Charles R. Dubuc, Jr.
Western Resource Advocates
150 South 600 East, Suite 2AB
Salt Lake City, UT 84102
801-487-9911
Attorney for Western Resource Advocates

Steven S. Michel
Western Resource Advocates
409 E. Palace Ave. #2
Santa Fe NM 87501
505-820-1590
Attorney for Western Resource Advocates

BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of the Voluntary Request of Rocky Mountain Power for Approval of Resource Decision to Construct Selective Catalytic Reduction Systems on Jim Bridger Units 3 and 4	Docket No. 12-035-92

PREFILED

DIRECT TESTIMONY OF STACY F. TELLINGHUISEN

ON BEHALF OF

WESTERN RESOURCE ADVOCATES

November 30, 2012

Q. Please state your name, position and business address.

A. My name is Stacy Tellinghuisen, and I am employed as a Senior Energy/Water Policy Analyst for Western Resource Advocates (WRA). My business address is 2260 Baseline Road, Suite 200, Boulder, Colorado, 80302.

Q. Please describe WRA.

A. WRA is a non-profit policy and law organization whose mission is to protect and restore the natural environment of the Interior West. WRA's Water Program promotes urban water conservation and works to protect or improve flows in critical rivers throughout the region. The Lands Program seeks to protect the integrity of public lands and preserve special places while meeting the infrastructure needs of a clean energy future. WRA's Energy Program works to reduce the environmental impact of electricity production in the Interior West and advance the region's transition to renewable energy, energy efficiency, and other clean-energy technologies. WRA has offices in Boulder, Colorado, Carson City, Nevada, Santa Fe, New Mexico, and here in Salt Lake City.

Q. Please describe your experience and qualifications.

A. I have worked as an energy/water analyst for over five years, focusing on both the water demands of different forms of electricity generation, and the energy needs of water supplies. I have submitted testimony in cases before the Colorado Public Utilities Commission, the Arizona Corporation Commission, and the Public Utilities Commission of Nevada. My submitted testimonies have addressed the water impacts of energy choices, the value of water, and the risk of drought. I have performed research and published numerous reports on the energy-water nexus, much of which has informed my

prior testimony. In 2007, I received a Masters of Environmental Science and Management from the University of California, Santa Barbara, where my thesis focused on the energy-water nexus in California. My resumé is provided as Attachment A.

Q. On whose behalf are you testifying in this case?

A. I'm testifying on behalf of WRA.

Q. Have you previously testified before the Public Service Commission of Utah?

A. No. I have not filed testimony or appeared before this Commission before this time.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to present WRA's analysis of how alternative resource strategies to comply with environmental regulations at the Jim Bridger Power Plant could impact water resources. In addition, I address the potential monetary and environmental value of reducing water use by the Jim Bridger plant.

Q. Please describe the importance of water in the region.

A. In the Interior West, water is critical to sustaining communities, agriculture, industry, and our environment. Today, most water supplies are fully or over-allocated, and meeting current water needs is an ongoing challenge. That challenge is particularly apparent for the Colorado River, of which the Green River is a major tributary. In the last decade, average Colorado River basin-wide water use equaled or exceeded available flows (Figure 1). While Lake Mead and Lake Powell regulate runoff and moderate the impact of droughts,

storage in the reservoirs fell to 55% of capacity in 2010.[1] Growing urban populations are likely to increase water demands, and climate change is expected to compound the existing challenge of meeting water demands in the Basin: Scientists project climate change will reduce Colorado River flows by 5–20% by mid-century.[2]

