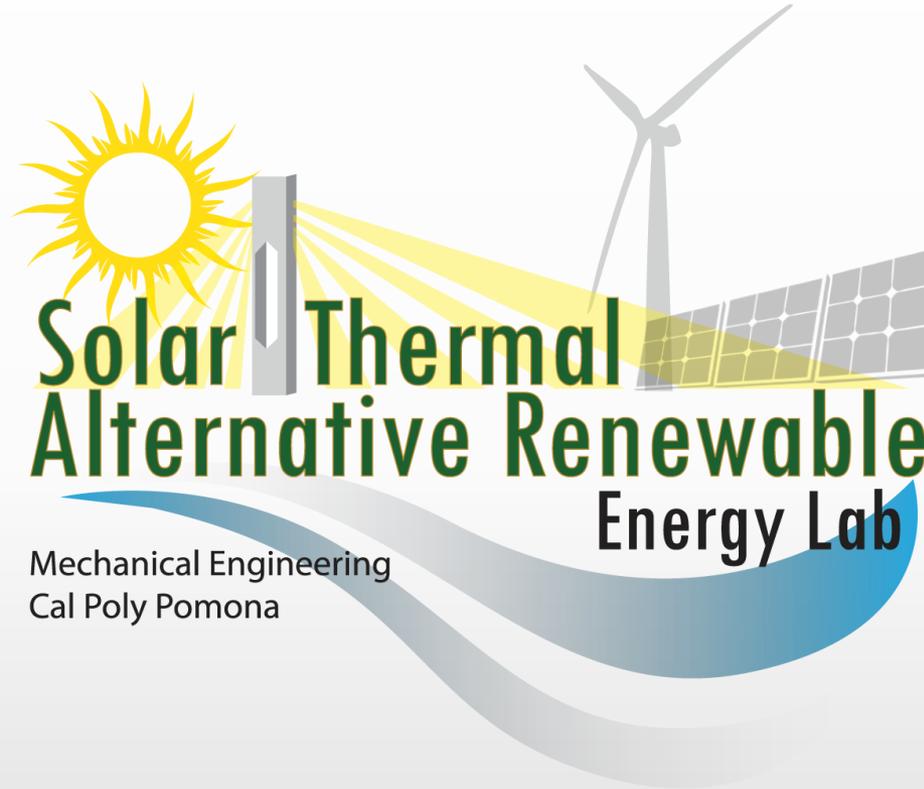
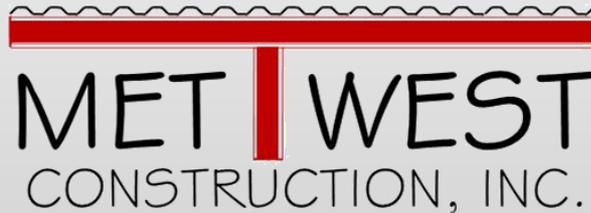


COMPO ENERGY INC.



**Solar Thermal
Alternative Renewable
Energy Lab**

Mechanical Engineering
Cal Poly Pomona

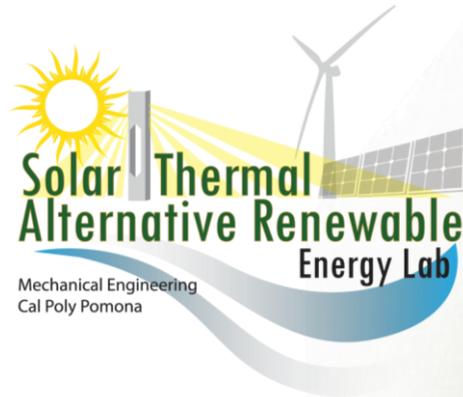


MWH[®]

BUILDING A BETTER WORLD

Compost Waste Heat to Energy Solar Chimney Power Plant

COMPO ENERGY INC.



CASE STUDY OF A SOLAR TOWER/COMPOST WASTE TO ENERGY TEST FACILITY

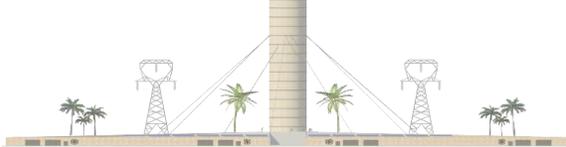
Dr. Kevin R. Anderson¹, Suzzane Shihadeh¹, Pedro Perez², Benjamin Kampen¹, Chris McNamara¹, Souha Jouhar², Saman Bahrani², Kaian Wang², Joeshp Juarez³, Dr. Yasser Salem⁴, Dr. Maryam Shafahi¹, Dr. Monica Palomo⁵, Dr. Reza Baghaei Lakeh⁵, Dr. Ali Sharbat⁵, ¹Mechanical Engr., ²Construction Engr. Technology, ³Agricultural & Plant Sciences, ⁴Civil Engr., ⁵Engr. Technology
Calif. State Polytechnic Univ. at Pomona, 3801 W. Temple Ave, Pomona, CA, 91768 USA
PRESENTED AT THE 31ST CONFERENCE ON SOLID WASTE TECHNOLOGY & MANAGEMENT

