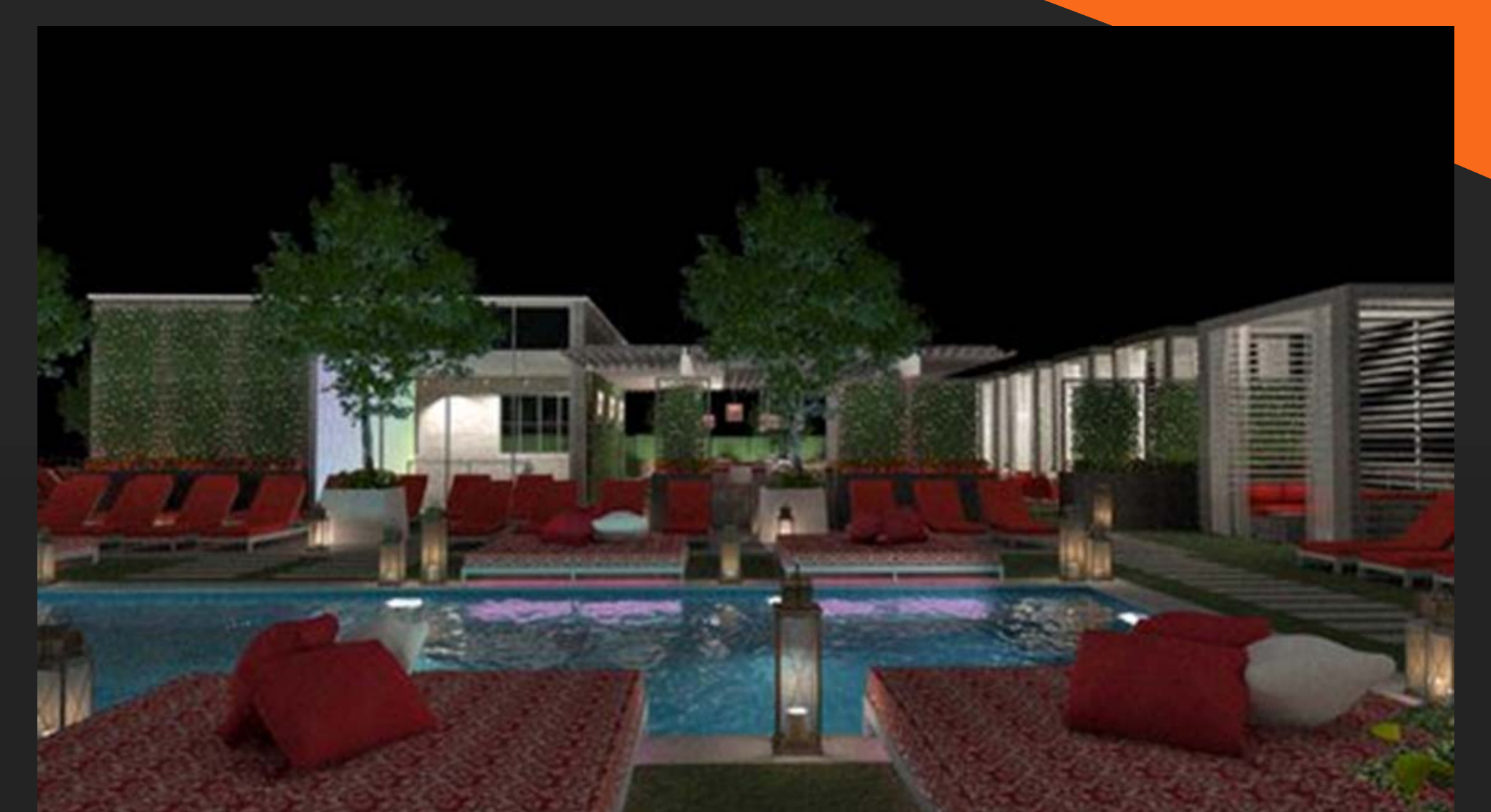
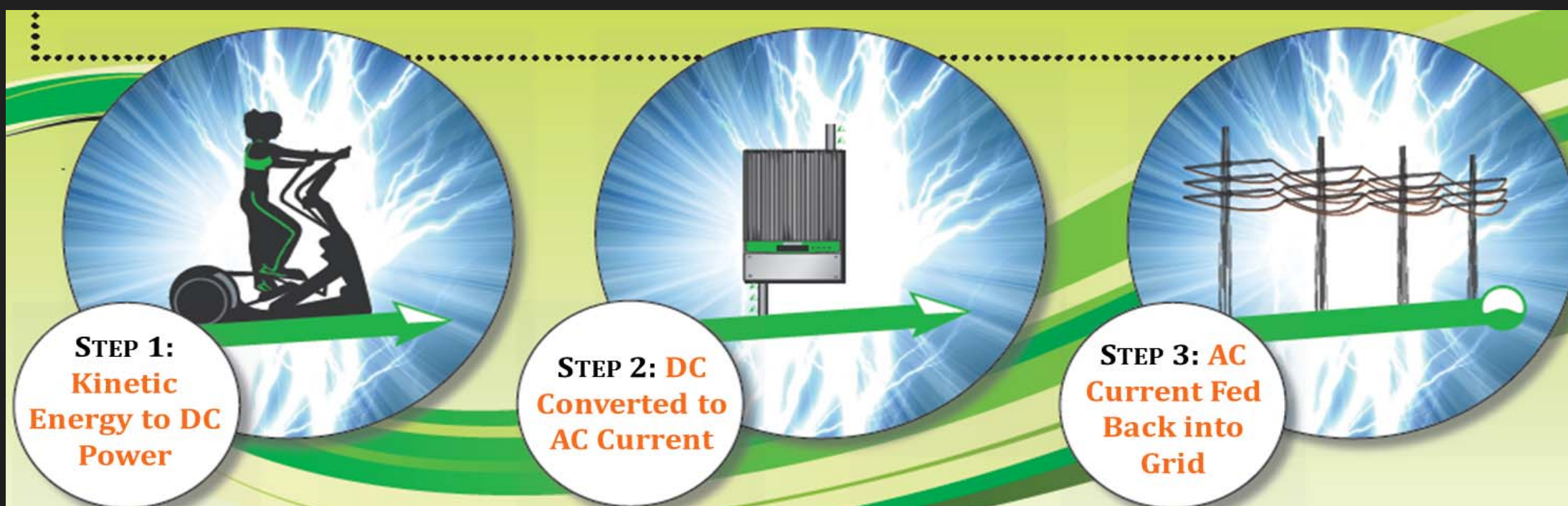