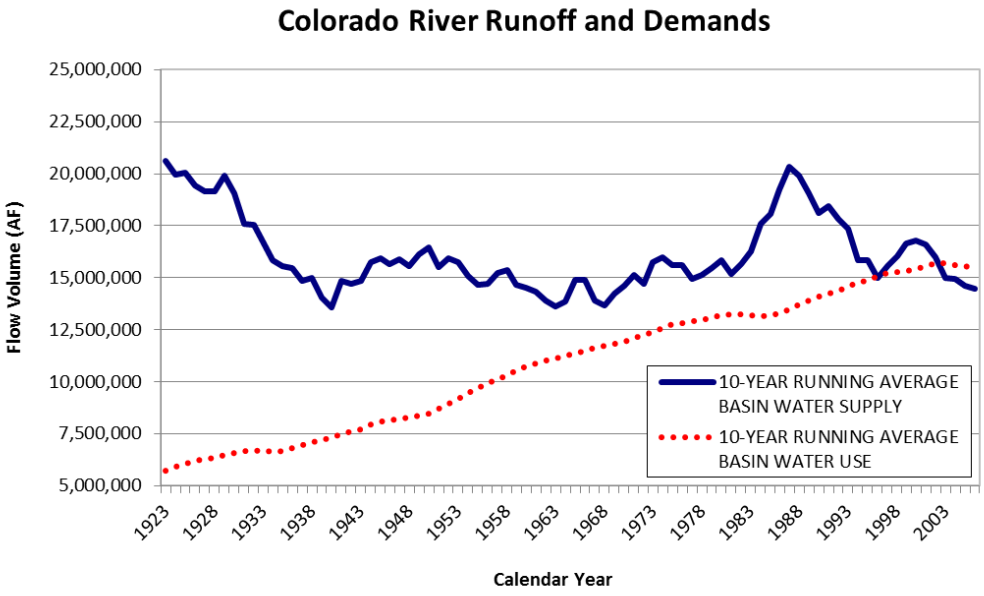

Figure 1. Colorado River use exceeded average basin water supplies throughout the last decade. Data source: Bureau of Reclamation, 2010. "Use" includes consumptive use or depletions in the U.S., evaporative losses from reservoirs, and deliveries to Mexico (not all of which are consumptive).

Q. Please describe the connection between water and the Jim Bridger Power Plant.

A. Thermoelectric power plants rely on water from rivers, aquifers, or lakes to cool and condense steam. According to PacifiCorp's response to OCS Data Request 7.41, over the ten year period from 2002 – 2011, the Jim Bridger Plant consumed, on average, 26,272 acre-feet (AF) of water per year (8.6 billion gallons/year). The Green River is the source

[1] U.S. Bureau of Reclamation. Lower Colorado River operations schedule. http://www.usbr.gov/lc/region/g4000/hourly/rivops.html (accessed April 16, 2010).
[2] Hoerling, M., D. Lettenmaier, D. Cayan, and B. Udall. 2009. Reconciling projections of Colorado River streamflow. Southwest Hydrology 8:20-21, 31.

of the vast majority of water used at the Jim Bridger Plant. Assuming an average person uses (consumes) 50 gallons/day for their residential use, the water used at the Jim Bridger Plant could otherwise meet the annual water needs of approximately 470,000 people.[3]

Q. How would different environmental compliance alternatives affect water use at Jim Bridger Units 3 and 4?

A. According to PacifiCorp's response to OCS Data Request 7.41, installing SCR systems would not change water use at the units. While PacifiCorp "has not completed a study of the water balance requirements" for converting Units 3 and 4 to a gas facility or replacing those units with CCCTs, we can estimate the likely water requirements.

The water intensity of a natural gas-fired steam cycle plant is similar to the water intensity of a conventional coal plant. However, because the units would be operated differently, the hours of operation, and therefore annual water needs, would be reduced.

Combined cycle gas plants are considerably more water efficient than conventional coal or natural gas-fired steam plants. Whereas a conventional wet-cooled coal plant consumes approximately 687 gallons/MWh, a wet-cooled combined cycle gas plant consumes only 198 gallons/MWh. [4] A dry-cooled combined cycle gas plant – several of which have been constructed in recent years in Arizona and Nevada – can reduce water use to very low levels (estimated at just 2 gallons/MWh).[5] Using the water use data reported in OCS Data Request 7.41 and electricity generation data reported to the U.S.

[3] A consumptive use rate of 50 gallons/person/day reflects a typical water use rate in a moderately efficient household. The figure does not include other system-wide uses (such as commercial or industrial uses in a city).
[4] Macknick, J., R. Newmark, G. Heath, and KC Hallett. 2011. A Review of Operational Water Consumption and Withdrawal Factors for Electricity Generating Technologies. National Renewable Energy Lab. Figures reflect the median water use for a generic, tower-cooled coal plant and a tower-cooled combined cycle gas plant.
[5] Id.