PHILADELPHIA, PA, U.S.A. APRIL 3-6, 2016

INTRODUCTION

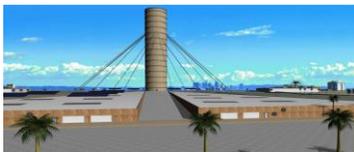
RESEARCH SPONSORED BY: **COMPO ENERGY INC.**
The Smartest Name in Energy

- HYBRID COMPOST WASTE HEAT TO ENERGY / SOLAR CHIMNEY POWER PLANT (SCPP)
 - US PATENT NUMBER 7956487
 - CANADIAN PATENT NUMBER 2720544



OBJECTIVES

- SYNERGY OF WASTE MANAGEMENT AND RENEWABLE ENERGY TECHNOLOGIES
 - COMPOST WASTE HEAT TO ENERGY
 - TURBINE / GENERATORS
 - PHOTOVOLTAIC ARRAY ON SOLAR COLLECTOR ROOF
 - WASTE MANAGEMENT
 - ADDRESSES LANDFILL INFRASTRUCTURE ISSUES
 - FERTILIZER / COMPOST FOR URBAN FARMING
 - SUSTAINABLE AGRICULTURE AND COMMUNITIES
- SCPP DESIGN WITH THE FOLLOWING FEATURES
 - NO INCINERATORS ARE USED IN THIS PROJECT
 - CHIMNEY HEIGHT = 100 m
 - CHIMNEY DIAMETER = 10 m
 - FOOTPRINT = 24 ACRES (97,125 m²)
 - OVER 100 MW ENERGY GENERATION CAPABILITY
 - 12 CHAMBER CONFIGURATION ALLOWS 24/7 OPERATION AND SUPPORTS PLANT MAINTENANCE & SERVICING
 - TRANSPARENT ROOF ALLOWS SOLAR AIR COLLECTOR TO TRAP HOT AIR FROM THE SUN
 - HEAT RELEASED FROM COMPOST ENHANCES THE NATURAL CONVECTION SOLAR UPDRAFT POWER PRODUCTION
 - COMPOST FERTILIZER FOR USE IN URBAN FARMING AND AGRICULTURE APPLICATIONS
 - IDEAL FOR REMOTE DESERT CLIMATES



