Appendix 2: Literature Reviews and Best Practices for Agencies

In response to the Telework Enhancement Act of 2010, two literature reviews were compiled by OPM researchers. They detail best practices for agencies and summarize the state of the literature on telework as a tool for reducing energy use and environmental impacts, alleviating traffic congestion, and increasing job availability.

Telework, Energy, Transportation, and the Environment

Telework can be a useful tool for agencies or organizations that hope to lessen traffic congestion, reduce greenhouse gas emissions, and improve local air quality. Both the public and private sectors have steadily come to promote telework as a means for achieving a variety of goals. Frequently telework is credited with decreasing energy costs, adverse environmental impacts, and emissions of greenhouse gases. This may be a fair assumption, but both the private and public sectors have room to improve methods of measuring and verifying these savings.

The energy impact of telework can be broadly modeled as a function of transportation, home and office space and equipment, and information and communication technology (Horvath, 2010). Below are a few highlights from the growing literature on telework, energy, and the environment.

- The estimated impact of telework on **national energy use** is small. One study estimated national energy savings of between 0.01 and 0.40 percent in the U.S. and 0.03 to 0.36 percent in Japan (Matthews & Williams, 2005).
- Numerous studies have estimated the impact of telework on **vehicle miles traveled**, or VMT, which in turn impacts gasoline consumption and traffic congestion. One conservative estimate puts the impact of teleworking at about 1 percent of overall U.S. household VMT (Mokhtarian, 1998). Although this reduction appears small, telework is a much more cost-effective method of reducing congestion than other approaches, such as expanding mass transit (Choo, Mokhtarian, & Salomon, 2005).
- Telework appears to result in significant trip reductions and lower VMT for individual teleworkers. Multiple studies have found that individual employees save in the range of 30 to 50 miles per day or 50 to 80 percent less VMT per year (Lake, 2008).
- Beyond energy use, telework can impact **greenhouse gas emissions** and **office space** needs. Studies have estimated a possible savings of 3.5 billion square feet of office space (Romm, 2002) and a ten year savings of 312.4 million tons of greenhouse gas emissions (Fuhr & Pociask, 2011).

Many studies suffer from an inability to account for all the different ways the work environment affects energy use. A few have emerged that attempt to quantify the **net impact** of telework on energy consumption in the home and office. Below are a few conclusions of these studies:

- When teleworking, employees have lower impacts on energy consumption and air pollution. Non-telework energy use and air pollution costs are likely equal to or higher than those for telework days (Kitou & Horvath, 2008).
- Telework generally reduces air pollutant emissions, but may not reduce all types of emissions equally.[7] Impacts will differ by pollutant, location, heating or cooling season, induced travel, avoided VMT, latent demand, and minimizing space and equipment use when teleworking. Program designers must consider factors such as their local climate, energy mix, transportation patterns, and whether teleworking employees will maintain offices at home and at the central worksite (Kitou & Horvath, Energy-related emissions from telework, 2003).
- Certain forms of transportation may actually increase emissions. Substituting shorter commutes may not reduce energy or emissions because of rebound effects from home energy use. A rebound effect is an unintended increase in energy use due to a behavioral change or new technology that negates the savings from the change. Successful telework programs will encourage the avoidance of polluting forms of transportation, increase commuter vehicle occupancy rates, substitute longer commuters, and increase teleworking frequency (Kitou & Horvath, Transportation choices and air pollution, 2006).

Success Stories in the Private Sector

A quick search of media associated with telework will reveal a number of striking savings estimates from private companies. Companies have reduced energy costs, real estate costs, employee fuel costs, other utility costs, and travel costs. These estimates certainly suggest that telework has great potential for all sectors to save on energy and building costs.

