Clockwise from top left: Ridgeview Medical Center in Waconia uses this hydrogen peroxide plasma sterilizer to eliminate their use of toxic ethylene oxide, saving the hospital $13,965 annually; Anchor Glass in Shakopee is the largest consumer of recycled glass in the state, employing 280 people; Tera Guetter from

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Minnesota Office of Environmental Assistance

2004 Biennial Report to the Legislature

Environmental **innovation** promotes economic growth!

January 2005

Contents

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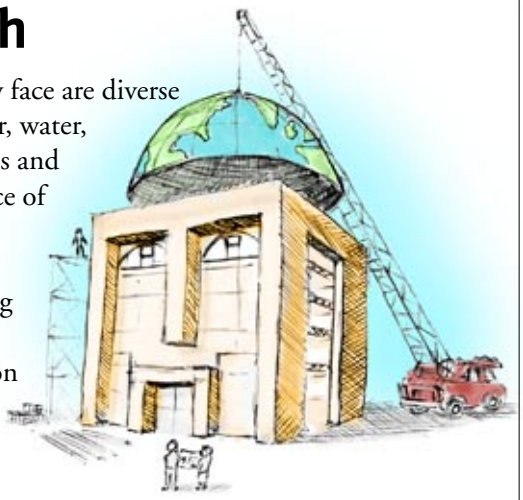
Environmental innovation promotes economic growth



The environmental issues we now face are diverse and complex. Pollutants in our air, water, and land come from many sources and many human activities. The Office of Environmental Assistance (OEA) plays a unique role in creating a stronger Minnesota by specializing in voluntary, economically driven approaches to pollution prevention and resource conservation.

Partnerships: Using voluntary, market-based approaches to protect the environment OEA's strength lies in its ability to apply market-based approaches through goal-oriented partnerships, as well as in its education and outreach efforts. The OEA and its partners develop newer, more efficient technologies and business models that use materials and resources efficiently. This, in turn, creates new jobs, fosters economic development, and protects public health and our environment. OEA's primary tools are technical assistance, financial assistance, policy development, and environmental education. With these tools, the OEA helps Minnesota businesses, communities, state and local governments, educators, citizens, and others:

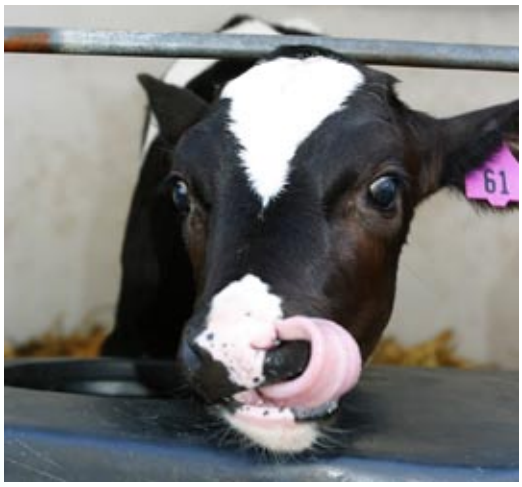
- Eliminate use and generation of toxic chemicals from products and buildings.

- Link market forces with opportunities to optimize materials, water, and resource use.

- Convert waste into energy or into high-value products.

- Reduce costs and increase efficiency.

The successful use of partnerships and market-driven tools helps move Minnesotans toward an environmentally sound and economically strong future.



Planting a seed. **A 2001 OEA grant helped pioneer a technology that captures methane from the breakdown of manure. The methane is then used to generate electricity. Building upon this project, work is under way to use the methane for a hydrogen fuel cell to produce more electricity.**

Economic impact of environmental innovation

From working with the medical technologies industry to achieve multi-million dollar savings in design changes, to partnering with utilities to advance "clean" energy technologies, to finding new high-value uses for waste products such as asphalt shingles, OEA works with a variety of partners to build a healthier environment, stronger economy, and more livable communities.

Recycling

- Each year, the OEA provides $12.5 million in SCORE funding, as well as technical assistance, to support Minnesota's recycling infrastructure. In return, the state benefits from the economic impact of **Minnesota's recycling industry**, which created more than 9,000 jobs and provides nearly $64 million in tax revenues. These jobs, in turn, support another 10,200 people in indirect and induced jobs. Altogether, the recycling industry pays an estimated **$760 million in wages** and adds $2.98 billion to the state's economy. Significantly, while many sectors of the state lost jobs in 2001-2003, the recycling industry showed a 3.4 percent gain in

(continued)

employment, adding over 300 jobs. In addition, Minnesotans save the equivalent of 180,000 tons of coal, or the electric consumption of more than 321,000 homes, by recycling.

- In Medford, **Nylon Board Manufacturing**, which makes products from **recycled carpet**, has added 22 new jobs and a $4.5 million investment to the local economy.
- **Bituminous Roadways** is working with MnDOT and OEA to use **recycled asphalt shingles** in hot-mix asphalt, potentially saving $2.8 million in costs, 200,000 cubic yards of landfill capacity, and generating $6 million in new business activity.
- The OEA's Capital Assistance Program supports 30 recycling and waste-to-energy facilities throughout the state that generate approximately **$10 million** in annual sales of energy and commodities produced from waste.

Pollution prevention

- **General Mills' Chanhassen facility** is saving $354,000 per year and reducing manufacturing waste by 40 percent through design changes on one product line. The company plans to save over $4.5 million annually by implementing the design changes throughout that facility.
- **Medtronic** developed a coating process that resulted in a 75 to 85 percent reduction in chemical usage and wastewater loading, a 30 to 35 percent reduction in materials use, and annual cost savings of $2.1 million.
- Minnesota **businesses saved $5.1 million** in 2003-2004 by working with OEA's pollution prevention experts at MnTAP to reduce 62.9 million pounds of waste, 11 million pounds of wastewater pollutants, and conserve 29 million gallons of water.
- Three new state buildings have energy-efficient designs at least 30 percent better than code. Their reduced energy use will save the state more than **$1 million** in combined operational savings per year, with a payback of less than three years, and avoid approximately 5,900 tons of air pollution each year.

LOOKING AHEAD

Opportunities and challenges for the OEA

The future offers both challenges and significant opportunities for the OEA and its partners.

