



OUR **WIND** OUR **POWER** OUR **FUTURE**



Composite subgroup lead **C.P. "Case" van Dam**

Warren & Leta Giedt Endowed Professor
Chair, Mechanical & Aerospace
Engineering
University of California, Davis
Davis, CA

cpvandam@ucdavis.edu



Brief Bio - Case van Dam

- Faculty member at UC Davis since 1985
- Active in wind energy since 1988
- Founded California Wind Energy Collaborative in 2002
- Department chair since 2010
- Graduated a large number of MS and PhD students who are now active professionals in wind energy

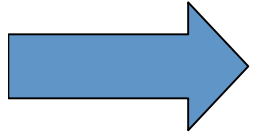
Alumni Active in Wind Energy

• Jonathan Baker	PhD 2009	Frontier Wind, Rocklin, CA
• Myra Blaylock	PhD 2012	Sandia National Laboratories
• Ray Chow	PhD 2011	UC Davis
• Aubryn Cooperman	PhD 2012	TU Delft
• Phil De Mello	PhD 2012	UC Davis
• Kevin Jackson	PhD 1989	Dynamic Design, Davis, CA
• Scott Johnson	MS 2008	Siemens Wind, Boulder, CO
• Rob Kamisky	MS 2007	UC Davis/
• Scott Larwood	PhD 2009	University of the Pacific, CA
• Edward Mayda	PhD 2007	Siemens Wind, Boulder, CO
• Dora Yen Nakafuji	PhD 2001	Hawaiian Electric Company
• Henry Shiu	MS 2000	UC Davis
• Kevin Standish	MS 2003	Siemens Wind, Boulder, CO
• Jose Zayas	MS 2002	U.S. Department of Energy

Partial List of Distributed Wind Activities

- Built-environment test turbine at UC Davis
- Building integrated wind power project
- Small turbine short courses
- Feasibility study of behind the meter wind power for brewery
- Study on agricultural application of wind turbines
- Built-environment wind turbine workshop and road map contributor
- California GIS wind map interface

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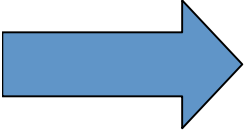
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Turbine Demonstration Site

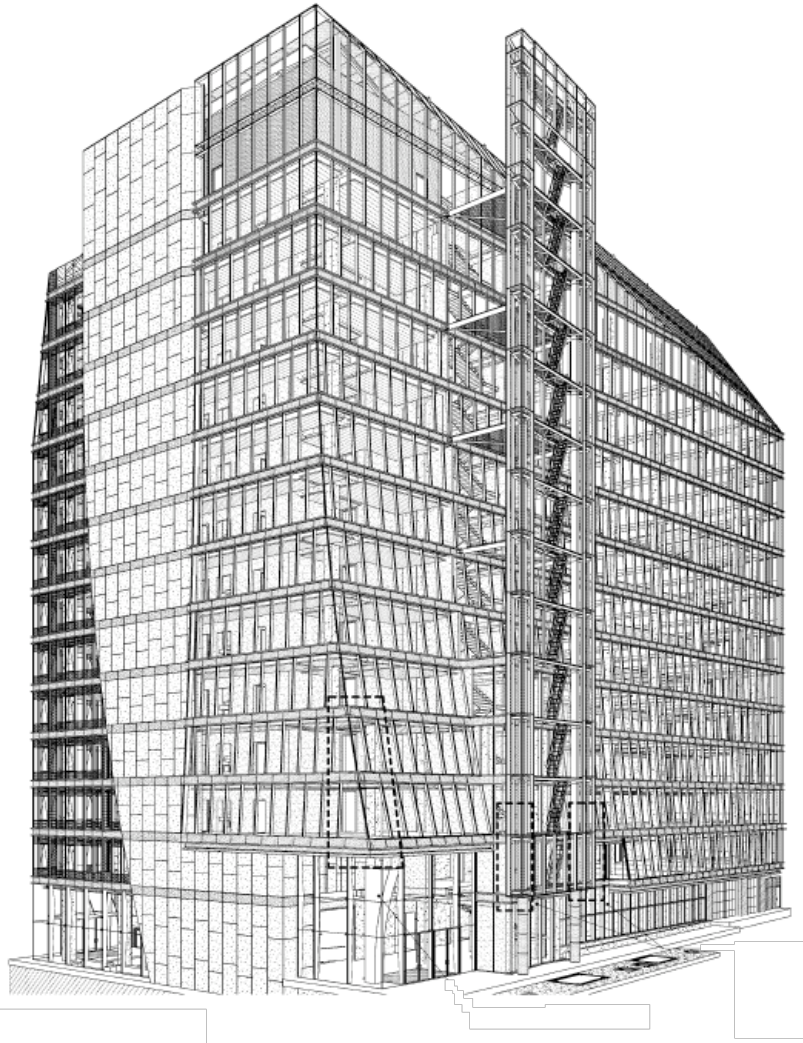
- Bergey XL1 on roof of Bainer Hall
- Used as a demonstration site...
 - Collecting meteorological data and performance data for turbine in built environment
 - Undergraduate senior design research projects (redesign blade set)
 - Basis for providing general wind energy information (group tours, interested students)