MATERIALS AND METHODS

- BUILDING CONSTRUCTION ENGINEERING TECHNOLOGY

3-D ISOMETRIC RENDERING OF SCPP INFRASTRUCTURE



3-D ISOMETRIC RENDERING OF SCPP INFRASTRUCTURE



- EXPERIMENTAL PROTOTYPE TEST FACILITY

FRONT VIEW OF PROTOTYPE



SIDE VIEW OF PROTOTYPE



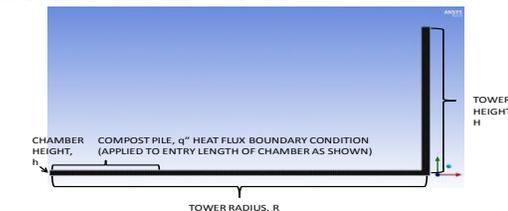
INSIDE VIEW OF PROTOTYPE



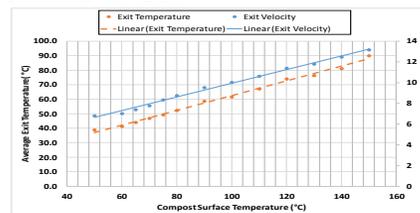
RESULTS

- NUMERICAL HEAT TRANSFER AND FLUID FLOW MODELING

NUMERICAL MODEL OF SOLAR AIR COLLECTOR AND CHIMNEY

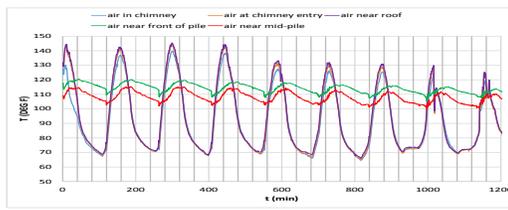


NUMERICAL MODEL TRADE STUDY RESULTS

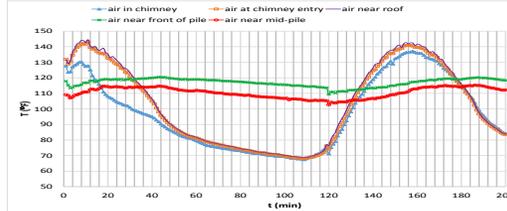


- EXPERIMENTAL PROTOTYPE EMPIRICAL DATA COLLECTION

PROTOTYPE EXPERIMENTAL RESULTS

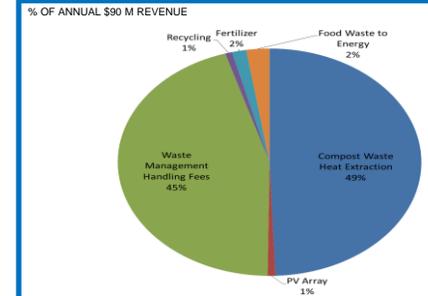


PROTOTYPE EXPERIMENTAL RESULTS



CONCLUSIONS

- ECONOMIC ANALYSIS



- ECONOMIC ANALYSIS

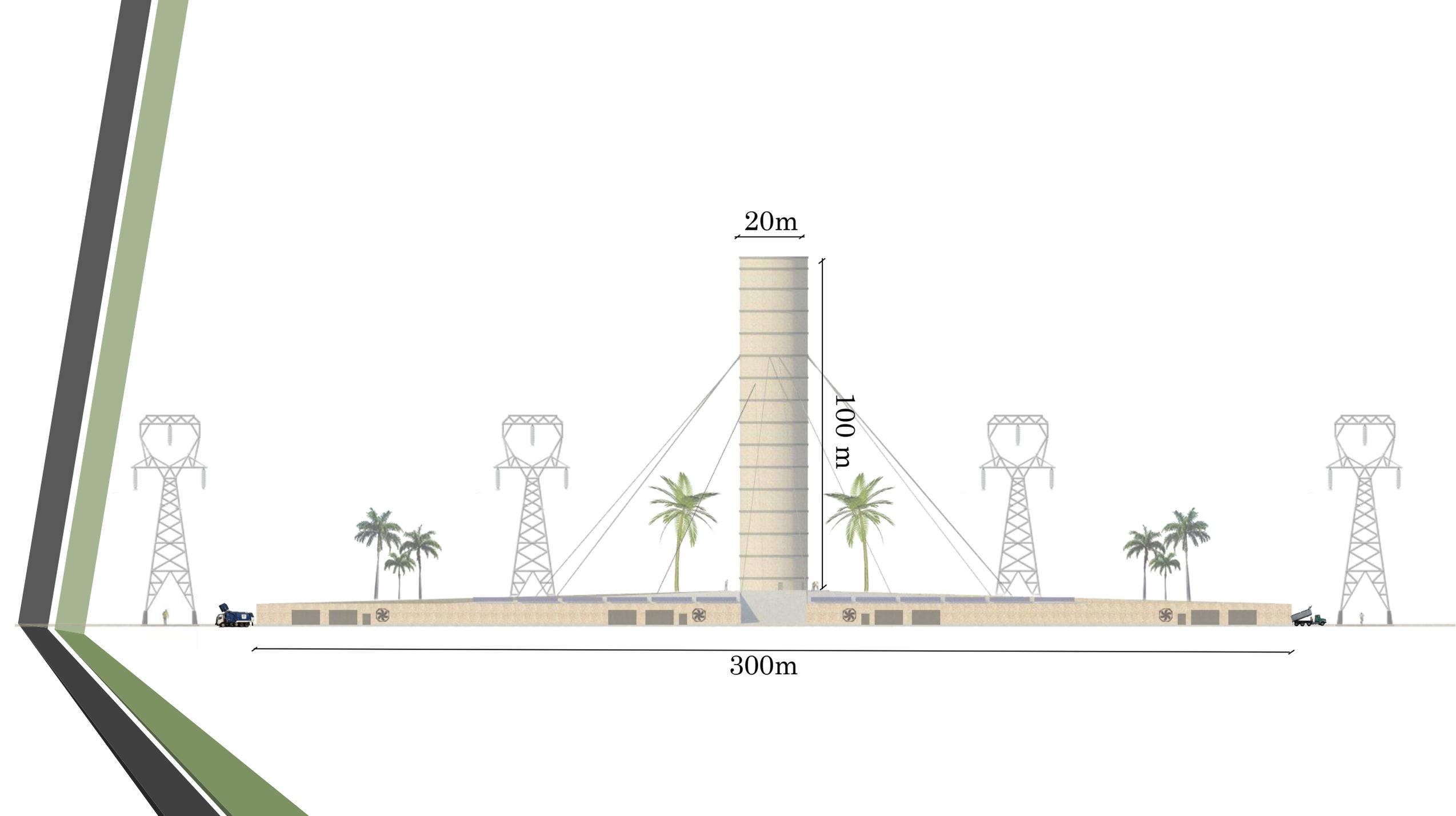
- COMPOST WASTE HEAT ENERGY CONVERSION 49% (\$44.1M)
- WASTE MANAGEMENT 45% (\$40.5M)
- MISCELLANEOUS (PV ARRAY, RECYCLING, FERTILIZER, FOOD WASTE TO HEAT) 6% (\$5.4M)
- BUILDING CONSTRUCTION COST ESTIMATE \$156M
 - SOLAR TOWER = \$59.71M
 - FOUNDATION / STRUCTURAL SUPPORT = \$12.47M
 - SITE PREPARATION = \$42M
 - GENERAL CONDITIONS = \$42.3M