- **Waste and recycling** | Our recycling rates remain flat and local recycling opportunities are reduced as some local recycling centers close or eliminate the collection of plastic or glass recycling due to budget reductions. Yet Minnesotans continue to generate more waste and throw away over 1 million tons of material each year that would be worth over $85 million if recycled. Further, an estimated 1.5 percent of the state's municipal solid waste is still burned in backyard burn barrels, generating harmful levels of dioxin. OEA will continue to work with counties and the recycling industry to support and strengthen secondary markets and to develop more cost-effective approaches to waste management and address the challenge of on-site disposal.
- **Toxic chemicals** | While Minnesota industries have made significant strides in reducing their release of toxic chemicals, 2002 Toxic Release Inventory data shows that more than 15,000 tons of toxic chemicals are still released to the environment by reporting facilities. Virtually all of these facilities are in compliance with regulations. Since further improvements are voluntary, OEA must continue to help businesses find cost-effective alternatives to decrease use and generation of these chemicals.

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Photo: MnTAP

A MnTAP student intern's work at Endocardial Solutions in St. Paul during the summer of 2004 helped the company prevent waste and pollution in its catheter manufacturing process. The company anticipates saving over $35,000 annually by reducing waste associated with solvent, clean room wipes, shoe covers, and Teflon rods.

- **Buildings and energy use** | Buildings' use of energy and materials has a major impact on our environment. Buildings consume 65 percent of all electricity in the United States and use 40 percent of all raw materials globally. A 300,000 square-foot energy-efficient green building will use *at least* 30 percent less energy and avoid over 1,500 tons of air pollution each year compared to an office building designed to meet the existing energy code. OEA needs to build on its strategic partnerships to increase integration of low-toxic, resource- and energy-efficient building components in the construction industry.

- **Problem wastes** | Product stewardship is an approach to managing problem materials that encourages manufacturers, retailers, and consumers to reduce the environmental impacts associated with products. Problem wastes such as used electronics need to be managed to protect human health and the environment. Environmentally preferable products and technologies often face start-up barriers that can be overcome through partnership assistance. OEA has had good results in product stewardship initiatives to manage used carpet, waste electronics, mercury switches in vehicles, and leftover paint. Due to high public costs of managing problem materials, OEA will continue working to manage problem wastes through approaches such as product stewardship and to help build markets for environmentally preferable products.

- **Design for the Environment** | The economic potential for broader integration of Design for the Environment technologies is significant. The interest in investing in new products and innovative technologies is demonstrated by a November 2004 PricewaterhouseCoopers survey that indicates that venture capital spending in the third quarter in the "clean technology" energy/industrial sector exceeded $8 million, an increase of nearly 10 percent. OEA has documented the powerful economic and environmental benefits of incorporating environmental concerns into the design of a product. The OEA will continue efforts to identify opportunities for Minnesota businesses to benefit through increased outreach in this area.

- **Clean energy** | Minnesota is dependent on coal to generate about 75 percent of the state's electricity. Current plants produce reliable and cost-effective energy, but they also account for over 60 percent of the sulfur dioxide and lead emissions, 20 percent of nitrogen oxides, 38 percent of carbon dioxide, and 40 percent of mercury released in the state. Because a large amount of pollution results from our production and use of energy, the OEA needs to build on its partnerships with Minnesota Department of Commerce, industry, and utilities to help assure that Minnesota receives the maximum, long-term environmental and economic benefit from emerging, "clean" energy technologies.

Minnesota recycles over 2.35 million tons of material, supporting more than 9,000 jobs in the state.

Electronic waste is growing rapidly. OEA is working with manufacturers and retailers to increase recycling opportunities.

Pollution prevention fosters environmental health and economic growth

In contrast to managing pollution *after* it is created, pollution prevention (P2) reduces or eliminates waste at its source. P2 is a "front-end" approach that decreases the costs of production and waste disposal, as well as reduces risks to the environment and public health. OEA assists a variety of partners to identify opportunities to use more efficient, less polluting technologies and processes. These preventative approaches not only protect the environment, but also create jobs, save money, and increase productivity. Once practices are in place, environmental and economic savings from pollution prevention continue year after year. The OEA provides P2 assistance in several ways.

▸ Design for the Environment

The design stage of a product offers a unique, powerful opportunity to eliminate or reduce the use of hazardous materials. This is when decisions about which materials will be used to manufacture a product are made. Environmental considerations also facilitate efficient use of energy and materials, which can generate significant cost savings.

OEA assistance directly enabled integration of Design for the Environment (DfE) into product design at two Minnesota manufacturers, **Medtronic, Inc.** and **General Mills**. The projects have resulted in annual cost savings of more than $2.4 million by eliminating 640,000 pounds of waste and reducing toxic chemical water use by 75 to 85 percent. Both companies have continued to further expand use of DfE after these initial projects. By implementing these design changes throughout its facility, General Mills expects to save over $4.5 million annually.

United Defense's Armament Systems Division, (Arden Hills), has developed an Environmental Design Guide with the specific goal of eliminating the use of dozens of hazardous materials in the design stage of products. When these high-risk chemicals are designed out of a product, the product has a significantly lower impact on the environment during its life cycle, which may extend for decades. Designers and engineers are required to use the guide as they select materials for new and significantly modified products. The company has saved $248,700 over the past three years by implementing the design guide. This approach gives a competitive edge for the company when bidding for defense contracts.

DfE outreach Recognizing the benefits of DfE, IBM (Rochester), General Mills (Chanhassen), 3M, and Medtronic, Inc. collaborated with OEA to produce an eight-minute *Better by Design* video to help other manufacturers promote DfE practices to their management. Reflecting interest and need for the assistance, the OEA's online DfE Guide Book (**www.moea.state.mn.us/p2/dfe-guide.cfm**) has been downloaded more than 120,000 times.

DfE has the potential to help many sectors of the state's economy. If Minnesota manufacturers with processes similar to Medtronic and General Mills adopted DfE and achieved only 10% of their success, those companies could save more than $131 million a year.

Through OEA Design for the Environment assistance, Medtronic saves $2.1 annually and has reduced waste and chemical use by 75%.

General Mills saves more than $350,000 a year and has reduced waste by 40%, with potential savings of $4.5 million per year, validating OEA's DfE assistance to industry.

▸ Minnesota Technical Assistance Program

The OEA accomplishes much of its on-site P2 technical assistance through the Minnesota Technical Assistance Program (MnTAP), located at the University of Minnesota. MnTAP relies upon its ability to provide assistance such as site visits, a summer intern program, and materials exchange services to produce results.

