition of mixed garbage occurs anaerobically, which generates methane emissions, while compost breaks down the food scraps aerobically and creates small amounts of fugitive methane and nitrous oxide emissions. Starting with the number of garbage bins at a restaurant and their pickup frequency, we can estimate the annual weight of garbage going to a landfill and food scraps heading to a compost facility. EPA's Waste Reduction Model (WARM) provides landfilling net emissions factors (in GHGs per ton of waste) on a national average as well as fugitive emissions from composting.

Note that we do not attribute any emissions to the recycling or reuse of fryer oil, as we do not consider the repurposing efforts part of the restaurant's *foodprint*.

Ingredients

An important aspect of the *foodprint* that expands on traditional greenhouse gas inventories is that we include life cycle emissions from the production and acquisition of foods and beverages.

We have compiled an extensive list of readily available life cycle emission factors from peer-reviewed journal articles, government-sponsored LCA studies, and web-based databases to estimate emissions from the production and distribution of ingredients. For the ingredients purveyed to the restaurant we apply life cycle emission factors against the total quantity over the span of one year. As we are already capturing the emissions associated with the final delivery from wholesaler to restaurant in the transportation section, the cooking emissions in the energy section, and the end-of-life emissions in the waste section of the *foodprint*, we take care to back those aspects out of the LCA emission factors to avoid any double-counting.

Since we are using published factors rather than conducting our own in-depth LCA studies, actual ingredient sourcing may very well differ from the generic LCA-path we use. For example, the GHG emissions associated with a kilogram of processed honey, per a report conducted out of University of California, Davis to the National Honey Board[1], is based on surveys of a range of six U.S. beekeepers from five states as well as surveys of five large scale processing and packing facilities. Through these surveys the researchers assigned average characteristics on material and energy inputs required to produce and pack honey, and utilized information like the average travel distance from beekeepers to honey packers. When we see honey as a line item on a restaurant's ingredient inventory, we assign the LCA emissions concluded by the Davis study, which may not reflect the actual material use, energy inputs and travel distances associated with the honey that was actually served at this particular restaurant.

Additionally, actual emissions are understood to vary considerably from region-to-region and across the multitude of different producers. Similarly, the most widely available LCA studies are based on conventionally produced foods (i.e. feedlot/grain-finished beef as opposed to pasture raised beef). As a result, we may not capture benefits associated with foods that are organic, derived from grass-fed animals, or otherwise anticipated to differ from conventional production until the science catches up with these practices.

In some instances, allocation of emissions is needed to account for a process that results in multiple co-products varying in value. For example, certain cuts of beef are more expensive and an increased demand of those cuts is thought to drive further production of beef cows – in effect owning a larger share of responsibility for the greenhouse gases associated with production of that animal. On the other end of the spectrum we want to assign fewer emissions to the offal and the inedible portions of an animal, as those markets are generally secondary to the primal cuts. This economic allocation is performed using the approach outlined in PAS 2050: Specifications of the life cycle GHG emissions of goods and services, published by the British Standards Institution, the Carbon Trust, and the Department for Environment, Food & Rural Affairs (DEFRA). For market pricing we turn to USDA reports such as the Annual Meat Trade Review or the Weekly By-product Drop Value.

The Foodprint as a tool for change

Once the above methodology has been carried out on a restaurant and the *foodprint* is established, we can use this information as a tool for change. Though we have a small list of caveats and can expect a certain margin of error with these emission factors, the idea is that we can identify the relative order of magnitude that each aspect of the *foodprint* contributes to the overall, and how they compare to other restaurants for benchmarking and identifying room for improvement. If energy use stands out, we can look for opportunities to increase efficiencies. Maybe certain procurement practices are having a larger impact than expected. With that said, we expect to find the unexpected and we hope to be surprised, as these findings offer us the agents for change, one restaurant at a time.

[1] Kendall, A., Yuan J., Brodt, S., and Jan Kramer, K. 2010. Carbon Footprint of U.S. Honey Production and Packing