

William R. Morrow III, P. E., Ph.D.

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Dr. Morrow supports energy sector clients with regulatory applications and infrastructure planning and policy analysis. Prior to joining E3 in November 2007, he spent five years performing CHP and renewable energy technology policy analysis in pursuit of his Ph.D. in Civil and Environmental Engineering at Carnegie Mellon University (CMU), and as a post doctoral research fellow with the USDOE at the National Energy Technology Laboratory. His CMU and NETL research focused on economic and infrastructure modeling of cofiring biomass and coal as a carbon mitigation option and ethanol production and distribution as a transportation fuel alternative. Before graduate school, he served eight years as a mechanical engineer, designing and constructing large industrial facilities such as power plants, processing facilities, chemical plants, and paper mills and earned a Professional Engineering License in Mechanical Engineering, Thermal Fluid Systems, in 2002.

ENERGY & ENVIRONMENTAL ECONOMICS, INC. *Senior Consultant*

San Francisco, CA
2007-Present

- Rate Design - support a large regulated electric utility's application for a electric rate redesigns for their residential and large general service commercial customers.
- Long-Distance Transmission Line Analysis – develop and support a long-distance transmission line policy analysis model which evaluates the relative value of alternative long-distance power lines linking potential renewable energy resource development to demand loads throughout the WECC.
- Energy Efficiency, Distributed Generation, and Demand Side Management Analysis – develop models to evaluate the potential cost effectiveness of energy efficiency measures, distributed generation technologies, and demand side management programs.
- Greenhouse Gas Policy Analysis – develop a multi-sector infrastructure model to evaluate CA's policy options to meet legislated year 2050 Greenhouse Gas (GHG) emission reduction targets.
- Renewable Project Development – develop a linear programming (LP) model used for the evaluation of potential renewable energy project developments.

U. S. DEPARTMENT OF ENERGY (DOE) **National Energy Technology Laboratory (NETL)** **Office of Systems Analysis and Planning** **Appointment through the Oak Ridge Institute of Science and Education** *Post-doctoral Research Fellow*

Pittsburgh, PA
2006-2007

“Biomass Allocation Model” development and analysis

- Development of a linear programming bioenergy (biomass-energy) resource forecast model within NETL's Office of Systems Analysis and Planning. The model consists of:
 - A bioenergy resource geo-dataset – a regionally detailed bioenergy resource GIS database.
 - Bioenergy process models for ethanol production (corn (wet and dry mills) and cellulosic-based processes) and electricity generation (co-firing with coal in existing coal-fired power plants).

- Econometric infrastructure investment tools, including transportation and distribution parameters, and microeconomic models for bioenergy industrial sectors.
- Macroeconomic model for estimating bioenergy industry sectors' affect on fossil energy resource demand and carbon emissions.
- Wrote a report detailing the linear program model technique and policy analysis results. See *DOE/NETL2008/1302*

CARENGIE MELLON UNIVERSITY, GREEN DESIGN INSTITUTE
Visiting Scholar

Pittsburgh, PA
2006-2007

- Collaborated with Carnegie Mellon University's Engineering and Public Policy and Carnegie Electricity Industry Center researchers on Plug-Hybrid-Electric-Vehicle (PHEV) research: estimating energy resource demand, infrastructure requirements, economic impacts, and environmental performance from a large-scale shift towards PHEV dominated light-duty vehicle fleet.

WILLIAM R. MORROW AND ASSOCIATES
Mechanical Engineering Consultant

St. Louis, MO
1999-2002

- **Clients (multiple project with each client):**
Mead Johnson, Evansville, IN; Infant Nutritional Products; Sigma-Aldrich, St. Louis, MO; Biopharmaceutical Products; Anheuser-Busch, St. Louis, M; Brewery; Warrenton Products, Warrenton, MO; Beverage Bottling; Semi-Bulk Systems, St. Louis, MO; Process Equipment Manufacture
- **Engineering:**
Project Scope Development (Process Flow Diagrams, Piping and Instrumentation Diagrams); Process Engineering (Design and Specification of: Tanks & Agitators, Pumps, Heat Exchangers, Bulk Transfer Equipment, Powder/Liquid Blending, Packaging Equipment); Utility Engineering (Design and Specification of: HVAC systems, Steam and Condensate, Boilers, Chillers, Air Compression, Hot Water Sets, Pneumatic Air Systems for process controls); Piping Engineering (Design and Specification of: Piping Specs, Sizing, Process Control Devices, Stress Analysis, Layout and Routing Design)
- **Project Management:**
Scope, Budgets, Procurement, Contractor Bidding, Construction Support and Plant Start-Up