Clara Watson | Construction Option | Advisor: Dr. Robert Leicht | <http://www.engr.psu.edu/ae/thesis/portfolios/2012/CKW5012/index.html>



### Analysis 1: ReRev Energy Harvesting System

Captures kinetic energy produced in the form of DC power generated from cardio equipment use and converts it to AC power to be fed back into the grid



The Total ReRev System Cost Provided is \$148,000

PEPCO C&I Energy Savings Program: Total \$14,311.10  
 Brainstorming Renewable Energy Opportunities: \$1,000.00  
 Renewable Energy Simulation Analysis for first 50,000 SF: \$5,000.00  
 \$0.03 is available for each additional SF: \$311.10  
 Incorporating Designed Measures During Construction: \$8,000.00  
 D.C. Renewable Energy Incentive Program: Total \$16,500/Yr  
 Rise in Energy Costs Per Year: 5%  
 Estimated Monthly Air Conditioning Savings: 30%  
 Months of Air Conditioning Savings: 11.43  
 Watts Generated Per Year: 70,175,160  
 \$1.50 Provided for first 3,000 Watts Produced: \$4,500.00  
 \$1.00 Provided for next 7,000 Watts Produced: \$7,000.00  
 \$0.50 Provided for next 10,000 Watts Produced: \$5,000.00