WWW.WIKIPEDIA.ORG

REFERENCES

- "Design of a Compost Waste Heat to Energy Solar Chimney Power Plant" by Kevin R. Anderson¹, Yasser Salem², Suzzane Shihadeh¹, Pedro Perez², Benjamin Kampen¹, Souha Jouhar², Saman Bahrani², Kaian Wang², *Journal of Civil Engr. Research*, in press, Feb. 2016, ¹Mech. Engr., ²Civil Engr., ³Construction Engr. Tech.
- "Experimental and Numerical Investigation of Natural Convection in a Compost Waste-to-Energy Solar Tower" by Dr. Kevin R. Anderson, Mr. Christopher McNamara, Dr. Maryam Shafahi, Mechanical Engineering, Cal Poly Pomona Dr. Reza Baghaei Lakeh, Engineering Technology, Cal Poly Pomona, ¹ Pacific Rim Thermal Engineering Conference, March, 2016, Big Island, HI, USA.
- "Thermal-fluids Analysis of a Hybrid Solar/Compost Waste Heat Updraft Tower." by Kevin R. Anderson, Maryam Shafahi, and Chris McNamara, Cal Poly Pomona, *Journal of Clean Energy Technologies*, Vol. 4, No. 3 May 2016.
- "Compost Waste Heat/Solar Tower Prototype Test Facility for a Sustainable Infrastructure" by Kevin R. Anderson, Maryam Shafahi, Pedro Perez, Benjamin Kampen, Chris McNamara, Mech. Engr., Ali Sharbat, Monica Palomo, Civil Engr., and Reza Baghaei Lakeh, Engr. Tech., Cal Poly Pomona, accepted to the 7th Civil Engineering Conference in the Asian Region (CECAR 7) August 30 to September 2, 2016 Hilton Hawaiian Village, Waikiki, Oahu, Hawaii, U.S.A.