For every $1 spent on the MnTAP program, Minnesota industries save $4. During 2003-2004, through 248 site visits and summer intern projects at 14 other facilities, MnTAP helped businesses save $5.1 million through reduction of 62.9 million pounds of waste, reduction of 11 million pounds of pollution in wastewater, reuse of 5.3 million pounds of waste, and conservation of 29 million gallons of water. Further, through additional proposed waste reduction measures identified by MnTAP's 2004 summer intern projects, up to 261,000 pounds of waste can be eliminated and 9.7 million gallons of water can be saved. Three intern projects also identified energy efficiency measures with possible savings of 33,250 MMBTU (enough energy to heat 170 homes per year). If implemented, these measures would result in additional cost savings of $419,293.

Photo: MnTAP

At the request of the hospital, a MnTAP intern researched PVC-free IV bags.

P2 with industrial energy efficiency | To increase effectiveness of site visits and help address pollution due to energy production, OEA, MnTAP, Minnesota Department of Commerce Energy Office, and local utilities have collaborated to bring U.S. Department of Energy (DOE) Industry Best Energy Efficiency Practices to the state. As a result, MnTAP site visits and intern projects increasingly include energy efficiency in P2 assessments.

RETAP | OEA's Retired Engineers Technical Assistance Program (RETAP) assists businesses and public entities, focusing primarily on sectors not covered by MnTAP. Using retired engineers with experience in waste reduction, RETAP performed 75 on-site visits from 2002 to 2004, resulting in $93,700 in projected savings to businesses from reduced energy use, waste reduction, and water conservation. To ensure coordination, RETAP is housed at MnTAP.

Materials Exchange Alliance | Actively promoting a materials exchange network that links companies that have excess materials with those needing them, MnTAP facilitated 991 exchanges, totaling 2,664 tons of materials, saving companies $2.5 million in avoided purchases and disposal costs in 2003-2004. Materials exchange staff at eight county exchange sites also responded to 1,404 calls and helped facilitate 35,609 web self-referrals to the online database.

Ridgeview Medical Center in Waconia uses a hydrogen peroxide plasma sterilizer to eliminate their use of toxic ethylene oxide, saving the hospital $13,965 annually and providing a healthier environment for employees.

▸ Pollution prevention for hospitals

OEA and MnTAP are active participants in Hospitals for a Healthy Environment (H2E), a national partnership between U.S. EPA and the American Hospital Association. The H2E goals are to eliminate mercury from the hospital waste stream by 2005 and to reduce the total volume of waste by 33 percent in 2005 and by 50 percent in 2010. MnTAP worked directly with 34 Minnesota healthcare facilities (22 percent of the state's hospitals), which so far have eliminated 394 pounds of mercury, 751 gallons of hazardous chemicals, and 250,000 pounds of solid waste, while saving $152,600 in the process. Additional reductions and savings are expected as this effort continues.

An OEA grant and MnTAP student intern technical assistance helped Ridgeview Medical Center institute comprehensive pollution prevention practices throughout its facility. Ridgeview's efforts, which were recognized nationally by Hospitals for a Healthy Environment, have reduced water use by 30 percent, eliminated 350 gallons of hazardous chemical waste, 225,900 pounds of solid waste, 700 aerosol cans, and resulted in annual cost savings of $39,330. The results were marketed to other hospitals to help them obtain management buy-in for the national program.

▸ Green building

Buildings are costly to construct and expensive to operate – and they have a major impact on our environment. Globally, buildings are responsible for about 40 percent of all raw materials used and 30 percent of total U.S. greenhouse gas emissions. "Green" buildings can save money and reduce the impact on the environment through using low- or non-toxic building materials and energy conservation.

Energy efficiency is an important component of green building, because Minnesota's commercial and residential buildings consume 68 percent of the natural gas and 47 percent of the electricity used in the state. Green office buildings offer significant economic and environmental advantages compared to traditional buildings. For example, a 200,000 square-foot green office building, designed to be about 30 percent more efficient than Minnesota's current energy code, will save $50,000 to $100,000 annually in energy expenses. The payback on this energy efficiency typically ranges from zero to a maximum of three years. It will also prevent roughly 1,000 tons of air pollution each year, if that energy otherwise would come from existing fossil fuel plants.

OEA promotes green building through technical assistance, development of web-based information resources, grant projects, and recognition awards. While these efforts have only begun to reach a small segment of the construction industry, the potential pollution prevention opportunities and energy and resource savings are very large. Currently, OEA's LEED-accredited staff is assisting on a number of design projects for local government, nonprofits, and businesses.

- OEA awarded **grants for design modeling** of Augsburg College's science building and of PuttingGreen, Inc.'s interpretive center. These projects will educate communities about sustainable design, while creating sustainable structures. OEA assisted in the sustainable design work for Ridgeview Medical Center and the city of Plymouth, provided green roof information for the Municipal Building Commission, and assisted in landscaping and materials selection for Northeast Metro 916 Career and Technical Center.
- OEA partners with other state agencies in a "one-stop shop" that provides **technical assistance to companies building facilities** in Minnesota. Polaris, the Ryan Companies, and Medtronic, Inc. received site-specific information from OEA to help implement sustainable design strategies as part of this program in 2004.
- OEA provided funding and technical assistance to develop the **Minnesota Sustainable Design Guide**, which was used to design three state office buildings currently under construction in St. Paul. OEA also helped develop the new Minnesota Sustainable Building Guidelines, which will provide high-performance buildings with short paybacks and annual cost savings for new state bond-funded construction projects.
- OEA joined green building advocates throughout the Twin Cities to form a Minnesota chapter of the U.S. Green Building Council.

The Department of Human Services building was designed using the Minnesota Sustainable Design Guide, developed with grant funding and technical assistance from the OEA. The building, currently under construction, is modeled as 39 percent more energy-efficient than required by Minnesota code. Created for an 80-year life, the building is designed for flexibility with raised floors, movable partitions, and zones that can shift between open and closed offices.

▸ Clean energy technologies

The fossil fuels we use to produce energy create significant pollution. Renewable energy technologies yield multiple benefits, including significantly lower air and water pollution; stable, long-term locally based energy; and local economic benefits by keeping energy dollars in our communities. As past success shows, public/private partnerships are needed to assure that transitions to new sources of energy are cost effective and successful.

The OEA collaborates with the Department of Commerce and other stakeholders to expand the use of P2 renewable energy technologies. OEA also works with Commerce to promote energy efficiency in buildings and in industries, and to encourage the use of renewable technologies whenever possible, such as the Million Solar Roofs Partnership project, part of a national effort to increase the use of solar energy systems.