Year	Annual KW Savings	Annual A/C Savings	Potential Pepco Incentive	Potential REIP Incentive	Total Savings	Potential Profit
1	\$ 9,080.67	\$ 2,594.80	\$ 14,311.10	\$ 16,500.00	\$ 42,486.57	\$ (105,513.43)
2	\$ 9,534.70	\$ 2,724.54	\$ -	\$ 16,500.00	\$ 71,245.81	\$ (76,754.19)
3	\$ 10,011.43	\$ 2,860.77	\$ -	\$ 16,500.00	\$ 100,618.01	\$ (47,381.99)
4	\$ 10,512.01	\$ 3,003.81	\$ -	\$ 16,500.00	\$ 130,633.82	\$ (17,366.18)
5	\$ 11,037.61	\$ 3,154.00	\$ -	\$ 16,500.00	\$ 161,325.42	\$ 13,325.42

(Annual kW Savings) + (Annual AC Savings) = Total Annual Cost Savings

Twenty Year Potential Profit of \$582,371.52

Kilograms of CO<sub>2</sub> Saved: 41,648 kg Annually

US EPA Study on Energy Generating Equipment:

- Improved understanding of renewable energy sources
- Increased amount of participants engaging in positive environmental behavior

LEED Gold Rating: 3 Additional Points for Renewable Energy

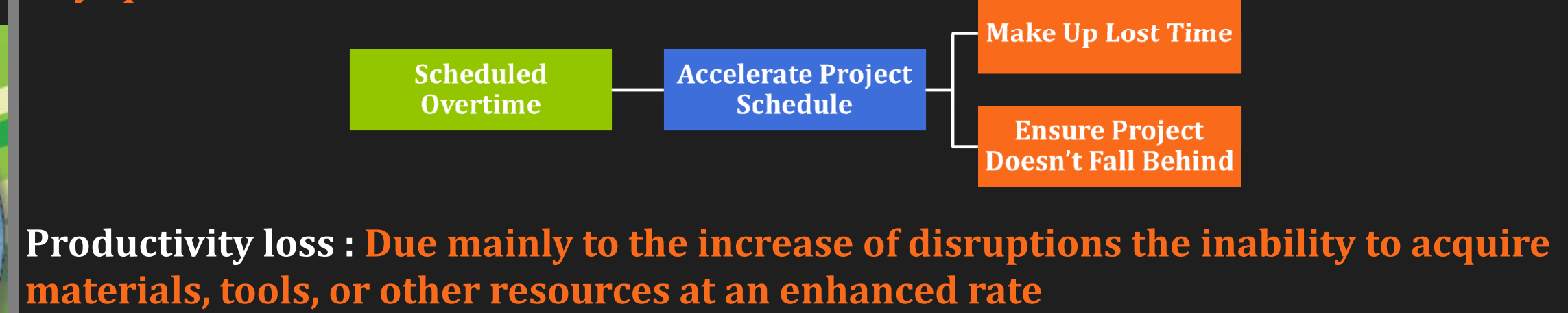
Instead of an **immeasurable** quantity people find difficult to relate to, ReRev allows for energy to become a **quantifiable value** tied to activities and decisions in everyday life.