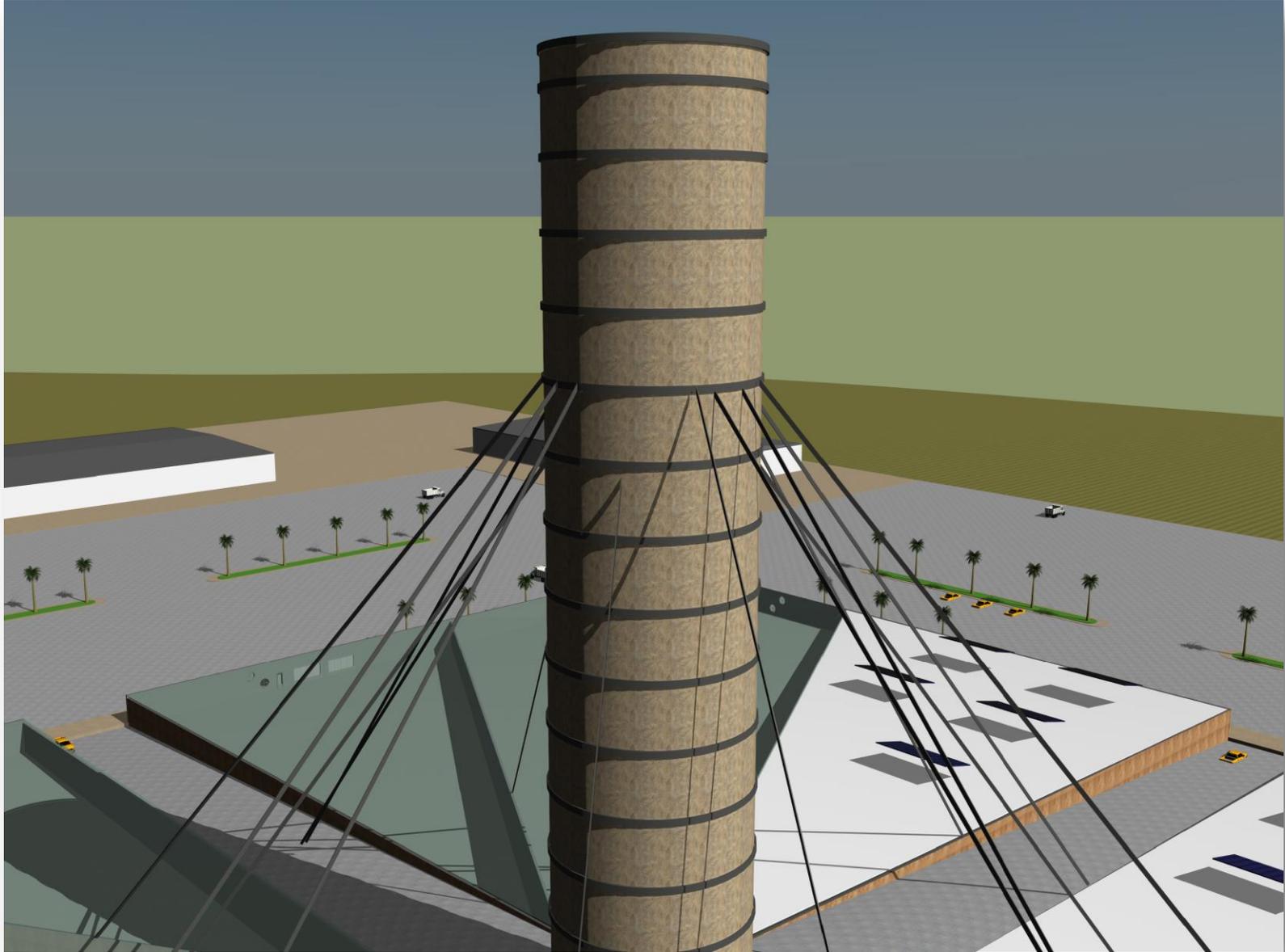


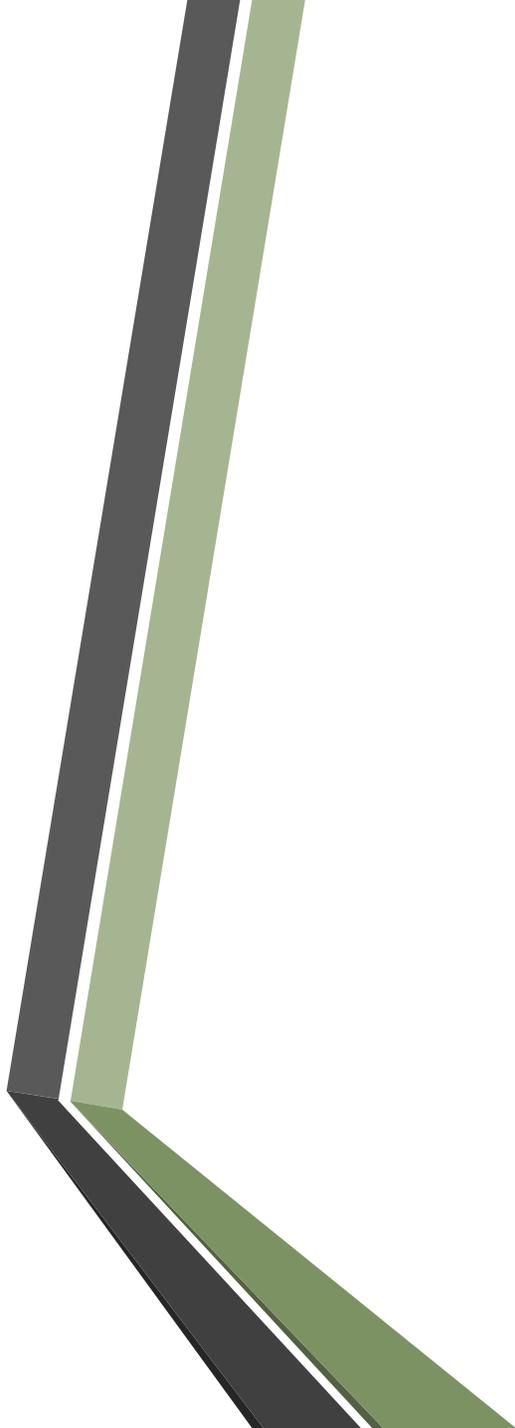