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Building Integrated Wind Power Project



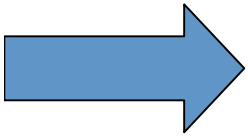
Full-scale



1:150 scale wind tunnel model

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One-Day Short Course on Small Wind Energy Systems

- 8:00 – 8:30 am Welcome & Introductions
- 8:30 – 9:45 am Overview & Perspectives on Wind Energy Large & Small
 - What is wind energy, what is small wind?
 - What are the upcoming changes?
- 9:45 – 10:00 am Break
- 10:00 – 11:45 am Wind Resource Assessment for Small Wind
 - Do I have enough wind?
 - How do I determine my wind resource?
- 11:45 – 12:45 pm Lunch Break
- 12:45 – 1:45 pm Siting Considerations & Challenges
 - What does the government require me to do?
- 1:45 – 2:45 pm Economics & Incentives
 - Is it worth my investment?
 - What can the government do for me?
- 2:45 – 3:00 pm Break
- 3:00 - 4:30 pm Installing a Small Turbine
 - What to do from A to Z
- 4:30 – 5:00 pm Wrap-Up

Instructors:

C.P. (Case) van Dam, UC Davis, cpvandam@ucdavis.edu

Rob Kamisky, UC Davis, rjkamisky@ucdavis.edu

Sean Kenny, Fresco Solar & Wind, sean@frescosolar.com



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View of Brewery with Utility-Scale Turbine

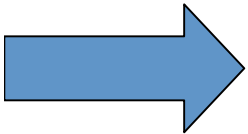


Study Outline

- Preliminary wind resource assessment based on:
 - Existing local anemometer data
 - Computational modeling (California Wind Resource Maps)
- Calculation of energy production
- Economic analysis
 - Including state and federal incentives, federal tax credits
- Installation of on-site anemometer to obtain accurate wind data
- Communicating with FAA regarding obstruction evaluation and long range radar
- Communicating with utility regarding interconnection
- Investigating various setback requirements

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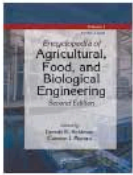
Case Study: Irrigation in Salinas Valley

- One 450 acre ranch
 - Two wells (two 50kW pumps on each)
 - Conversion: 100 hp = 75 kW
 - Each well requires ~100kW to operate irrigation system

Energy Cost Summary (2007)

	Well 1 (AG-1B)	Well 2 (AG-5B)
Energy Use	100,445 kWh/yr	139,740 kWh/yr
Energy Charge	\$0.15/kWh	\$0.05-0.16/kWh
Energy Cost	\$15,140	\$10,750
Monthly Demand	98 kW	93 kW
Demand Charge	\$4.20-\$6.08/kW	\$4-10/kW
Demand Cost	\$4,760	\$11,400
Total Cost	\$20,110	\$22,450

Publication Summarizing Distributed Wind Projects



Encyclopedia of Agricultural, Food, and Biological Engineering, Second Edition

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/doi/book/10.1081/E-EAFE2>

Wind Power for Farming and Food Processing

C.P. van Dam Henry Shiu Scott Johnson ^a, Scott Larwood ^b

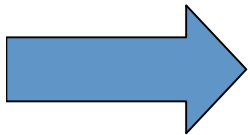
^a Department of Mechanical and Aerospace Engineering, University of California—Davis, Davis, California, U.S.A.

^b Department of Mechanical Engineering, University of the Pacific, Stockton, California, U.S.A.

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Built-Environment Wind Turbine Workshop and Roadmap

- Contributor to workshop and reviewer of roadmap



SAVE THIS DATE!

ROOFTOP & BUILT ENVIRONMENT WIND TURBINE WORKSHOP

11th & 12th August 2010

Lawrence Livermore National Laboratory, University of California - Davis, and the National Renewable Energy Laboratory (NREL) will be hosting a technical exchange on the topic of Urban Wind and Built-environment Wind Turbines (BWTs).