Energy Information Administration over the 2009 – 2011 period, the Jim Bridger plant consumes approximately 546 gallons/MWh.[6] Over the 2012 – 2030 period, replacing the electricity generated at Jim Bridger Units 3 and 4 with generation from a combined cycle gas facility would, therefore, save approximately 8,900 AF/yr (2.9 billion gallons/yr). If the combined cycle plant is located at a place other than the Jim Bridger plant site, the water savings at Jim Bridger would amount to approximately 14,000 AF/yr (4.5 billion gallons/yr).

Q. Are the water rights held by PacifiCorp for the Jim Bridger Plant valuable?

A. Yes. The value of a water right depends on a host of factors, including its potential use (i.e. municipal, agricultural, industrial, etc.), the seniority of the water right, the quality of the water provided with that right, and the general scarcity of water in the area, among other factors. According to PacifiCorp's response to OCS Data Request 7.43, PacifiCorp could hold the water rights until a future date, sell or lease the water rights, or abandon the water rights. Unless PacifiCorp abandoned its water rights, the Company would likely see some value to "freeing up" the water rights currently used at the Jim Bridger Plant.

The monetary value of those water rights is difficult to determine. Few well-functioning water markets exist in the West, making it difficult to estimate the value of a water right. However, as water demands grow or supplies become scarcer (because of drought, long-term climate change, or other factors), the value of water is likely to increase. Northeastern Colorado has one of the only well-functioning water markets in the West, the Colorado-Big Thompson market. While the water prices in the Colorado-Big

[6] Electricity generation data from U.S. Department of Energy, Energy Information Administration. Form EIA-923. Data from years 2009, 2010, and 2011.

Thompson market are not directly relevant to this case, the *trends* observed in recent years can be instructive. Figure 2 illustrates how prices in that region changed over the period from 1987 to 2008.[7] In 2002/2003 prices rose sharply, likely in response to severe drought and long-term population growth. Overall, I believe that the value of PacifiCorp's water rights on the Green River is not zero, and that it is likely to rise in the future.

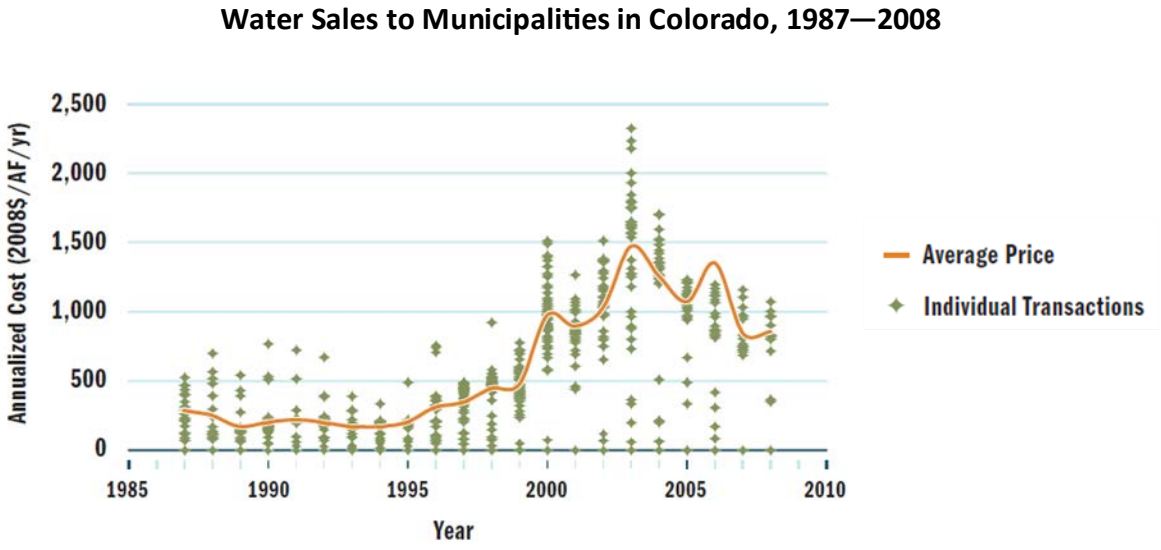

Figure 2. Annualized cost of water sold to municipalities in Colorado. Prices rose steadily in the late 1990s and early 2000s, likely as a result of population growth, and rose more precipitously in 2002/2003, when Colorado experienced severe drought. Source of graphic: Western Resource Advocates, 2011. *Every Drop Counts: Valuing the Water Used to Generate Electricity*.