PEAK TECHNICAL SERVICES
Mechanical Engineering Consultant

Pittsburgh, PA
1995-1999

- **Clients (and Projects):**
Stone & Webster, Boston, MA; (*Harquahala Power Project NGCC*); Fru-Con Engineering and Construction, St. Louis, MO (*Procter & Gamble Project, MEMC Technologies Project, Monsanto Project*); Jacobs Engineering, Cincinnati, OH (*Genentech Project*); Power Engineering, Haley, ID (*Micron Technologies Project*); Chiyota International, Seattle, WA (*South Korea Petrochemical Refinery Project*)
- **Engineering:**
Piping Systems Design using 3_D engineering Plant design Software (Piping Specs, Sizing, Process Control Devices, Stress Analysis, Layout and Routing Design)

RUST ENGINEERING
Mechanical Engineering Consultant

Birmingham, AL
1993-1995

- **Clients (and Projects):**
GE (Lexan Plastic Plant Expansion), Burkville, AL; International Paper (Greenfield Recycle Fiber and Paper Machine Project), Mansfield, LA; 3M (Glue Products Plant Expansion), Decatur, AL; Connecticut Power (Greenfield MSW Power Generation Project), Lisbon, CT; Gulf States Paper (Lime Kiln and Re-Causticing Plant), Demopolis, AL
- **Engineering:**
Process, Utilities, and Piping Engineering (Design and Specification of: Tanks & Agitators, Pumps, Heat Exchangers; Steam and Condensate Systems; Piping Specs, Sizing, Stress Analysis, Layout and Routing Design)

Education

- Carnegie Mellon University** Pittsburgh, PA
Ph.D., Civil and Environmental Engineering 2006
Thesis Title: "U.S. Biomass Energy: An Assessment of Costs & Infrastructure for Alternative Uses of Biomass Energy Crops as an Energy Feedstock"
- Carnegie Mellon University** Pittsburgh, PA
M.S., Civil and Environmental Engineering 2003
Research Topic: CHP Economic Feasibility Assessment
- Georgia Institute of Technology** Atlanta, GA
B.S., Mechanical Engineering, Minor in Philosophy 1993

Awards and Achievements

Steinbrenner Seed Fund Award, Steinbrenner Institute for Environmental Education and Research, Carnegie Mellon University, 2004 – Grant for Environmental Research (Modeling Cellulosic Ethanol Distribution Networks)

Pennsylvania Infrastructure Technology Alliance (PITA), 2004 - Grant through CMU's Institute for Complex Engineered Systems (Modeling Pennsylvania Biomass and Coal Co-Firing Impacts and Economics)

Teresa Heinz Scholars for Environmental Research, Heinz Family Philanthropy, 2003 – Grant for Alternative Energy Research (Modeling Cellulosic Ethanol Infrastructure)

U.S. Professional Engineer, 2002 – Mechanical Engineering, Thermal Fluid Systems;
Missouri: # 2002003211; Pennsylvania: # PE 073901

Publications and Working Papers

1. Orens, King, Woo, Morrow GHG reductions via residential electricity ratemaking. *Public Utilities Fortnightly* – Accepted, publication forthcoming
2. Morrow, W. R., Balash P. *Biomass Allocation Model – Comparing alternative uses of scarce biomass energy resource through estimations of future biomass use for liquid fuels and electricity. U.S. Department of Energy and the National Energy Technology Laboratory Report, 2008, DOE/NETL2008/1302*

3. *Morrow, W. R., Griffin, W. M., and Matthews, H. S. National-level infrastructure and economic effects of switchgrass co-firing with coal in existing power-plants for carbon mitigation. Environmental Science and Technology, 2008, 42, (10), 3501-3507*
4. *Morrow, W. R., Griffin, W. M., and Matthews, H. S. State-level infrastructure and economic effects of switchgrass co-firing with coal in existing power-plants for carbon mitigation. Environmental Science and Technology, 2007, 41 (19), 6657-6662.*
5. *Morrow, W. R., Griffin, W. M., and Matthews, H. S. Modeling Switchgrass Derived Cellulosic Ethanol Distribution in the United States. Environmental Science & Technology May 1 2006, 40 [9], 2877-2886 – Cover Article*

Conferences

1. *Morrow, W. R., Hanson D., Balash P. Comparing alternative uses of scarce biomass energy resources using the AMIGA model. 27th Annual Conference of the United States Association of Energy Economics/ International Association of Energy Economics, September 16-19, 2007, Houston TX*
2. *Morrow, W. R., Griffin, W. M., and Matthews, H. S. "Alternative Transportation Fuels: Modeling National-Scale Ethanol Production and Distribution," Institute for Operations Research and the Management Sciences, Annual Meeting, November 5 - 8, 2006, Pittsburgh, PA*
3. *Morrow, W. R. , Griffin, W. M., and Matthews, H. S. "Modeling Cellulosic Ethanol Production and Distribution in the U.S.," 27th Symposium on Biotechnology for Fuels and Chemicals, May 1-4, 2005, Denver, CO*

Citizenship

United States