All renderings courtesy of SvS Architects

### Analysis 2: Overtime Effects on Productivity

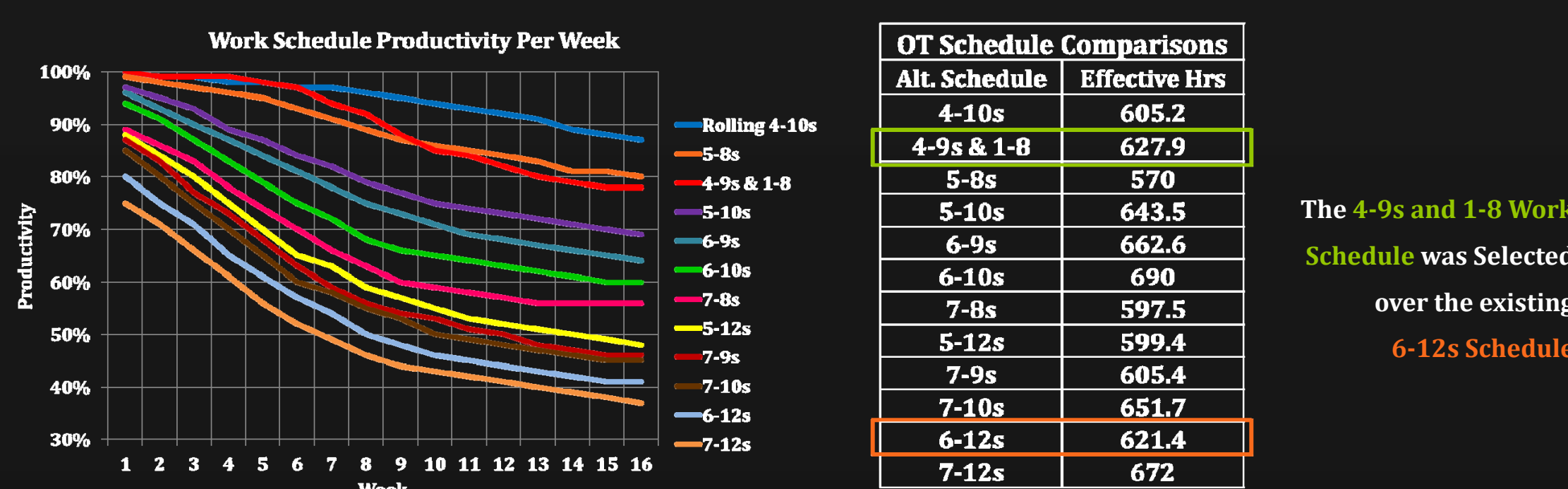
Productivity levels decrease with: Increases in the number of work hours and work days per week



Productivity loss: Due mainly to the increase of disruptions the inability to acquire materials, tools, or other resources at an enhanced rate

Electrical Subcontractor Lost Wages (6-12s)												
Week	Regular Hrs/Wk	OT Hrs/Wk	Productivity	Effective Regular Hrs	Effective OT Hrs	Regular Hrs Lost	OT Hrs Lost	Avg Laborer \$/Hr	OT Laborer \$/Hr	Lost \$ Per Laborer	Total Lost Wages	
1	40	32	0.80	32.0	25.6	8.0	6.4	\$ 48.25	\$ 72.38	\$ 849.20	6	\$ 5,095.20
2	40	32	0.75	30.0	24.0	10.0	8.0	\$ 48.25	\$ 72.38	\$ 1,061.50	9	\$ 9,553.50
3	40	32	0.71	28.4	22.7	11.6	9.3	\$ 48.25	\$ 72.38	\$ 1,231.34	9	\$ 11,082.06
4	40	32	0.65	26.0	20.8	14.0	11.2	\$ 48.25	\$ 72.38	\$ 1,486.10	11	\$ 16,347.10
5	40	32	0.61	24.4	19.5	15.6	12.5	\$ 48.25	\$ 72.38	\$ 1,655.94	11	\$ 18,215.34
6	40	32	0.57	22.8	18.2	17.2	13.8	\$ 48.25	\$ 72.38	\$ 1,825.78	9	\$ 16,432.02
7	40	32	0.54	21.6	17.3	18.4	14.7	\$ 48.25	\$ 72.38	\$ 1,953.16	8	\$ 15,625.28
8	40	32	0.50	20.0	16.0	20.0	16.0	\$ 48.25	\$ 72.38	\$ 2,123.00	9	\$ 19,107.00
9	40	32	0.48	19.2	15.4	20.8	16.6	\$ 48.25	\$ 72.38	\$ 2,207.92	10	\$ 22,079.20
10	40	32	0.46	18.4	14.7	21.6	17.3	\$ 48.25	\$ 72.38	\$ 2,292.84	10	\$ 22,928.40
11	40	32	0.45	18.0	14.4	22.0	17.6	\$ 48.25	\$ 72.38	\$ 2,335.30	9	\$ 21,817.70
12	40	32	0.44	17.6	14.1	22.4	17.9	\$ 48.25	\$ 72.38	\$ 2,377.76	12	\$ 28,533.12
13	40	32	0.43	17.2	13.8	22.8	18.2	\$ 48.25	\$ 72.38	\$ 2,420.22	12	\$ 29,042.64
14	40	32	0.42	16.8	13.4	23.2	18.6	\$ 48.25	\$ 72.38	\$ 2,462.68	15	\$ 36,940.20
15	40	32	0.41	16.4	13.1	23.6	18.9	\$ 48.25	\$ 72.38	\$ 2,505.14	12	\$ 30,061.68
16	40	32	0.41	16.4	13.1	23.6	18.9	\$ 48.25	\$ 72.38	\$ 2,505.14	11	\$ 27,556.54
Total				345.2	276.2	294.8	235.8			\$ 31,293.02		\$ 329,616.98