Q. Are these rights valuable, even if the Green River is not fully appropriated?

A. Yes. In Wyoming, as in most western states, "senior" or older water rights generally have a higher priority than a newer or "junior" water right. An application to appropriate a new water right today would likely be granted a priority date of 2012. In the event of shortage,

[7] The figure reflects permanent water sales, not leases. Most, but not all of the sales were in the Colorado-Big Thompson market. All sale prices were adjusted to an annualized cost, using a 4.46% discount rate and 30 year period.

a junior water right would face a higher risk of curtailment than a more senior water right such as PacifiCorp's. Even if water is still available to appropriate, as noted in PacifiCorp's response to Data Request 7.43b, PacifiCorp's main water right has a priority date of 1968, and would therefore be more reliable – and more valuable – than a newly appropriated right.

Q. If the Jim Bridger Plant required less water, could that benefit Utah customers?

A. Yes. Reducing the water used at the Jim Bridger Plant could benefit Utah customers in two ways: 1) If PacifiCorp sells or leases its water rights, now or in the future, it would see revenues that could benefit rate-payers, or 2) by temporarily holding excess water rights in a "no-use status", as described in PacifiCorp's response to OCS Data Request 7.43, the water could remain in-stream and provide environmental benefits in the Green River.

Q. Please describe the environmental and recreational values associated with the Green River, and Utah's efforts to protect or enhance these values.

A. The Green River supports a vibrant recreation and tourism industry, as well as habitat for cold water fisheries and four species of endangered warm-water fish. Below Fontanelle Reservoir, the Green River flows through three national wildlife refuges (NWR), including the Seedskadee NWR in Wyoming, Browns Park NWR in Colorado, and the Ouray NWR in Utah. The river also flows through Flaming Gorge National Recreation Area (in Utah and Wyoming) and Dinosaur National Monument in Utah. Each of these depend on sufficient quantities of water to support a recreation and tourism economy in the region. The tourism sector provides important economic benefits in the region, too;

for example, the Bureau of Reclamation estimated that the tourism and recreation industry in the three-county region around Flaming Gorge Reservoir generated $217 million in 1999.[8]

The Green River also plays an essential role in the Upper Colorado River Endangered Fish Recovery Program ("Recovery Program"), a program run by the federal government in cooperation with Upper Colorado River basin states and other partners. The Recovery Program works to recover four federally endangered fish species (Colorado pikeminnow, humpback chub, bonytail, and razorback sucker), while allowing continued development of Colorado River (and tributary) water by the Upper Basin states, and avoiding a more severe application of the Endangered Species Act (ESA). Since its inception 25 years ago, the Recovery Program has held out flow protection and improvement in the major tributaries of the Colorado River as an essential foundation for success of the Program.

The need to protect Green River flows is specifically articulated in the Recovery Program's 1987 **"**Blue Book.**"** Participation in the Recovery Program provides ESA compliance for both existing and future water development by the Upper Basin States. Over the past 25 years, the Recovery Program has spent tens of millions of dollars on fish passage, bottom-land habitat acquisition, non-native fish management, and improved flows below major federal dams. While some progress has been made—including the 2000 U.S. Fish & Wildlife Service Biological Opinion and the Bureau of Reclamation's Final Environmental Impact Statement and accompanying 2006 Record of Decision to re-operate Flaming Gorge Dam—flow protection for endangered fish has not yet been

[8] U.S. Bureau of Reclamation, 2006. Operation of Flaming Gorge Dam Final Environmental Impact Statement, Appendix 8 – Socioeconomics. This figure reflects the value of annual regional output in the Bureau of Reclamation's "most affected sectors", and is in 1999 dollars. The three county region includes Daggett and Uintah Counties in Utah and Sweetwater County in Wyoming.

secured in the Green River. It is a significant unfinished task in the Recovery Action Plan.

The State of Utah has invested significant resources towards achieving the Recovery Program's goals. Utah's effort to secure base flows in the Green River is embodied in a 1994 policy to subordinate future water right applications to fish flows during summer and fall. In 2010, the State of Utah developed a Work Plan, seeking to implement additional flow protections by 2015. As part of these efforts, the State of Utah, with input from numerous federal and non-governmental stakeholders is currently developing a Green River MODSIM[9] hydrological model that is intended to help the state develop its final flow protection policy for the Green River.

