

**Fairfax County Planning Commission Environment Committee Review of
Recommendations in the March 15, 2013 Report from the MITRE Corporation Entitled
“Building Energy Technology Recommendations to Fairfax County,”
January 26, 2017**

**Summary of Planning Commission Environment Committee Recommendation for Action
by the Board of Supervisors**

The following action is recommended per the committee’s review:

- The green building policy in Objective 13 of the Environment section of the Policy Plan should be amended such that there would be an increased emphasis on energy efficiency and conservation efforts. The related policy (Objective 13, Policy b) addressing nonresidential development and multifamily residential development proposals that would be eligible to attain the LEED-NC (New Construction) or LEED-CS (Core and Shell) Certification should incorporate guidance that would encourage applicants and their development teams to emphasize energy efforts within their green building strategies without establishing a prescription or expectation for any additional specific levels of energy performance. Further, this guidance should not establish a preference for any particular approach or certification system relating to energy efficiency/conservation. There should instead be general guidance encouraging such efforts. Note that this proposed action would not apply to single family detached or attached residential projects, for which the green building policy in the Policy Plan (Environmental Objective 13, Policy c) already has established an energy focus.

Introduction

On March 15, 2013, the MITRE Corporation issued a report entitled “Building Energy Technology Recommendations to Fairfax County.” The report was prepared as the second (and final) component of the fulfillment of a proffer commitment (RZ 2008-PR-011) to the support of county sustainability initiatives, particularly as they relate to the Tysons Corner Urban Center. The first component was a report addressing electric vehicle charging infrastructure; the Planning Commission’s Environment Committee has undertaken a separate review process for that report.

MITRE’s building energy technology report, which is included as Appendix A to this document, was transmitted to the Board of Supervisors on May 8, 2013 and was referred by the board to the Planning Commission for review and recommendation. The Planning Commission tasked its Environment Committee with this review.

This report provides:

- A brief discussion of the MITRE report.
- An overview of the Environment Committee’s review process.
- Copies of, or excerpts from, MITRE’s recommendations.

- For each of MITRE's recommendations, county staff's perspective and stakeholder comments, if any, on the recommendation.
- For each of MITRE's recommendations, the Environment Committee's conclusions and recommendations.

The MITRE Report

MITRE's report addresses four of the five specific tasks identified in a scope of work that was developed in collaboration with the county to identify the work products needed to satisfy the aforementioned proffer commitment (the fifth task addressed electric vehicle charging infrastructure, which MITRE has addressed within a separate report). These four tasks are identified on page 1 of MITRE's report and are not repeated here. In short, MITRE was asked to review and describe emerging building energy technologies, including renewable energy technologies, and to identify measures that could/should be pursued through building design at this time to accommodate implementation of these technologies in the future. The report was not intended to provide a comprehensive review of the county's green building policy but was instead intended to address a question regarding whether there are any particular anticipated future building energy technologies for which preparatory design commitments should be sought at this time through the zoning process. The reader should note that, at the time the MITRE report was referred to the Planning Commission, the Environment Committee was conducting a comprehensive review of the green building policy in the Policy Plan volume of the Comprehensive Plan, and that review ultimately led to the Board of Supervisors' adoption, on July 1, 2014, of revisions to this policy.

MITRE's report provides the requested overviews of individual building energy technologies but reaches the following key conclusion, as stated in the executive summary of the report:

We offer references on individual technologies, but find that since energy efficiency is a function of design, integration, construction and use, the determination of a particular technology's general effect (in terms of energy and economics) on future Tysons Corner buildings is largely infeasible.

The MITRE report issues a series of recommendations that have been provided in light of the conclusion excerpted above. The executive summary continues with the following guidance:

This does not mean that FCG [Fairfax County Government] is powerless to ensure energy efficiency in Tysons Corner – far from it, in fact. Instead, we find that FCG is already pursuing a strategy that will yield the best environmental and economic results. We recommend only minor additions to current proffer policy (we do not recommend any change to code).