The Total Lost Wages for the Six Main Subs is \$1,539,481



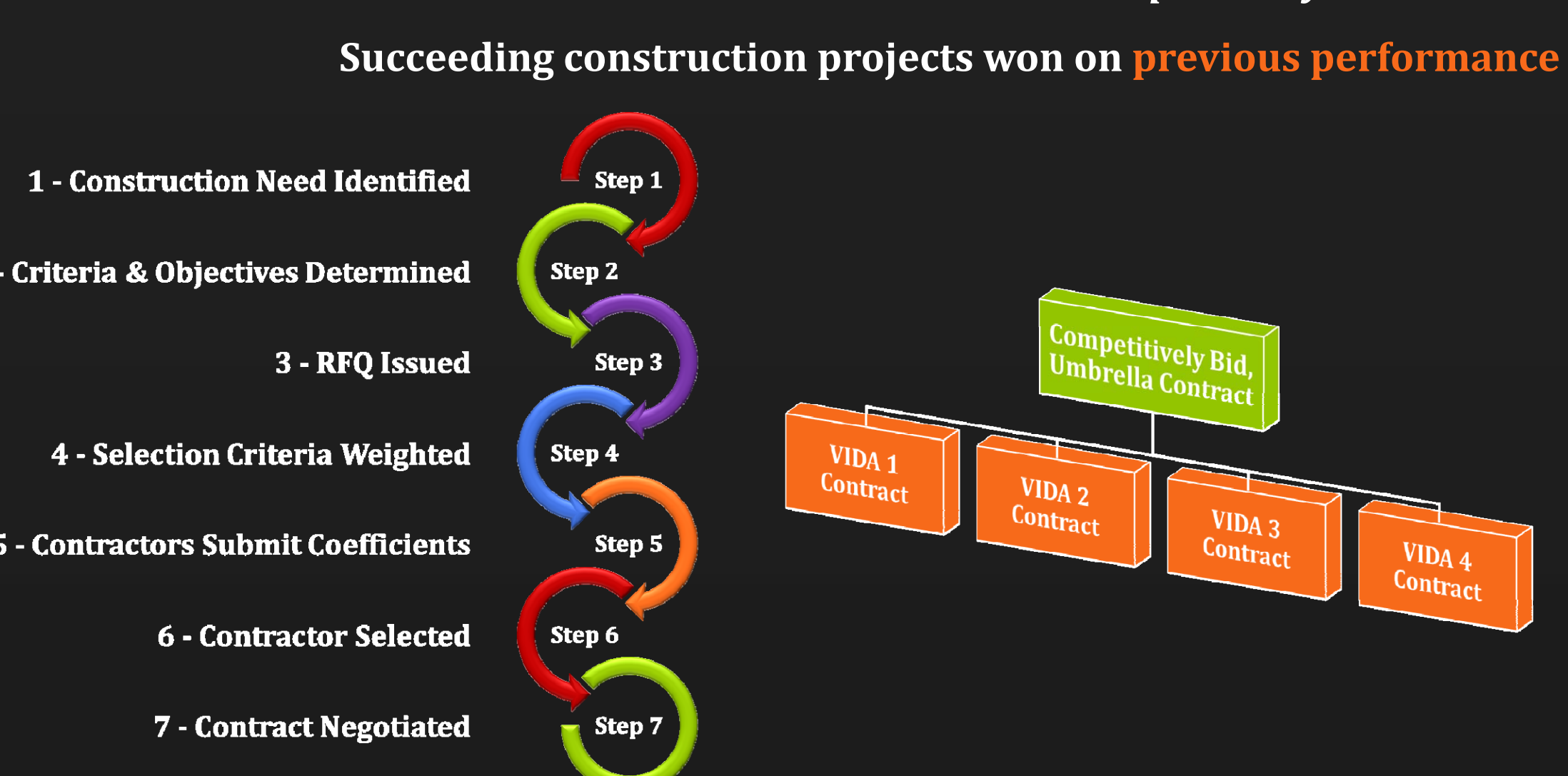
The 4-8s & 1-9 Schedule Saved \$1,346,619 in Labor Costs