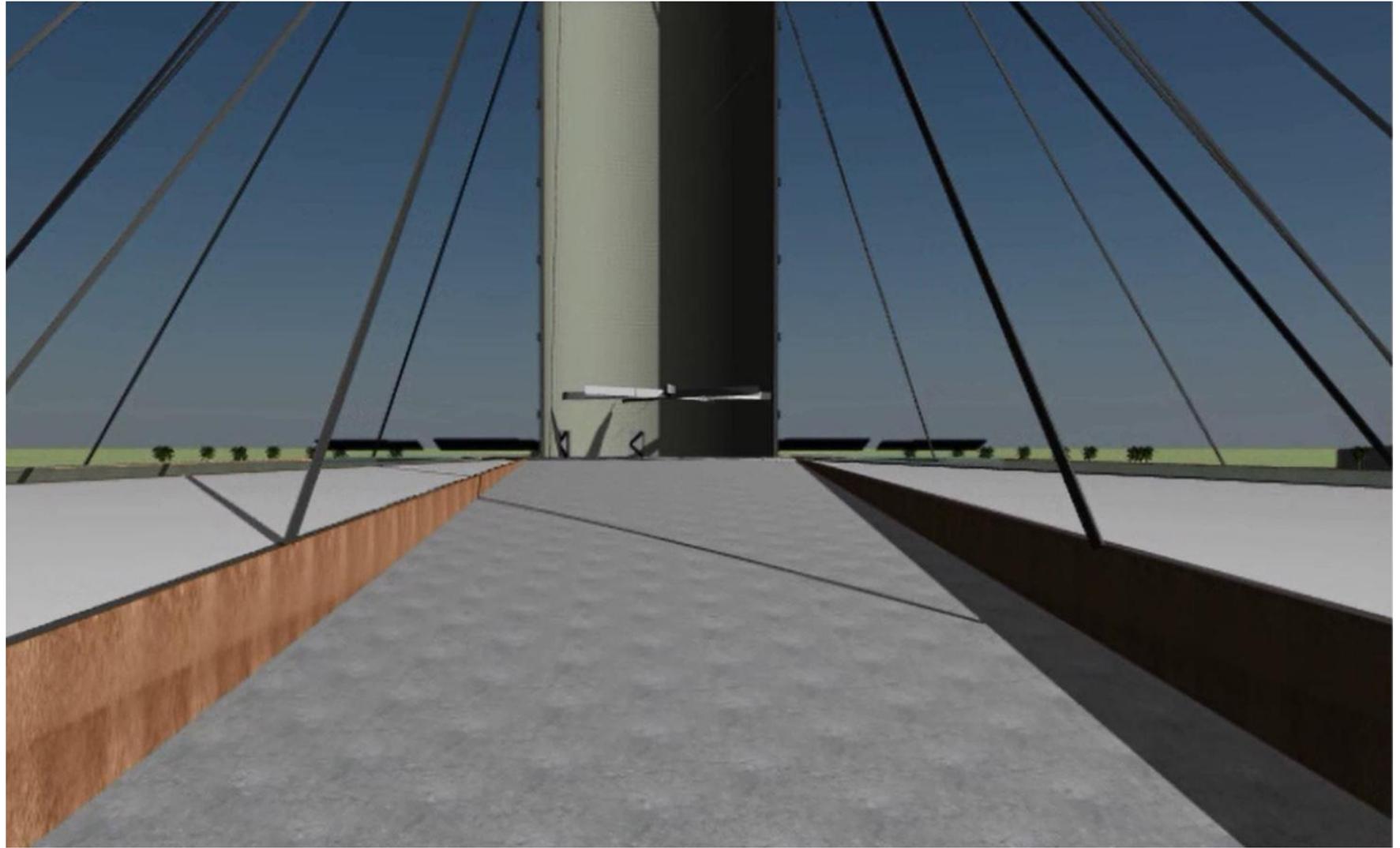
20m