The meeting will be Wednesday & Thursday, August 11 & 12 at NREL's National Wind Technology Center (NWTTC), located 8km south of Boulder, Colorado (For a map to the NWTTC, go to www.nrel.gov/visiting_nrel/directions_map.html).



This event will be an opportunity to share technical experience on modeling urban wind resources and practical experiences with BWTs.

The featured speaker will be Sander Mertens, author of "Wind Energy in the Built Environment" among other related research publications.




The goal of this meeting is to identify areas of future research and collaboration on topics related to wind energy in the built environment.

Due to space limitations, this invitation applies only to groups with technical information to share. Only 2 representatives from each group will be allowed.

If you are interested in attending, **please RSVP** with Arielle Wolfe (arielle.wolfe@nrel.gov 303-384-6925).

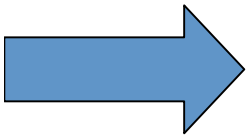


RSVP Required



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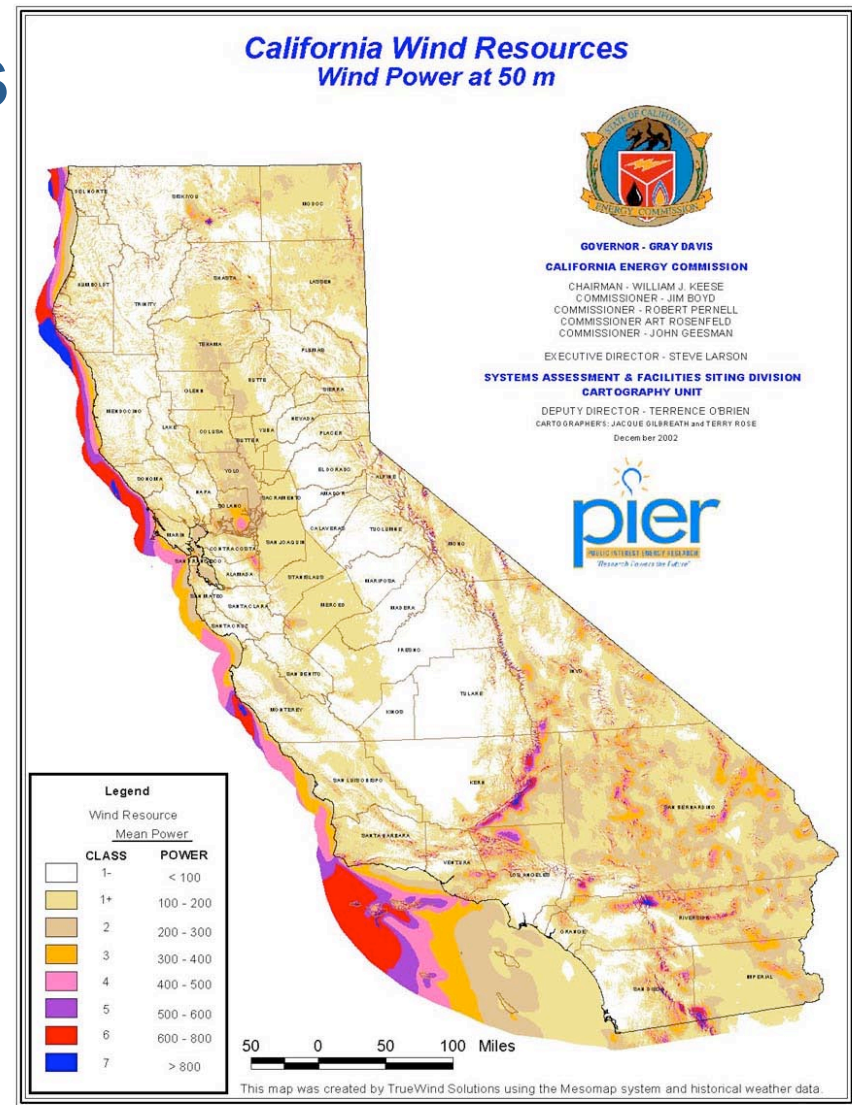


GIS Map Tool Interface

- Effort funded by California Energy Commission
- Develop an online wind assessment tool for general public
 - CEC/PIER funded development of detailed wind maps for California
 - Maps provide annual wind power and speed at several heights above the ground
 - Maps generated by AWS TruePower
 - Maps are available in pdf format from CEC website
 - Difficult to pinpoint locations and determine wind speed at specified location and height
 - CEC has GIS-based version of wind maps
 - Disadvantage of GIS-based wind maps is that specific software (ArcExplorer) is needed to access information
 - Limited to 30, 50, 70, 100 m AGL
 - Develop a web-based version of GIS-based wind maps
 - Combine GIS-based wind maps with Google maps
 - Allow users to click on or search for a particular location to view wind data information
 - Able to get wind data as function of height