The OEA has partnered with CenterPoint Energy, 3M, and Hennepin County to demonstrate and test use of a natural gas-to-hydrogen fuel cell at a new public library. The fuel cell does not

emit any nitrous oxides, sulfur oxides, or mercury, and less than one-sixth of the greenhouse gas emissions compared to electricity produced from burning coal. Bringing energy efficiency and new energy-generation technology together, the library will have annual utility savings of $82,000, saving enough natural gas to heat seven homes, and reducing electrical demand by the equivalent of 30 homes. The OEA also partnered with Xcel Energy and the University of Minnesota to provide a pollution-free, solar photovoltaic, water electrolysis-to-hydrogen fuel cell research and development project.

Xcel Energy, the University of Minnesota, and OEA collaborated to provide a pollution-free hydrogen production teaching/research facility. Lead researcher, Louise Goldberg, stands by a storage tank of renewable hydrogen made by using electricity from solar PV to separate water into its components, hydrogen and oxygen. The hydrogen is then used in a fuel cell which can produce electricity when the sun isn't shining.

Because Minnesota could see large potential economic and environmental benefits from the long-term transition to renewable hydrogen as an energy source, the OEA and the Department of Commerce helped to form the Minnesota Renewable Hydrogen Initiative, along with the Departments of Employee and Economic Development and Agriculture, the University of Minnesota, trade associations, industry, utilities, and nonprofits. This partnership is designed to support the use of Minnesota's renewable resources (wind, biomass, solar) to produce hydrogen. Minnesota's bio-based industries, principally agriculture and forestry, would benefit from economic development and local jobs. The initiative also intends to support the Minnesota companies, such as Entegris, 3M, Donaldson Company, and TSI, already providing leading-edge technology and products for the hydrogen fuel cell industry – an industry that is on track to grow to $1.7 trillion annually within the next 15 years.

▸ Clean air partnerships

The OEA is a founding member of Clean Air Minnesota (CAM), a voluntary partnership of government, industry, and nonprofits working to keep Minnesota in compliance with federal air quality standards through outreach, education, and pollution prevention. CAM's goal is to reduce VOC emissions by 5,475 tons per year by 2010. The 55 CAM partners have agreed to reduce their own VOC emissions by 38 tons per year through voluntary prevention measures such as replacing inefficient equipment with low-emission equipment, diesel engine retrofits, natural landscaping, and changing manufacturing operations. The partnership is also working to educate Minnesotans to take actions that reduce air quality impacts. Nearly 100,000 flyers were distributed in water bills to Minneapolis residents. MPCA air pollution alerts are now e-mailed to thousands of people statewide, including over 37,000 people through the University of Minnesota. The flyers and alerts explain actions that people can take to reduce their VOC emissions, particularly when an air pollution alert has been issued.

Ramsey County plow driver, Heath Hoglund, stands next to a truck retrofitted with a diesel oxidation catalyst, which reduces emissions by about 30%. The retrofit is part of Clean Air Minnesota's pilot focusing on reducing diesel truck emissions.

Recognizing pollution prevention achievements

The OEA's **Governor's Awards for Excellence in Pollution Prevention** promotes organizations that are in compliance with environmental regulations and demonstrate superior leadership and the economic and environmental benefits of going "beyond compliance." Pollution prevention savings continue each year as long as the preventative actions continue. Award winners from 2002-2004 reduced more than 56 million pounds of solid waste, prevented 211 million pounds of sludge and toxic chemicals, documented 800,000 KWh energy savings, and show total economic benefits of $22.7 million a year.

Recycling strengthens our environment and creates jobs in Minnesota

Our waste is a resource because it has economic and environmental value. In 2003, Minnesota generated 5.9 million tons of mixed municipal solid waste (MSW). We recycle 40 percent of that waste, over 2.35 million tons of material. The state's recycling programs save 34 trillion BTUs of energy, enough to power nearly all the homes in Ramsey County for one year. Recycling also reduces the amount of pollution, including greenhouse gases, released to the environment from extraction and production of raw materials.

There is still tremendous potential growth in the recycling industry. The waste that we *don't* recycle contains more than one million tons of recyclable and organic materials – materials that if recovered would have an estimated economic value of $85 million – yet it costs $45 million to throw them away.

Each year, the OEA provides $12.5 million in SCORE funding to county governments, as well as technical assistance, to support this recycling infrastructure that is a significant contributor to the state's economy and environment. In return, the state benefits from the economic impact of Minnesota's recycling industry, which supports more than 9,000 jobs and provides nearly $64 million in tax revenues. These jobs, in turn, support another 10,200 people in indirect and induced jobs. Altogether, the recycling industry pays an estimated $760 million in wages and adds $2.98 billion to the state's economy.

Paper stock used to make corrugated cardboard rolls off the line at Liberty Paper's mill in Becker, Minn. Liberty processes 600 tons of waste paper per day.

Anchor Glass in Shakopee produces 915 million bottles every year and is the biggest consumer of recycled glass feedstock in the upper Midwest. Anchor employs 280 workers.

Minnesota's recycling manufacturers: An economic activity and environmental benefit summary

Minnesota's recycling programs do an excellent job of keeping waste out of the solid waste disposal system. However, recycling is more than an alternative to waste disposal. It also creates new businesses, which in turn creates new jobs, fosters economic development, and protects public health and our environment.

Minnesota's recycling industry adds significant value to our state's economy. In order to document this economic activity, the OEA periodically examines the role of recycling in Minnesota's economy. These studies of economic activity looked at value-added recycling manufacturers – those businesses that remanufacture recyclables into secondary materials such as paper, plastic, metals, glass, and other materials.

Shingles made from tires represent a growing alternative to asphalt shingles.

In 2004 the OEA reexamined the economic activity associated with recycling in Minnesota's economy. This study was conducted in order to measure current economic activity and to identify a more complete range of benefits from Minnesota's recycling industries.

In comparing the 2004 to the 2000 data, Minnesota's valued-added recycling manufacturing industry continues to be a stable, growing, and vibrant sector of the economy. The number of jobs in value-added recycling manufacturing has increased by 3.4 percent. This is a very good indicator of the strength of this sector, since the manufacturing sector as a whole lost jobs over the last five years, due mostly to foreign competition.