100 m

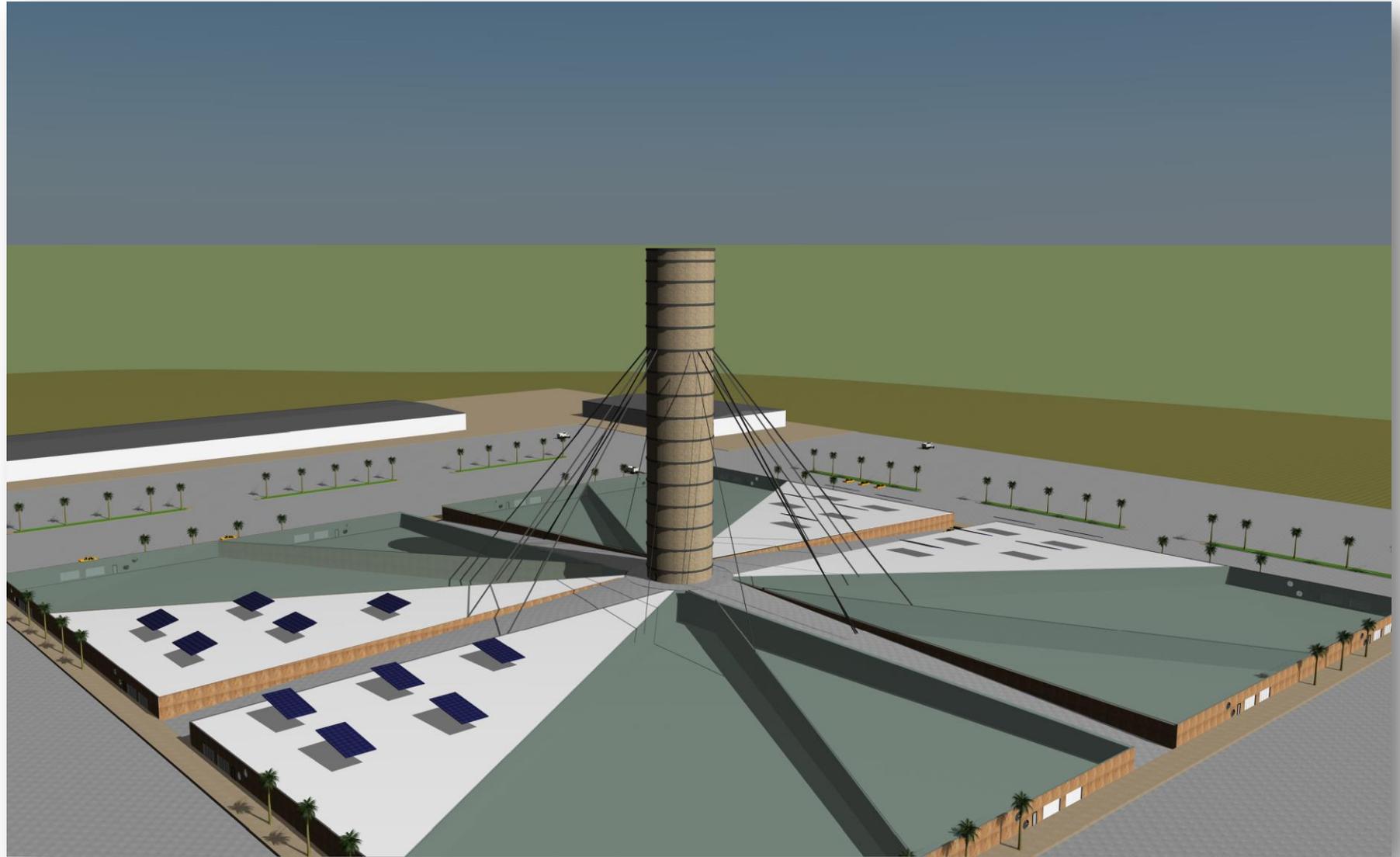
300m











Supplemental Presentation from CBC Steel Buildings

MET WEST CONSTRUCTION, INC.

- **40 Years industry experience**
- **Design build specialists with in-house engineering**
- **Ability to handle any project**
- **L.A. City Fabricator**

CBC STEEL BUILDINGS

Founded by an engineer, CBC was structured to take the confusion out of the building process. Based as a true Service Company, our goal is to provide the highest quality building in the shortest time possible.

CAPABILITIES

- CBC does not outsource – People make projects successful and CBC has the best in the business.
- Design Flexibility - We haven't seen it all yet. But we are prepared to handle whatever the challenge.

It Pays To Take A Closer Look...

L. A. COUNTY FACILITIES

HANGAR 25 AT BOB HOPE AIRPORT 1ST LEED PLATINUM HANGAR



W: 157' L: 361' EH: 47'



W: 140.5' L: 199.3' EH: 29.5'