### [ Project Overview ]

Building Location: 1612 U Street NW, Washington DC  
 Building Size: 60,370 SF  
 Number of Stories: 4 Stories + Penthouse/Accessible Roof  
 Occupancy / Function Type: Fitness Gym, Salon, Spa, Restaurant  
 Project Cost: \$14 Million  
 Project Delivery Method: Design - Bid - Build with Design Assist

### Analysis 3: Implementation of Job Order Contracting

Allows Owner to achieve many smaller contracts under the umbrella of a larger, competitively bid contract



Forrester Construction Cost Savings from Employing JOC						
VIDA Name	Square Footage	Cost/SF	Total Cost	Min Savings (9%)	Max Savings (21%)	Avg Savings (15%)
U Street	80,000	\$ 199.91	\$ 15,992,800.00	\$ 1,439,352.00	\$ 3,358,488.00	\$ 2,399,920.00
Metropole	65,000	\$ 199.91	\$ 12,994,150.00	\$ 1,169,473.50	\$ 2,728,771.50	\$ 1,949,122.50
Verizon Center	60,000	\$ 199.91	\$ 11,994,600.00	\$ 1,079,514.00	\$ 2,518,866.00	\$ 1,799,190.00
Renaissance Hotel	32,000	\$ 199.91	\$ 6,397,120.00	\$ 575,740.80	\$ 1,343,395.20	\$ 959,568.00
TOTAL			\$ 47,378,670.00	\$ 4,264,080.30	\$ 9,949,520.70	\$ 7,106,800.50

The GC total savings for all four VIDAs is \$7,106,800

Steel Subcontractor Cost Savings from Employing JOC						
VIDA Name	Square Footage	Steel Cost/SF	Total Cost	Min Savings (8%)	Max Savings (15%)	Avg Savings (11.5%)
U Street	80,000	\$ 13.07	\$ 1,045,600.00	\$ 83,648.00	\$ 156,840.00	\$ 120,244.00
Metropole	65,000	\$ 13.07	\$ 849,550.00	\$ 67,964.00	\$ 127,432.50	\$ 97,698.25
Verizon Center	60,000	\$ 13.07	\$ 784,200.00	\$ 62,736.00	\$ 117,630.00	\$ 90,183.00
Renaissance Hotel	32,000	\$ 13.07	\$ 418,240.00	\$ 33,459.20	\$ 62,736.00	\$ 48,097.60
TOTAL			\$ 3,097,590.00	\$ 247,807.20	\$ 464,638.50	\$ 356,222.85

The total subcontractor savings for all four VIDAs is \$356,222

The Steel Precon Schedule Could be Reduced by 68 days

### Analysis 4: Mechanical System Layout

Existing Layout: Supply & Exhaust lines located outside; several areas not properly conditioned