Minnesota's recycling manufacturers: Jobs and dollars

Economic activity indicator associated with Minnesota's value-added recycling manufacturers	**Based on reported employment**	**Based on total estimated employment**
Direct jobs at the companies	6,499	9,003
Estimated indirect jobs Impacts on local suppliers statewide, unadjusted for displacement effects.	2,595	3,057
Estimated induced jobs Long-term effects on personal income and consumer spending, localized and statewide.	5,475	7,200
Total estimated jobs	**14,870**	**19,260**
Total estimated wages and salary disbursements The monetary remuneration of employees, including compensation of officers, commissions, tips and bonuses, and receipts-in-kind that represent income to the recipient.	$560 million	$760 million
Total estimated tax revenue on direct jobs Business/personal state income taxes, sales tax, excise tax and miscellaneous taxes, real estate taxes, and business taxes.	$46 million	$64 million
Total estimated value-added activity Contribution to Gross State Product analogous to GDP (gross domestic product), output excluding the intermediate inputs (primarily compensation and profit).	$1.09 billion	$1.29 billion
Total estimated gross economic activity Amount of production in total sales, includes intermediate goods purchased as well as value-added (compensation plus profit).	$2.35 billion	$2.98 billion

Source: Scenarios calculated using the Regional Economic Models, Inc. (REMI) Minnesota Forecasting and Simulation Model, December 2004, Minnesota Office of Environmental Assistance, Wayne Gjerde.

Estimated gross economic activity for Minnesota's value-added recycling manufacturing industry is $2.98 billion.

Rock Tenn in St. Paul processes 1,000 tons of waste paper a day into products like cereal boxes.

The overall numbers, excluding jobs, decreased slightly since 2000, due in part to the increase in competition from the globalization of the economy. This has resulted in leaner margins across the manufacturing sector. However, the plastic lumber manufacturing sector continues to experience strong growth and is responsible for significant economic activity.

Master Mark Plastics in Albany, Minn., used 30 million pounds of milk jugs last year to produce plastic lumber (top). Pactiv in Moorhead turned 8,000 tons of newspaper into 265 million egg cartons last year. By The Yard in Jordan produces premium patio furniture made from recycled plastic containers, and markets its products nationally.

Minnesota's value-added recycling manufacturers

Minnesota's value-added manufacturers generated an estimated $65 million in state tax revenue and employ an estimated 9,000 people in direct jobs. These jobs, in turn, support another estimated 10,200 people downstream in indirect and induced jobs. Altogether these jobs, which pay an estimated $760 million in wages, represent a major force in the Minnesota economy.

The largest segment of the value-added recycling industry is made up of manufacturers who use recycled paper, post-consumer paper, old corrugated cardboard (OCC), and newspaper as raw material sources. Rock Tenn in St. Paul, Liberty Paper in Becker, Stora Enso in Duluth, and Pactiv in Moorhead are major companies using this feedstock. Much of their raw material – recycled paper and OCC – comes from Minnesota curbside and business recycling programs.

Environmental benefits of recycling

The recycling efforts of Minnesota residents and businesses are improving our environment every day. The results are clear – cleaner air and water, avoided material consumption, avoided energy consumption, more forested land and open space, and reduced greenhouse gases.

An "environmental benefits calculator" was developed through a partnership with Recycling Association of Minnesota and the National Recycling Coalition to quantify the impact of recycling. By inputting Minnesota's recycling data for 2003, the OEA calculated the following:

- **Recycling in Minnesota conserves energy and reduces greenhouse gas emissions.** The 2.35 million tons of paper, glass, metals, plastic, and other materials recycled in 2003 saved nearly 34 trillion BTUs of energy—enough energy to power nearly 321,000 homes for one year. In addition, recycling resulted in reduction of net greenhouse gas emissions of 1.5 million tons, equivalent to taking more than one million cars off the road.
- **Recycling in Minnesota conserves natural resources.** By using recycled materials instead of trees, metal ores, minerals, oil, and other raw materials harvested from the Earth, recycling-based manufacturing conserves the world's valuable natural resources. For example, material consumption of natural resources for making steel was reduced by 585,000 tons as a result of recycling efforts.
- **Recycling in Minnesota reduces air and water pollution.** Last year, recycling reduced overall emissions, excluding carbon dioxide and methane, by 1.98 million tons. In addition, waterborne wastes were reduced by 6,700 tons.

▸ Funding an Integrated Waste Management System

OEA grants and assistance are important aspects of OEA's work with public and private entities to develop an integrated waste management system that treats waste as a resource. The OEA relies upon this finanical and technical assistance to support composting; household hazardous waste recovery; waste reduction focused on the manufacturing and service sectors; and reducing toxics and on-site disposal – all important components of a comprehensive, integrated waste management system based on the state's waste management policy in Minn. Stat. Ch. 115A.

OEA's Capital Assistance Program funds recycling facilities like this one in Fosston.

The Capital Assistance Program (CAP) leverages local dollars to help local government build facilities to convert waste materials into energy and useful commodities. Minnesota's 30 CAP projects contribute significantly to Minnesota's economy and environmental quality.

- The 24 CAP-funded **recycling centers** employ 140 people and recycle over 60,000 tons of waste annually. They serve over 40 of Minnesota's counties, many in rural areas of counties like Kittson, Houston, Murray, and Cook. Further, annual revenues from commodity sales resulting from their operation exceeded $3.8 million in 2003.
- Minnesota's six CAP-funded **waste-to-energy facilities**, which are equipped with state-of-the-art air pollution control equipment, convert over 221,000 tons of mixed municipal solid waste into electricity, generating annual energy sales of almost $6 million and providing steam and electricity to over 100,000 homes and businesses. These six facilities serve 18 counties (Olmsted, Dodge, Pope, Douglas, Goodhue, Wabasha, Polk, Beltrami, Norman, Clearwater, Mahnomen, Otter Tail, Wilkin, Grant, Stevens, Todd, Wadena, and Stearns) and employ 105 people.

The continued operation of CAP facilities is threatened by tight budgets and changing waste disposal markets. However, robust secondary materials markets and rising energy costs appear to be significant factors that improve the economics of these types of projects. OEA continues to work with local governments to expand recycling and waste-to-energy opportunities and support our existing integrated waste management facilities. For more information on OEA's activities relating to waste management, see OEA's *2003 Solid Waste Policy Report*: **www.moea.state.mn.us/publications/policy2003.pdf**.