In sum, healthy flows in the Green River are a key component of both the regional recreation and tourism economy and the recovery of four endangered fish species. Reducing water use by the Jim Bridger plant could, at least temporarily, increase flows in the Green River.

Q. Does this conclude your testimony?

A. Yes, thank you.

[9] MODSIM is a "river basin Decision Support System" developed at Colorado State University. http://modsim.engr.colostate.edu/

Attachment A

Stacy F. Tellinghuisen

stacy@westernresources.org • 2260 Baseline Rd. • Boulder, CO 80302 • (805) 794-0936

PROFESSIONAL AND RESEARCH EXPERIENCE

Senior Energy/Water Policy Analyst, Western Resource Advocates (full-time, 8/08 – present; consultant, 7/07 – 8/08)

- Researching and presenting on the energy-water nexus in the Interior West, including the water demands of conventional and renewable sources of energy, and the energy demands of water supply projects and water conservation.
- Identifying the price and value of water for cities, agriculture, and environmental uses throughout the region.
- Authoring reports, presentations, and comments on federal and state agency documents with regard to energy/water issues.
- Serving on the South Platte Enhancement Board, which protects the Upper South Platte River.

Water/Energy Analyst, California Sustainability Alliance and Navigant Consulting (6/07 – 4/08)

- Quantified the energy intensity of different water supplies in Southern California as part of a utility-funded study to reduce the energy and GHG intensity of California's water supplies.
- Assessed the potential for expanding recycled water use by four major water agencies, and identified important financial barriers and incentives to expanded recycled water use.

Independent Researcher, UCSB and PG&E (2/07 – 7/07)

- Developed a metric for quantifying the water, energy, and greenhouse gas emissions associated with turf grass-covered lawns and "California Friendly" landscapes.

Water Resources Intern, City of Moab, UT (6/06 – 8/06)

- Developed a conservation-rewarding water rate structure for commercial and residential customers.
- Designed a preliminary watershed management plan for the Mill Creek Watershed.
- Assisted with stormwater runoff analysis and mitigation plans.

Marketing-Development Assistant/Field Instructor, Canyonlands Field Institute, Moab, UT (3/03 – 8/03; 4/05 – 9/05)

- Assisted with membership drives, press releases, and annual reports for a small non-profit organization.
- Instructed students in the desert and riparian ecology, geology, and water politics of the Colorado Plateau.

Field Coordinator/Environmental Educator, Naturalists at Large, Ventura, CA (8/00 – 3/03 *seasonal*; 8/03 – 4/05)

- Taught natural history to school groups on hiking and canoeing trips in public lands throughout California, focusing on the Sonoran Desert and the Colorado River.
- Managed sites, coordinated programs, trained new staff, and developed curriculum resources.

Researcher – Keck Geology Consortium Research Project, Point Arena, CA (7/99 – 8/99)

- Analyzed GPS mapping data to determine rates of uplift along the San Andreas Fault and to identify unknown faults on the Gualala Block in Northern California.

EDUCATION

Donald Bren School of Environmental Science & Management – University of California, Santa Barbara
Master of Environmental Science and Management (June 2007)
Water Resources Management Specialization with an Emphasis in Policy
Group Project Master's Thesis: *California's Energy-Water Nexus: Water Use in Electricity Generation*
Honors: Most Outstanding Student Award (June 2007)
Fellowships: John Gray Memorial Fellowship, Donald Bren Fee Fellowship (2006); Monica Florian Fellowship (2005)
Leadership: Bren School Faculty Curriculum Committee – Elected Student Representative

Carleton College, Northfield, Minnesota
Bachelor of Arts in Geology (June 2000)
Honors: Graduated Cum Laude, with distinction awarded for senior thesis
Senior Thesis: *Rates of Uplift along the San Andreas Fault, Gualala to Point Arena, CA*
International Geology Program: Osservatorio Geologico di Coldigioco, Italy (8/99 – 11/99)
Intensive study of structural development, sedimentary history, and cyclic climatic changes in Italy.