One company has reported savings of $387 million in reduced office space and utility costs due to its telework program between 2002 and 2008. In 2009, another company reported savings of $10.3 million in employee fuel costs and 47,320 metric tons of avoided greenhouse gas emissions. A third company reported saving $550 million in real estate and reduced overhead costs between 1991 and 1997.[8]

Success Stories in the Federal Government

While Federal Government data on telework participation and frequency has been collected over the years, there is still much more to learn about how telework has impacted energy use,

[7] Telework reduces the emissions of carbon dioxide (CO2), mono-nitrogen oxides (NOx), particulate matter (PM10), and carbon monoxide (CO) but not nitrous oxide (N2O) and methane (CH4).

[8] As a caution, often these savings figures come from telecommunications companies that may have a vested interest in supporting telework. Many are reported without background on how the estimates were produced and which assumptions were made. Lastly, the units of measurement of the savings differ widely and assumptions – if provided – also differ. This makes comparisons very difficult. Nonetheless, the savings numbers are impressive.

air quality, and emissions within the public sector. Agencies are still adapting to new telework programs and searching for new ways to estimate savings. Yet, a few examples from the Federal Government stand out as models for future research on the potential of telework to reduce energy use and environmental impacts.

- The United States Patent and Trademark office (PTO) is widely considered a leader in telework within the Federal Government. PTO has 7,030 teleworkers (86.52 percent of eligible workers) and 8,125 eligible telework positions (78.35 percent of the agency). Of PTO's teleworkers, 3,739 of them telework 4 to 5 days per week. Employees who telework 4 to 5 days per week relinquish their office space and use a hoteling system when at the Alexandria office. As a result of this unique arrangement, PTO has realized $19.8 million in real estate savings as of August 2011.
- GSA has developed an Excel-based tool for agencies wishing to calculate the break-even point for the costs of telework, purchasing information technology, and real estate savings – the Cost-per-Person Model (Kaczmarczyk, 2008). A GSA commissioned study by Booz Allen Hamilton found that agencies could realize a return on investment of between 225 percent and 1500 percent through a variety of telework program arrangements (General Services Administration, 2006).
- The National Institutes of Health has pursued cost savings from telework through its hoteling initiative. In 2007, the National Science Foundation found that employees saved, on average, 62 hours of commuting time, $1,201 in costs, and 1,751 lbs of emissions in a year of teleworking. This amounted to a 12 percent reduction in National Science Foundation teleworkers' carbon footprint (Telework Exchange, 2008).

Best Program Designs for Achieving Broad Community and Societal Goals

While research still must be improved and expanded, a review of the existing literature shows promise for telework as a tool for addressing energy and environmental challenges. The Telework Enhancement Act of 2010 has reaffirmed the Federal Government's commitment to expanding telework while accurately measuring participation and success. Undoubtedly, this will result in useful information that will help agencies better assess programs and design programs around achieving goals. For some agencies, energy savings and environmental impact may be among the most important program goals. Evidence suggests that agencies seeking to reduce energy costs and emissions should consider the following design elements:

- **Maximize hoteling in order to decrease office space**. If teleworkers maintain offices at work and if lights and equipment are left turned on at all times, this significantly decreases the potential savings from building costs and utility bills.
- **Encourage teleworking for those with longest commutes.** Evidence suggests that the most substantial energy savings benefits occur for those with long commutes and in some cases energy use at home could be greater than savings from telework (Kitou & Horvath, 2008).

- **Consider cost transfer to employees.** Some have suggested that energy savings from telework could merely be transferring utility costs onto employees rather than resulting in a net energy and cost savings overall (Overmeyer, 2011).
- **Consider local electricity energy mix**. Teleworking could be reducing pollution from one source (the source that powers the office) while increasing it at a dirtier source (the source that powers the home).
- **Be flexible with program design.** Developing a variety of telework arrangements that can be flexibly applied, as has been done by PTO, could maximize the energy benefit potential of a program.
- **Use information and communication technology effectively**. Technology plays a critical role in any telework program. Creativity can help maximize the energy benefit. For example, an agency could replace some air travel with teleconferencing or establish telework centers for those uncomfortable with working inside the home.
- **Educate teleworkers about how to save energy while teleworking.** Educating teleworkers about the arrangements and behaviors that best save energy and reduce pollution could increase the benefits seen from the program. Many workers may have personal desires to further these goals, but may be unsure of the best means to do so.