Annual results: CAP-funded projects

	Tons*	Sales	Jobs
Recycling facilities	60,441	$3,841,200	140
Waste-to-energy	228,028	$5,716,800	105

* Tons of municipal solid waste and recyclable materials

▸ Minnesota Waste Wise

The OEA provides grant funds to and partners with the Minnesota Chamber of Commerce to provide waste reduction assistance through the Chamber's Minnesota Waste Wise (MWW) program. Each grant dollar is leveraged by $5 from the private sector. In 2003, MWW members recycled 33 million pounds, helped businesses reuse 80,000 pounds of materials, composted 480 cubic yards of organics, and saved businesses more than $1.5 million.

Recently, the OEA also worked closely with MWW, the Chamber, and Supervalu to increase recycling of plastic bags. In just one year, the "It's in the Bag" program has recycled more than 24 million plastic bags. Such efforts show the effectiveness of collaborative, public-private sector partnerships.

New markets for recycled materials

Nylon Board Manufacturing | OEA has worked closely with Nylon Board Manufacturing (NBM) in Medford, Minn., to develop markets for products made from post-consumer carpet. Founded in 2001, NBM produces building products made from recycled 100% post-consumer carpet. NBM now employs 22 people and has invested over $4.5 million developing this technology over the past four years. Every day, 72 tons of post-consumer carpet are processed, diverting about four semi-loads of carpet from landfills. This new industry supports the OEA's effort to advance a national product stewardship agreement between the carpet industry; federal, state, and local government agencies; and other organizations to increase the amount of carpet that is recycled over the next 10 years.

Nylon Board Manufacturing recycles old carpet to make their NyBoard product.

Recycling asphalt shingles | Recycling old asphalt shingles can generate high economic returns for business and government, while diverting over 400,000 tons of waste shingles from landfills. Each year, Minnesota businesses and government agencies spend approximately $3.5 million buying 5 million tons of new hot mix asphalt. With an investment of $1.2 million for equipment that would recycle old asphalt shingles for use in hot mix asphalt, businesses and government would:

- save $2.8 million annually.
- generate over $6 million in new gross business activity associated with recycling.
- create 8 to 12 new jobs.
- save approximately 200,000 to 300,000 cubic yards of landfill space.

Recycling old asphalt shingles into new highway asphalt mix can save state and local government $2.8 million a year and generate $6 million in new business activity.

Regional mattress recycling project | In northeastern Minnesota, a partnership including seven northeast Minnesota counties, the University of Minnesota at Duluth, the Western Lake Superior Sanitary District, Goodwill Industries, Anderson Furniture, HOM Furniture, Hometown Furniture, and other businesses is testing a program to recycle mattresses. Since starting on June 1, 2004, the project has recycled over 800 mattresses, diverting 22 tons of recyclable materials from landfill, and creating one new job at Goodwill Industries.

By the end of the project's first year, it is estimated that up to 700 mattresses per month – over 9,000 annually – will be deconstructed and recycled; 260 tons of material will be diverted from landfills, saving 9,000 cubic yards of landfill space. The project is also expected to create employment for three workers and generate nearly $70,000 in revenues for Goodwill Industries.

Regional recycling market workshops | The OEA is working closely with counties to support existing recycling and reuse businesses and explore more efficient means of collecting and transporting recyclables. In the summer of 2004, the OEA organized five recycling market workshops in Bagley, Nelson, Slayton, Owatonna, and Duluth, customizing each agenda to address the specific needs of that region. Speakers representing paper, glass, and plastic end markets addressed issues in each region. In addition, a transportation logistics company, C.H. Robinson, provided suggestions on reducing collection and transportation costs.

Approximately 150 people participated in the workshops, representing state and local government, industry, and nonprofits. A follow-up survey indicated that the workshops succeeded in providing useful contacts and information to help improve recycling programs (**www.moea.state.mn.us/market/workshops.cfm**).

Recycling mattresses in northeast Minnesota will divert 260 tons of material from landfills per year.

Supporting innovative partnerships and technologies in our communities

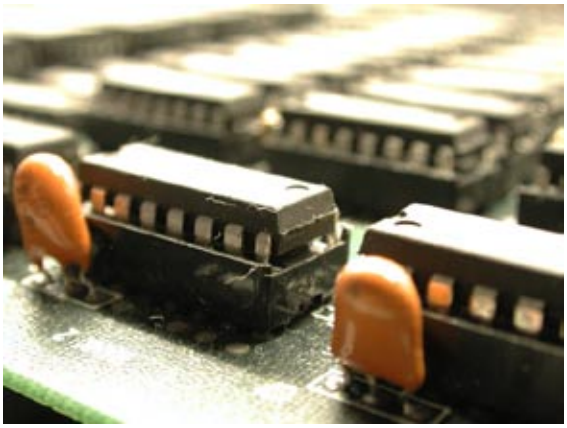
OEA helps support economic and community models that will yield long-term benefits. Several recent projects demonstrate how financial and technical assistance provided in the right place can help to produce a business that will then attract new partners or become self-sustaining.

In partnership with the OEA, Technomics has developed an aluminum casting technology that is 85% more efficient than the industry standard.

Technomics | The OEA provided needed technical support to Technomics to help the company apply for a $414,000 U.S. Department of Energy grant. Technomics is a small company seeking to commercialize a new heat treatment and curing technology for cast aluminum that is 85 percent more efficient than the industry standard. The demonstration project was successful, creating a new manufacturer in Minnesota that can, in turn, improve the efficiency of our metal casting industry. Technomics had $750,000 in sales in 2004, and expects them to double in 2005.

Restore Products | OEA provided a grant to Restore Products to develop and test a refillable bottle dispenser for non-hazardous cleaning products to be sold in grocery stores. The company was able to receive private equity financing after the testing phase. The refill station is now manufactured in Minnesota and, by the end of 2005, will be in more than 140 stores, with reusable bottles preventing 140 tons of solid waste, replacing 80,000 gallons of hazardous with non-hazardous cleaning products, generating more than $3 million in sales.

HOURCAR | An OEA grant for feasibility funding for the HOURCAR car-sharing service – a first in Minnesota – leveraged $270,000 in federal funding, a $50,000 pledge from Hennepin County, and a grant from the St. Paul Foundation in 2004. Car sharing is based upon a pool of cars in several locations available to members who pay their hourly portion of the annual costs of ownership. Members may save on transportation expenses, and with the project using late model and hybrid cars, the community will benefit from cleaner air and reduced congestion.