California Wind Maps

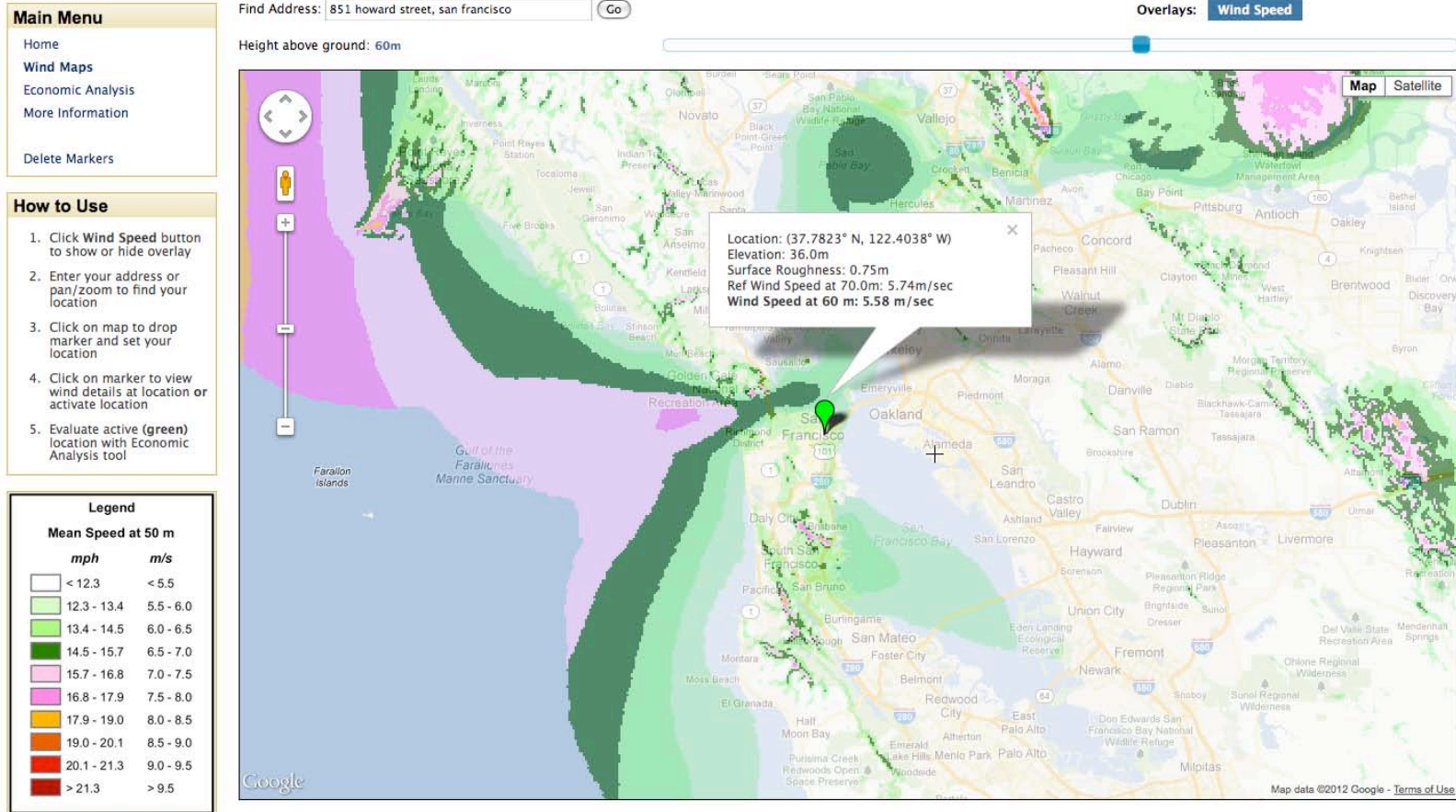
- Maps of annual average wind speed and power have been produced for California
- Maps have a grid resolution of 200 m
- Actual winds at a specific site for the turbine can vary significantly from the map
- Maps are good tools for guiding and estimating but do not replace Micro-Siting



Wind energy density at 50 meters above ground.
California Energy Commission.
<http://www.energy.ca.gov/maps/wind.html>

GIS Map Tool Interface

CWEC Tools: Wind Resource Maps



Final Observations

- Extensive experience in (distributed) wind energy
 - Education
 - Training
 - Outreach
 - Cooperative efforts with industry and government labs and agencies
 - Research:
 - Rotor design
 - Turbine performance
 - Forecasting
 - Siting
 - Etc.