PUBLICATIONS

S. Tellinghuisen, 2012. "A Powerful Thirst: Managing the Electricity Sector's Water Needs and the Risk of Drought," Western Resource Advocates.

K. Averyt, J. Fisher, A.Huber-Lee, A. Lewis, J. Macknick, N. Madden, J. Rogers, and S. Tellinghuisen, 2011. "Freshwater Use by U.S. Power Plants: Electricity's Thirst for a Precious Resource," Energy and Water in a Warming World Initiative.

S. Tellinghuisen, 2011. Energy Intensive Water Supplies. In D. Kenney and R. Wilkinson (Eds), *The Water-Energy Nexus in the American West* (p. 123 – 135).

S. Tellinghuisen, 2011. "Every Drop Counts: Valuing the Water Used to Generate Electricity," Western Resource Advocates.

S. Tellinghuisen and J. Milford, 2010. "Protecting the Lifeline of the West: How Climate and Clean Energy Policies Can Safeguard Water," Western Resource Advocates and Environmental Defense Fund.

S. Tellinghuisen, 2010. "Water for Power Generation: What's the Value?" *Natural Resources Journal*.

A. Keller, S. Tellinghuisen, C. Lee, D. Larson, B. Dennen, and J. Lee, 2010. "Projection of California's Future Freshwater Requirements for Power Generation," *Energy and Environment,* Vol. 21 No. 2.

S. Tellinghuisen, 2010. "The Energy and Water Nexus," a chapter in the Sustainable Water Resources Roundtable Report.

S. Tellinghuisen, 2009. "Water Conservation = Energy Conservation," A report for the Colorado Water Conservation Board. Western Resource Advocates.

S. Tellinghuisen, 2009. "A Sustainable Path: Meeting Future Water and Energy Demands in the Arkansas River Basin," Western Resource Advocates.

S. Tellinghuisen, 2008. "A Sustainable Path: Meeting Nevada's Water and Energy Demands," Western Resource Advocates.

L. Park, B. Bennett, S. Tellinghuisen, C. Smith, and B. Wilkinson, 2008. "The Role of Recycled Water in Energy Efficiency and Greenhouse Gas Reduction," California Sustainability Alliance.

PRESENTATIONS

Managing Energy, Water, & Drought – Solutions from the Interior West (EUCI Conference, October 2012).

Managing Energy, Water, & Drought (Colorado Public Utilities Commission, October 2012).

Managing Energy and Water: Solutions from the Interior West (Colorado Water Conservation Board, September 2012; The Nature Conservancy Energy-Water Conference, July 2012; World Renewable Energy Forum, May 2012).

The Role of the Water Sector in a Carbon-Constrained World (University of Colorado Natural Resources Law Center annual conference, June 2012).

The Energy-Water Nexus: Managing Risk in the Arid Southwest (Arizona Corporation Commission, March 2012).

Energy & Water in the West (Colorado Watershed Assembly, 2011).

Pipelines and Power Plants: the West's Future Energy and Water Supplies? (Environmental Protection Agency, July 2010; River Network's annual River Rally, May 2010; Colorado River Symposium, September 2009; Colorado Water Wise Annual Conference, September 2009; Center for Resource Conservation, September 2009; Northern Colorado Business Report's Green Summit, April 2009).

Water: Risks and Impacts of Changing Conditions (Tri-State Generation & Transmission resource planning stakeholder session, May 2010).

Valuing Water in Electric Resource Planning (Colorado Water Congress, August 2011; Arizona Public Service, May 2010; National Renewable Energy Laboratory, April 2010; Natural Resources Journal Annual Conference, February 2010).

The Energy-Water Nexus: A Case Study of the Arkansas Basin (Arkansas River Basin Roundtable, September 2009; Arkansas River Basin Water Forum, March 2009; Western Coalition of Arid States, October 2008; National Renewable Energy Laboratory, July 2008; Colorado Water Workshop, May 2008).

The Role of Wind in Meeting the Southwest's Energy and Water Needs (Natural Resources Law School annual conference, June 2009; American Wind Energy Association annual meeting, May 2009; Regional Wind Energy Institute, November 2008).

A Sustainable Path: Meeting Utah's Future Energy and Water Needs (Wind Powering America meeting, February 2009).

Nevada's Energy-Water Nexus: An Examination of Future Scenarios (Nevada Water Resources Association, March 2008).