Benchmark Electronics | Businesses often become more competitive by reducing pollution and improving efficiencies. Benchmark Electronics (Winona) received an OEA grant to pilot use of lead-free soldering in its circuit board assembly process. As a result of the grant, Benchmark will eliminate up to 8,300 pounds of lead at its facility and expand into new markets with a lead-free product. The pilot project shows how other Minnesota-based printed circuit board assemblers can benefit from this emerging technology.

Haubenschild Farms | OEA's grants often attract other partners who take a project to the next level. Several years ago, in partnership with other organizations, OEA awarded a grant to Haubenschild Farms (Princeton, Minn.), to pioneer the use of anaerobic manure digestion to produce methane for generating electricity. The 800-cow family farm now produces about $130,000 worth of electricity and powers the farm and 78 homes in the Princeton area. Recently, the Department of Agriculture received a grant though the LCMR that will enable the University of Minnesota to add a 5kW hydrogen fuel cell to the Haubenschild digester to create hydrogen from animal waste.

Product stewardship for used electronics, mercury, & paint

OEA is working for a long-term solution to assure that Minnesotans have the opportunity to recycle used electronic equipment, leftover paint, used carpet, and other products. To advance this objective, OEA has participated in several national product stewardship dialogues intended to develop a comprehensive approach to managing these projects at end-of-life. By involving manufacturers, retailers, government agencies, recyclers, environmental organizations, and consumers, we can manufacture, sell, and recycle products that are cheaper to produce, pollute less, have fewer toxic components, and recycle more easily.

Electronic waste, especially old computers and televisions, is a growing problem for environmental and waste managers across the state. Some recycling of electronics is being done, such as by Asset Recovery in St. Paul, but a comprehensive approach to the issue is needed.

▶ **Electronics** | Thousands of used electronic devices, such as computer monitors, televisions, and printers, need to be properly managed because of their rapidly increasing volume, their highly engineered components, and the toxic materials they may contain. With a Minnesota disposal ban on CRTs taking effect on July 1, 2005, OEA has been working with key stakeholders to develop an effective statewide program for managing used electronics.

In 2004, OEA co-sponsored six electronics recycling events with Minnesota retailers in the metro area and in greater Minnesota. The six events collected over 350,000 pounds of equipment, including over 250,000 pounds at a two-day event at Best Buy's headquarters. The events also provide useful information as the state considers how to establish an effective statewide electronics collection and recycling program in partnership with retailers, electronics manufacturers, and others. One of OEA's strategic goals this biennium is to expand value-added markets for used electronics to assure that these materials are recovered and properly managed.

▶ **Mercury** | Mercury can be released to the environment if automobile switches containing mercury are not removed before auto bodies are crushed to reclaim scrap metal. In a partnership to eliminate these emissions from older cars, OEA, the Minnesota Chamber of Commerce's Minnesota Waste Wise program, and the Alliance of Automobile Manufacturers have developed the Minnesota Mercury Recovery Program. Salvage yards can now remove mercury switches and place them in pre-paid recycling buckets. Vehicle manufacturers no longer use mercury switches in new cars.

▶ **Leftover paint** | Disposing of paint is the largest cost for local government household hazardous waste programs. The OEA is participating in a national product stewardship dialogue to develop a comprehensive, cost-effective means for managing leftover paint. The participants have agreed to undertake several demonstration projects to determine how to reduce the volume of leftover paint, to improve the use and marketing of recycled paint, and to develop new products from leftover paint.

Environmental education partnerships: Working to build knowledge and protect community resources

OEA works with environmental professionals and educators to develop effective environmental education (EE) programs at the state, regional, and local level. A key focus of OEA's education partners is to assure that EE organizations have the necessary tools and knowledge to educate Minnesota citizens on environmental issues. The OEA also works with its partners to educate citizens through public events such as the State Fair and the Living Green Expo.

▸ North Central Lakes Clean Water Partnership

A broad partnership of government, business, community, education, and other organizations is working to preserve the health of almost 3,000 recreational lakes in five north central Minnesota counties (Aitkin, Cass, Crow Wing, Hubbard, and Itasca). The area's population is growing rapidly, with some areas expecting a 60 percent growth rate over the next 30 years. This unprecedented growth will have a profound impact on the area's environment and its economy. OEA is assisting in developing educational materials to encourage people to take the steps necessary to protect lakeshore areas and water quality.

The goal of the North Central Lakes project is to protect water quality and the economic and natural value of the lakes by demonstrating and promoting use of innovative lake management tools, building a regional lake identity, and fostering local responsibility for managing and protecting these resources. Many of the outcomes and learning of the project will be replicable elsewhere.

The North Central Lakes project is significant both for the area's environment and its economy. A study by the Mississippi Headwaters Board and Bemidji State University in June 2003 concluded that the water quality of the lakes in the project area is strongly linked to property values. The better the water quality, the higher the property values.

▸ The Second Minnesota Report Card on Environmental Literacy

In August 2004, the OEA published the results of a second statewide survey of environmental literacy of adults in Minnesota. The first survey (2001) created a baseline of environmental literacy for residents of the state. The survey is not an evaluation of the public, but rather a collection of information concerning the knowledge about, attitudes toward, and behaviors related to the environment in Minnesota. Significant findings in the second report card include:

- 82 percent of Minnesotans view loss of wetlands and residential runoff from yards as a serious issue.
- 90 percent want schools to provide environmental education.
- Most Minnesotans frequently conserve energy (87 percent); do not use fertilizer on their lawns or use a phosphorus-free fertilizer (62 percent); and conserve water (51 percent).
- There is a connection between increased environmental knowledge, a more positive environmental attitude, and behavior changes to protect the environment. Respondents who received a higher grade in general environmental knowledge were significantly more likely to have a positive attitude toward the environment and to engage in more positive environmental behaviors.

The Living Green Expo showcases a wide range of environmentally oriented products, offering visitors a chance to talk with experts in a broad range of environmental and health fields.

Living Green

More than 10,500 people attended the third annual **Living Green Expo** co-organized by the Minnesota Office of Environmental Assistance and the Minnesota Pollution Control Agency and held May 1-2, 2004, at the Minnesota State Fair Grounds. The free event featured more than 200 exhibitors showcasing environmentally sound products, services, and practices created by local companies. In addition, 1,800 people attended nearly 100 workshops on topics such as how to compost, how to reduce toxicity in the home, and how to use the latest energy-saving technologies.