In order to succeed, telework programs must be thoroughly planned and all transportation and non-transportation trade-offs should be considered. Poor building management, inefficient work arrangements at the office, and low frequency telework schemes can offset any potential energy savings from telework (Kaczmarczyk, 2008). With careful planning, experimentation, and data collection, agencies as well as private companies can realize substantial cost savings while exercising societal responsibility through reducing energy and environmental impacts.

Increasing Job Availability through Telework

As noted previously, telework is promoted and implemented in order to achieve a variety of objectives. While a primary set of objectives includes recruitment, retention, and productivity, telework also has been pursued as a tool for job improvement and for making jobs more available to traditionally underserved populations. These last might include new mothers, employees with disabilities, and aged workers. Underserved populations are particularly strong candidates for telework because they may be hindered by substantial barriers that can be alleviated through using telework as a workplace flexibility (Tremblay, 2003; Feldblum 2008)

There is substantial anecdotal evidence to support the use of telework towards improving job satisfaction and expanding job availability. The available empirical studies, however, tend to focus more on telework as a tool for improving the workplace, rather than on telework's potential to create or expand job opportunities for specific populations. In fact, it is still not clear how telework creates jobs as opposed to making it possible for certain types of people to apply for jobs they would not be able to apply for otherwise. While qualitatively, the range and approximate magnitude of economic impacts such as productivity, wage rates, absenteeism and retention

rates has been well researched (mostly through surveys), quantitative estimates or forecasts of specific economic impacts of telework have been sparse (Doherty, Andrey, & Johnson, 2000). This trend is not only reflected in this report, but across the study of telework as a whole (Bailey & Kurland, 2002). Research suggests this measurement challenge may be due to "the lack of formal methods of reviewing or monitoring [telework] program success and the fact that many different 'players' exist in the administration and success of [telework] programs, combined with the wide range of possible organizational, individual and societal impacts in the short- and long-term (Doherty, Andrey, & Johnson, 2000)."

Success Stories in the Private Sector

The private sector provides unique insight into job creation and availability. Literature examining telework in the private sector commonly addresses job creation and job availability through rural development. Many universities, including Washington State University, have identified and encouraged telework as a strategy to revive the rural economy (Washington State University, 2004). Telework can be a very attractive employment option for economically struggling former manufacturing areas, seasonal resort areas, and cold-climate locales. Regions such as the mid-Atlantic and Northeast have lost population and tax base to the high-tech Northwest or warm southern regions of the United States because these areas have been better able to sustain year-round residents. The answer may lie in luring more residents who can work for anyone from anywhere (Fenson & Hill, 2003).

Examples of this revitalization can be found in Colorado ski communities such as Steamboat Springs and Telluride, which have been actively seeking to attract professional teleworkers. By design, these professionals live in the towns and communities (Fenson & Hill, 2003). The towns do not have to create industrial infrastructure or deal with industrial pollutants, and the areas can maintain a highly educated, well-paid populace. Creating these communities requires providing workers with access to a commercial airport, overnight mail services, and computer-based digital switching for telephones. In the past, this was particularly challenging for rural communities (Fenson & Hill, 2003).

Smaller communities outside large metropolitan areas can enjoy enormous benefits from telework. Teleworkers contribute to the revitalization of small towns in outlying areas. A well-placed telework center can allow residents to retain or secure a position with a firm in a metropolitan or inconveniently located area while continuing to work in close proximity to their rural homes. This can enhance retail, service, and food vendor revenue in the smaller struggling community as well (Fenson & Hill, 2003).