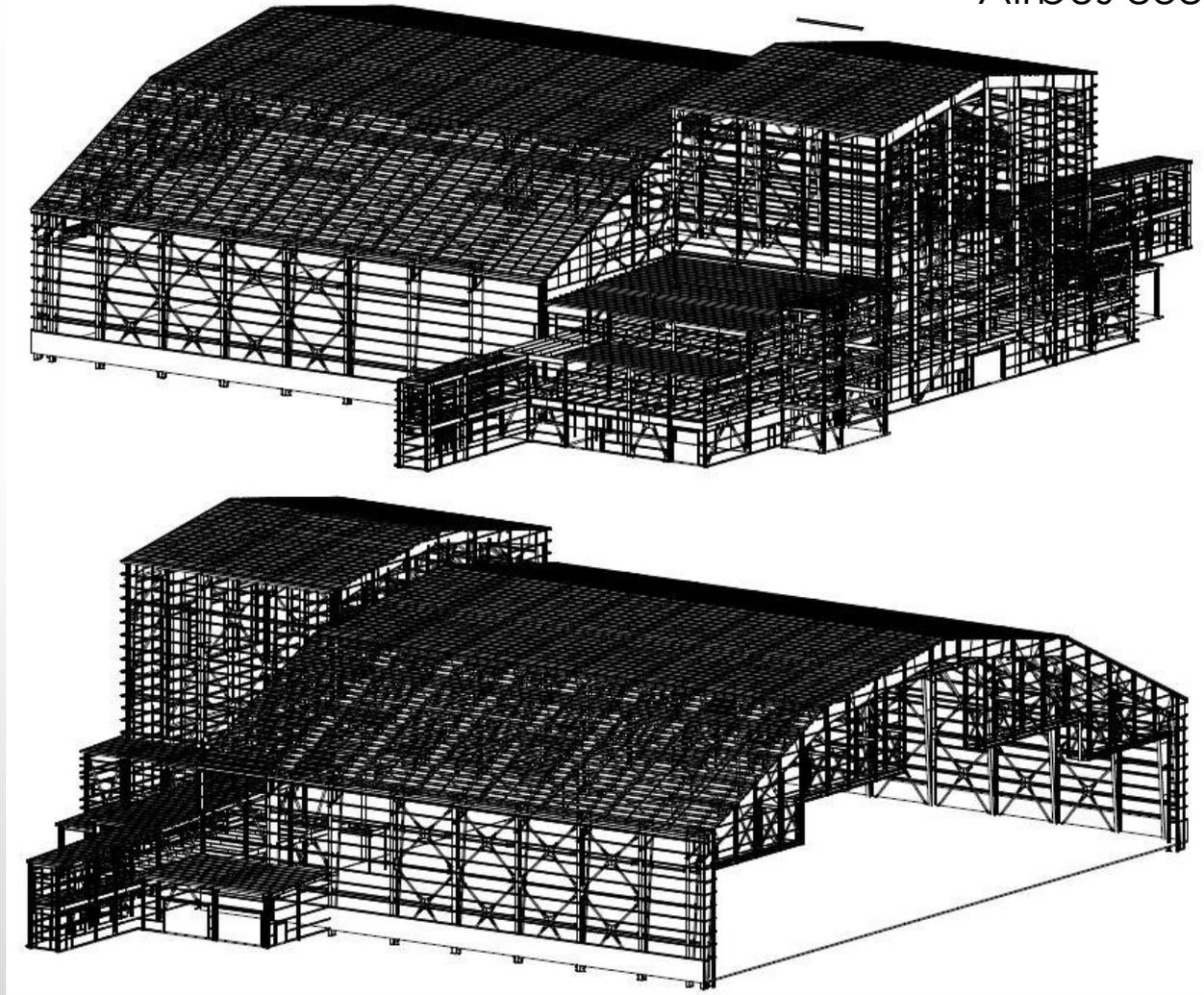
LAFD & LAPD HANGARS



W: 142'9 L: 64'2 EH: 22.8'

SPECIAL PROJECTS

W: 311.33' L: 227' EH: 54.5'
Hangar Door: 295' x 60' 93'-tail
Airbus 8380



QUANTAS HANGAR – L.A. CITY

RECYCLING FACILITIES

GRAND CENTRAL RECYCLING

W: 350' L: 348' EH: 32'



PUENTE HILLS RECYCLING FACILITY

W: 300' L: 750' EH: 37'



ZERO WASTE FACILITY

W: 232' L: 387' EH: 27'

MAJOR SPECIALTY PROJECTS

BIGELOW AEROSPACE "Space Hotels"



A)	W:188'	L: 145'	EH: 48'
B)	W: 80'	L: 400'	EH: 77'
C)	W: 93'	L: 400'	EH: 44'
D)	W: 80'	L: 450'	EH: 48'
E)	W: 80'	L: 50'	EH: 115'
F)	W: 75'	L: 253'	EH: 48'

MAJOR SPECIALTY PROJECTS



STRATOLAUNCH HANGAR
PAUL ALLEN / BURT RUTAN PROJECT

FABRICATION DOOR

W: 22' L: 48'

HANGAR MEGA DOOR

W: 426'

FABRICATION BUILDING

W: 275' L: 320' EH: 25'

HANGAR

W: 463' L: 149' EH: 57'

W: 212' L: 135' EH: 65'

OFFICE BUILDING

W: 75' L: 135' EH: 28'



Iger

MAJOR SPECIALTY PROJECTS

W: 236'

L: 240'

EH: 36'



THE SPACESHIP COMPANY

Sir Richard Branson / Virgin Galactic

LARGE CLEAR SPANS



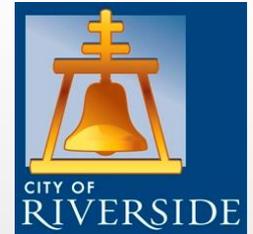
“Better Ways To Build For The Future”



L.A. CITY APPROVED
#FB01436



APPROVED
FABRICATOR #404



TYPE 1 FABRICATOR
#SP12-0009



U.S. Owned and Operated
Made in America With American Steel



83%



ACCREDITED
AC472