The OEA's living green exhibit at this year's **State Fair** helped Minnesotans learn about important environmental issues, including recycled products, composting, clean air, toxicity and waste reduction in the home, and alternative energy. An estimated 100,000 people were exposed to the exhibit, which received an award for Outstanding Indoor Exhibit for 2004.

Get the Lead Out campaign

OEA's focus on preventing pollution has resulted in keeping nearly 2,000 pounds of lead out of Minnesota's rivers and lakes through a voluntary lead tackle exchange effort. The OEA worked with a variety of businesses and other organizations to hold more than 50 lead tackle exchange events in 2003 and 2004. Anglers turned in lead tackle and received free non-lead alternatives.

This effort is encouraging increased market demand, which is, in turn, encouraging new products. Three Minnesota manufacturers introduced lead-free tackle products this year. **Water Gremlin** (White Bear Lake) introduced several new weights made with bismuth. Northland Fishing Tackle (Bemidji) introduced a non-lead Nature Jig made with bismuth. Tundra Composites (White Bear Lake) introduced a composite equal in density to lead.

Lead sinker exchange events collected hundreds of pounds of lead and helped educate anglers about alternatives.

Asset Recovery in St. Paul disassembles and recycles computers, monitors, and other electronic equipment.

Conclusion: Creating a stronger and healthier Minnesota

The OEA works to prevent pollution and waste at its source and to turn leftover materials into value-added products. The most effective way to protect our air, water, land, and long-term economic health is to avoid pollution by using manufacturing processes, materials, and products that are the most efficient and least harmful to the environment. The regulatory requirements established through legislation are a key to supporting our environmental and public health. The OEA promotes voluntary partnerships to create opportunities by relying upon technical and financial assistance, market development, policy initiatives, and education to create successful outcomes. We have achieved significant success, but also continue to face significant environmental and economic challenges.

Waste growth and the future of recycling

In 2003, Minnesota generated 5.9 million tons of mixed municipal waste. An estimated 36 percent of that waste went to landfills in Minnesota and adjacent states. By 2015, it is projected that this will increase to 9.1 million tons. This continued waste growth will stress the capacity of the waste management infrastructure. Although we now recycle 40 percent of this waste, there is an estimated 1 million tons of recyclable and organic material being thrown away that, if recovered, has a market value of over $85 million.

Despite the economic value of the recycling industry to the state's economy, Minnesota's recycling infrastructure faces challenges. Some counties are dealing with budget reductions by closing down recycling centers or limiting the types of materials they collect. Plastic and glass recycling have been eliminated in some communities. Rural recycling programs, in particular, are facing more obstacles in getting materials to distant markets. The OEA continues to explore better ways to support county recycling programs and secondary markets; to recover more recyclable and organic material from the waste stream; and to identify new opportunities to reduce, reuse, and recycle in the manufacturing and business sectors. OEA's strategic objective is to expand Minnesota's secondary markets, increase recycling employment to 11,200 jobs, and grow the industry overall by 20 percent in the next 10 years.

Potential economic impacts of adopting environmentally friendly industry practices

Part of OEA's mission is to act as a catalyst to help new innovative strategies become mainstream – working with our partners to help Minnesotans build stronger and healthier communities through voluntary, preventative actions. Much is accomplished when environmental innovation and economic growth work together, but more work remains.

There are approximately 425 facilities that, due to the quantities and type of chemicals they use, are required to report under Toxic Release Inventory (TRI). These facilities report release of approximately 15,000 tons of TRI chemicals annually, showing that opportunities for pollution prevention remain. Minnesota Department of Employment and Economic Development (DEED) data show that there are more than 6,000 facilities in the state that are in the same industries. The pollution prevention technologies that work for large facilities often work for small ones. Collaboration with DEED and outreach to trade associations, vendors, and consultants are designed to make full use of the opportunities for small facilities to achieve the benefits of pollution prevention.

The OEA will build on successful voluntary partnerships that use market-driven approaches to protect the environment. Such approaches can maximize the environmental and economic benefits of preventing waste and create value-added products from waste that cannot be prevented.

Rock Tenn paper processing plant in St. Paul.

What pollution prevention can do for Minnesota's economy

There are more than 70 industry sectors in business in Minnesota. The table below shows the potential economic impact for the medical, food, and housing industries if their facilities achieved **just 10 percent** of the cost savings documented by pollution prevention and Design for the Environment case studies at General Mills and Medtronic.

The Energy Star building practices column looks at the economic impact of adopting EPA's Energy Star building guidelines for new housing starts in Minnesota for one year.

Economic impact	Food industry pollution prevention	Medical device industry DFE	Energy Star building practices in new housing starts
Direct jobs at the companies	538	590	1,434
Estimated indirect jobs Impacts on local suppliers statewide, unadjusted for displacement effects.	87	155	394
Estimated induced jobs Long-term effects on personal income and consumer spending, localized and statewide.	209	365	463
Total estimated jobs	834	1,110	2,291
Total estimated wages and salary disbursements The monetary remuneration of employees, including compensation of officers, commissions, tips, and bonus and receipts-in-kind that represent income to the recipient.	$10 million	$20 million	$48 million
Total estimated tax revenue on direct jobs Business/personal state income taxes, sales tax, excise tax and miscellaneous taxes, real estate taxes and business taxes.	$1.6 million	$4 million	$10 million
Total estimated value-added activity Contribution to Gross State Product analogous to GDP (gross domestic product), output excluding the intermediate inputs (primarily compensation and profit).	$4.3 million	$38 million	$78 million
Total estimated gross economic activity Amount of production in total sales, includes intermediate goods purchased as well as value-added (compensation plus profit).	$19 million	$73 million	$163 million

Source: Scenarios calculated using the Regional Economic Models, Inc. (REMI) Minnesota Forecasting and Simulation Model, December 2004, Minnesota Office of Environmental Assistance, Wayne Gjerde.

(Continued from front cover)

Pelican River Water District in Grand Rapids works with homeowners and realtors to maintain water quality through better shoreline design and maintenance; an Asset Recovery Corporation employee hefts a computer monitor destined for disassembly and recycling of its toxic and non-toxic components. The St. Paul-based company employs 80 people.

The University of Minnesota's successful U-Pass program offers students subsidized all-you-can-ride passes for U of M and Metro Transit buses. The program has significantly increased ridership and decreased the need for new parking.

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OEA wishes to acknowledge and thank the many partners who have worked with us to achieve the results highlighted in this report. We look forward to continuing our work together to go beyond these results and achieve an even healthier and stronger Minnesota.