The literature suggests that issues associated with increasing telework in rural areas primarily lie in the lack of existing technological infrastructure (OECD, 2001). However, there is little qualitative data that identifies specific challenges to infrastructure provision. Overall, there is a wealth of private-sector information that discusses the benefits of telework, but little that addresses the challenges these companies face in program implementation. More qualitative

data is necessary to completely understand the challenges of implementing telework programs in rural areas.

Best Program Designs for Making Jobs More Available through Telework

- ***Expanding telework participation.*** In the United States, particularly in the public sector, agencies increasingly offer telework as a flexible workplace option. NASA's Langley Research Center, GSA, and other agencies have all established telework programs to meet their workforce needs, with some promising results. GSA reports that telework has been made available to 92 percent of its 12,205 employees (Feldblum, 2008).

- ***Legislation can expand opportunities for underrepresented populations.*** In the public sector, teleworking as a method to create and make jobs available differs in perspective between Federal and state government. In general, the Federal Government shows greater rates of participation in telework than state governments (Telework Research Network, 2011). This is predominantly due to the passage of legislation geared toward creating flexible work environments for specific groups, including disabled, veteran, and aged workers such as the Federal Employees Flexible and Compressed Work Schedules Act, the Americans With Disabilities Act (ADA), New Freedom Initiative, and most recently the Telework Enhancement Act of 2010 (Feldblum 2008; Virginia Commonwealth University, 2005; Eyster, Johnson, & Toder, 2008). The ADA of 1990, enacted over 20 years ago, provides a way for people with disabilities to maintain inclusion in the age of technology by deeming telework a reasonable accommodation. The ability to telework provides potential for employment opportunities for people who may not otherwise access or perform in a traditional work environment due to a disability (Sullenger, 2006).

  Just as there are policies and legislation in place to support job availability and job creation at the Federal level, a number of states have also played an integral role in increasing telework in their respective legislatures. According to a report on Workplace Flexibility by the Georgetown Law Center (2006), California, Georgia, Michigan, Utah, and Virginia are a few among many states that have enacted laws to increase opportunities through telework, whether in the form of private/ public partnerships or providing private-sector incentives to companies with telework policies.

- ***Using telework as a tool to encourage retention of workers nearing or at retirement age.*** The demographics of the workforce in the United States are rapidly changing as the Baby Boomers reach retirement age. Studies indicate that workers aged 55 to 64 in the American workforce will increase by 48 percent in the next five years, and those aged 65 and older will increase by 40 percent. The Federal workforce has already begun to experience the impact of this shift as a large percentage of Federal employees are eligible to retire, risking a decrease of institutional knowledge and years of expertise. However, similar to the workplace dynamics in New Zealand, retirement-age workers are willing to postpone retirement despite their eligibility, whether by necessity or choice. Regardless of the choice, older employees will want or need

employment opportunities that support workplace programs such as flexible schedules and telework (Feldblum, 2008).

In 2006 the Department of Labor published a report suggesting that workplace flexibilities are particularly attractive to older workers and might help ensure their continued services (and thus better knowledge management) especially in an era when many Baby Boomers are now retirement eligible.

- ***Using telework as a tool to promote employment of highly trained and skilled veteran and employees with disabilities.*** In 2004, the Department of Labor, Office of Disability Employment Policy, funded three projects to help recently disabled veterans and workers' compensation clients with disabilities to get the training and equipment they need to find and perform teleworking jobs (West & Davis, 2007). Virginia Commonwealth University was funded as one of the projects. Their national employer survey (issued to public and private employers) regarding telework and employees with disabilities revealed that respondents were generally amenable to accommodating employees with disabilities and those with other pressing needs. The findings also revealed that most organizations that allowed employees to telework did so on an ad hoc basis. However, respondents were more likely to allow telework when the employee already had a work history in the organization and the supervisor and coworkers had confidence in the employee's work habits and dedication (West & Davis, 2007).