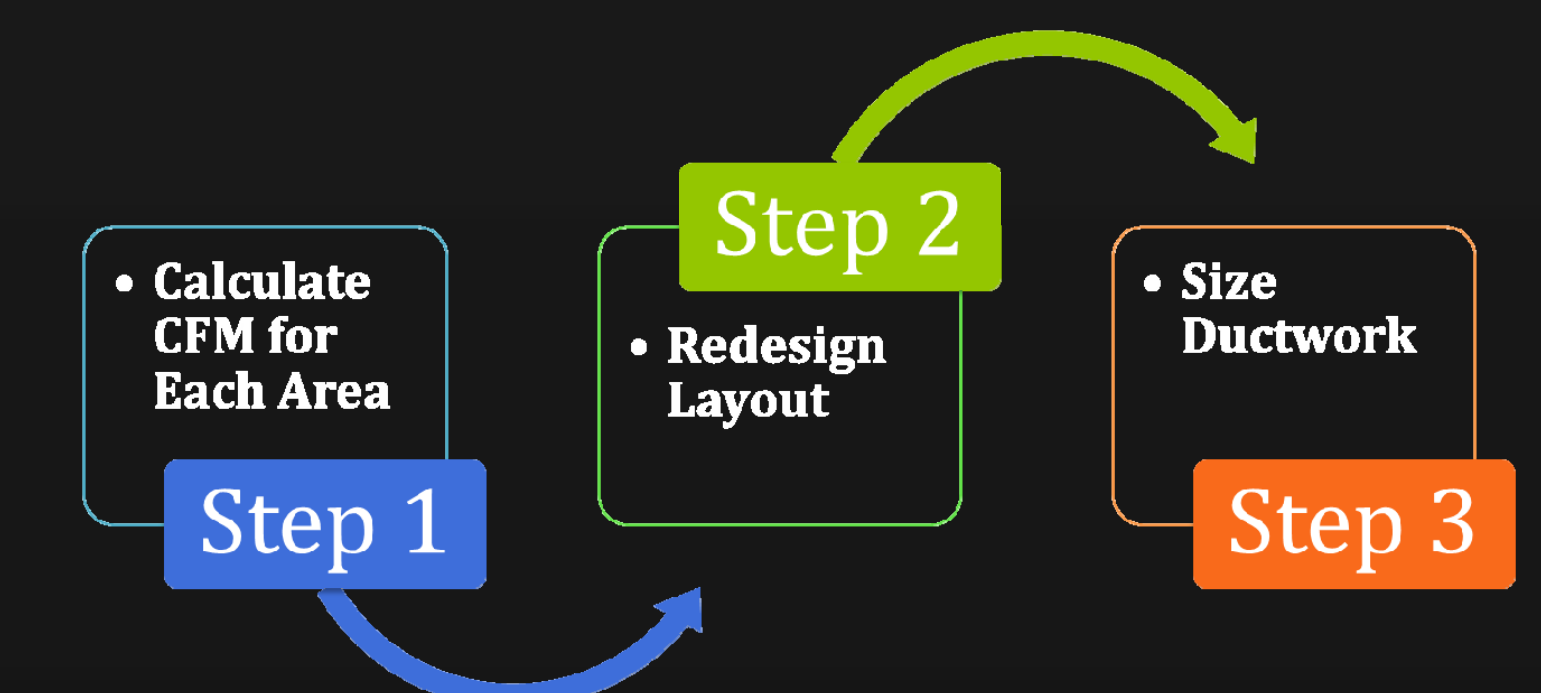
- Layout 1: Move Supply & Exhaust lines to SW corner**  
Remove Y Duct in GM Office on 3rd Floor  
Add 3 additional branch lines on 2nd Floor  
Add 2 additional branch lines on 3rd Floor
- Layout 2: Move Supply & Exhaust lines to elevator**  
Reroute Supply through GM Office on 3rd Floor  
Remove Y Duct in GM Office on 3rd Floor  
Add 3 additional branch lines on 2nd Floor  
Add 2 additional branch lines on 3rd Floor

Each layout was evaluated on 4 design variables with a 0-5 scale

Layout	Ductwork Layout Metrics Measuring Chart					Total
	Aesthetics	Cost	Schedule	Constructability		
Existing	0.5	5	5	2		12.5
Layout 1	3.5	1.5	1.5	4		10.5
Layout 2	4.5	4.5	4.5	4		17.5

Layout 2 was Chosen as the Best Option

All outside air and occupancy requirements were calculated using ASHRAE



### [ Project Participants ]

Owner: David von Storch  
 Architect: Core Architects; Stoneking von Storch  
 MEP Engineer: Allen and Shariff Engineers  
 Structural Engineer: Rathgeber-Goss Associates  
 Interior Designer: Wade Allyn Hallock Interiors  
 General Contractor: Forrester Construction Company

