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A Sustainability Analysis of Team Orange County's Home Life Events During the U.S. Department of Energy: 2015 Solar Decathlon

Lauren Sato
Chapman University, sato112@mail.chapman.edu

Alexandra FW Sidun
Chapman University, sidun100@mail.chapman.edu

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Sato, L. H., Sidun, A. F.W.
Chapman University

Introduction

This project will look at the U.S. Department of Energy's 2015 Solar Decathlon and examine Chapman University's involvement in Team Orange County. This project will further examine the Home Life sub-competition by studying the sustainability of the components of the two Home Life dinners, the movie night party, and the energy budget associated with each of the three events. Reviewing team documents and collecting data from affiliated team members will give us an overview of the efforts taken to achieve sustainability for the dinners and movie night. We found various practices were incorporated in the menu-concepts for the three nights, during which these events were hosted, which integrated sustainable practices to embody the goal of the U.S. DOE's Solar Decathlon. Finally, the overall sustainability of these three hosted events will be correlated to the net-zero nature of the home, Casa del Sol, and the impacts of these dinners in regards to the average meal and movie night to understand the sustainability of this sub-competition.

Figure 1: Rendering of Team Orange County's "Casa del Sol," submission to the U.S. Department of Energy's 2015 Solar Decathlon

Research Questions

In order to analyze the sustainability and impact of Team Orange County's efforts, we asked:

- How does a plant-based diet compare to a standard omnivorous diet, in regards to environmental impact?
- How are food, entertainment, & home life conceptualized as sustainable activities? Just how sustainable are these activities?
- How are the choices made in the meals selected & served reflective of sustainable living? What does the research tell us about this?
- What was the water footprint of food served during the competition, compared to a typical American meal of equal caliber?

Methods

In order to fully understand the sustainability of these three hosted events, a water footprint analysis was done for the ingredients of the meals and the energy demand of the food's production (based on trophic level source) was all taken into account. Information on the menus was sourced from Team Orange County's Home Life work group, which were submitted in the August 2015 deliverable for the U.S. DOE's Solar Decathlon requirements. This analysis will focus on the specific calculations for each individual ingredient, in terms of associated water budget to understand the immediate impact such menus would have on California's extreme state of drought.

Furthermore, and overall examination of plant-based diets was completed for a better understanding of the various facets in food consumption and the often hidden environmental impact of uninformed food choice.

Theoretical Framework

Principles of Sustainability:

•Primarily plant- and seafood-based diets (responsibly grown and harvested)
•Energy efficient food preparation (in relation to appliance efficiency and source of energy)

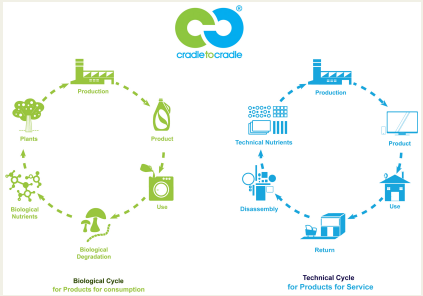

Figure 2: Cradle-to-cradle cycle framework; Source: www.c2cplatform.tw

Food	Meat-based diet[2]	Energy	Protein	Lactoovovegetarian diet[2]	Energy	Protein
	kg	*kcal*	*g*	*kg*	*kcal*	*g*
Food grain	114	849	24.9	152	1132	33.2
Pulses (legumes)	4.3	40	2.0	7.5	70	4.5
Vegetables	239	147	6.6	286	155	8.8
Oil crops	6	71	3.0	8	95	4.0
Fruit	109	122	1.4	112	122	1.9
Meat	124	452	41.1	0	0	0
Fish	20.3	28	4.7	0	0	0
Dairy products	256	385	22.5	307.1	473	30.0
Eggs	14.5	55	4.2	19.2	73	5.6
Vegetable oils	24	548	0.2	25	570	0.2
Animal fats	6.7	127	0.1	6.7	127	0.1
Sugar and sweeteners	74	686	0.2	74	686	0.2
Nuts	3.1	23	0.6	4.0	30	0.8
Total	994.9	3533	111.5	1001.5	3533	89.3
Feed grains[3]	816.0	—	—	450.0	—	—

[1]Data from FAOSTAT (©).
[2]Estimated.
[3]Feed grains are cereal grains fed to livestock.

Table 3: Per capita food consumption, energy, and protein of foods of a meat-based diet vs. a lacto-ovo-vegetarian diet in the U.S.

"Making a sustainable future feel like home."

Figure 3: Spread of dishes from one of the dinners
Source: Team Orange County Solar Decathlon 2015

Figure 4: Vertical garden utilizing drip-irrigation from grey water and rain water catchment systems in the home. Everything being grown is edible.
Source: http://teamoc2015.com/

Results:

Casa del Sol Dinner Course	Water Footprint for Ingredients (per serving)	"Control" American Dinner (1 plate setting)	Water Footprint for Ingredients (per serving)
Apple Pecan Salad with sourdough crostini (2 cups)	253.50 L, or 66.9 gallons	Grilled asparagus (8oz)	162.6 gallons
DIY Shrimp Street Tacos, with avocado puree and sautéed vegetables (2 tacos with all ingredients)	684.24 L, or 180 gallons	Serving of beef (8oz)	850.2 gallons
Buttermilk Pana Cotta (1 5oz cup)	1,359.17 L, or 359.1 gallons	Roasted potatoes (6oz)	17.9 gallons
Watermelon Agua Fresca with mint (8oz)	114.09 L, or 30.14 gallons	Apple juice (80z)	33.8 gallons
TOTAL:	636.14 gallons	TOTAL:	1,064.5 gallons

Table 1: Water budget analysis for a dinner course served during the Home Life competition, in comparison to an American dinner of equal economic status

Casa del Sol Movie Snacks	Water Footprint for Ingredients (per serving)	"Control" American Snacks	Water Footprint for Ingredients (per serving)
Rich Mexican Hot Chocolate (12oz)	480 L, or 126.8 gallons	Soda (16oz)	32.2 gallons
Chocolate Coconut Date Mounds	191.15 L, or 50.5 gallons	Chocolate-Almond Candy Bar	264 gallons
TOTAL:	177.3 gallons	TOTAL:	296.2 gallons

Table 2: Water budget analysis for movie snacks served during the Home Life competition, in comparison to a typical American movie snack

Conclusions

Unsurprisingly, our plant-based, three-course meal had a much smaller water footprint associated with it than the one plate setting meant to represent a typical dinner in the United States of equal caliber (specifically in relation to socio-economic status). The snacks chosen for the movie were also much healthier, less processed, and more wholesome than the snacks chosen to represent the "control," or standard, movie snack by an equally significant water budget. It should also be noted that the foods used in the mostly plant-based menu for the Solar Decathlon Home Life competition were also more inherently efficient due to trophic-level dynamics and the efficiency rate of transfer from one trophic level to the next. This analysis can conclude the sustainability of the meal prepared for the 2015 Solar Decathlon (as well as the movie snacks) was admirably high due to the high-efficiency of appliances, associated water footprint, and solar-powered aspect of our kitchen versus the typical American home.

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