1. We recommend that FCG continue its practice of using design and performance guidelines to set environmental goals while allowing developers to choose the best means of achieving them. We

recommend continued use of LEED. To bridge the gap between energy-efficient designs and energy-efficient operations, we also recommend that FCG apply components of the ENERGY STAR program. In particular, we recommend that when a proposed development fits into an ENERGY STAR building profile, FCG encourage developers to earn Designed to Earn the ENERGY STAR (DEES) certification. And for all facilities (regardless of DEES certification), we recommend that FCG encourage continued reporting of operational energy consumption through the ENERGY STAR Portfolio Manager.

2. We recommend that FCG make public the data and results of ENERGY STAR benchmarking to the extent possible. Such reporting can create public pressure on building owners to rigorously pursue energy efficiency.

3. We recommend that FCG continue its investigation of district energy – specifically combined heat and power – but we note that this investigation should be completed before encouraging any related proffer for normal developments.

4. We strongly recommend that FCG continue its practice of not prescribing technologies as part of the proffer process. Such a strategy increases building costs without improving environmental benefit. It ignores primary determinants of a building's energy efficiency, and it unnecessarily burdens FCG itself.

5. We note that some data collection may benefit future consideration of wind and geothermal installations.

The MITRE report continues with:

- An overview of several individual building energy technologies (on-site renewable generation, including wind, geothermal, and solar).
- A discussion of storage for load-shifting.
- A discussion of conservation.
- A discussion of district energy.
- A brief discussion of costs, benefits and market competitiveness of building energy technologies, concluding that such considerations are inappropriate as a policy-making tool for application through the county's development process, in light of the variability in circumstances affecting any particular development project and the need to consider each building as a system rather than a collection of individual technologies.
- A discussion of green building certification and energy benchmarking, which is what MITRE recommends as appropriate areas of focus as opposed to individual building energy technologies.
- A reiteration of recommendations issued in previous sections of the report.

MITRE presents recommendations throughout its report. Working closely with county staff, the Environment Committee has identified 12 recommendations in the following five categories; these categories align with MITRE's summary of recommendations within Section 6 of its report:

- Building technologies (in general).
- Individual technologies and data collection (wind, geothermal, solar, storage for load shifting).
- District energy.
- Third-party certification and performance guidelines (LEED[®], Designed to Earn the ENERGY STAR[®], benchmarking with Portfolio Manager[®], Net Zero and Passive House and innovative energy proposals).
- Public reporting.

These recommendations are presented in detail later within this report.

It is notable that MITRE's focus in its report is on development in Tysons. The Environment Committee feels that the issues addressed within the report are more universal and should be considered on a countywide basis. None of the committee's discussions, therefore, were limited to any particular geographic area of the county, and the committee's recommendations reflect a countywide perspective.

Planning Commission Environment Committee Review

Overview

The Planning Commission's Environment Committee met 16 times between February 19, 2014 and January 26, 2017 to discuss the building energy technology report. The committee began its review with a presentation from Matt Olson (MITRE's primary author of the report), who provided an overview of the report and its recommendations. At its next meeting, the committee considered the relationship between MITRE's recommendations and a Comprehensive Plan amendment that was under consideration at that time regarding the green building policy in the Policy Plan volume of the Plan—that Plan amendment was adopted by the Board of Supervisors on July 1, 2014.

After MITRE's presentation, the committee expressed interest in holding follow-up discussions regarding a number of issues—the committee received briefings on the following issues:

- District energy: Steve Sinclair and Susan Hafeli (Fairfax County Department of Cable and Consumer Services).
- The U.S. Environmental Protection Agency's Portfolio Manager system and how Portfolio Manager can be used to benchmark a building's energy use (Leslie Cook, EPA).
- Energy monitoring for facilities maintained by the county's Facilities Management Department (Garrick Augustus, FMD).

The committee also requested that county staff provide its perspectives on each of the recommendations in the MITRE report. Staff circulated a “staff perspectives” document (dated June 18, 2014), and the committee received, at its July 10, 2014 meeting, staff presentations on its perspectives on each of the 12 recommendations. The staff perspectives as presented at that meeting (with more recent refinements, as noted) are presented later within this document.

Stakeholder Review

Subsequent to the committee’s discussion on October 23, 2014, the committee sent a notice to over 200 stakeholders requesting their input on the MITRE report and staff perspectives document. The stakeholders who were contacted included representatives of the development community; architects/consultants; green building organizations; chambers of commerce; environmental organizations; the U.S. Environmental Protection Agency; the Federation of Citizens Associations; district councils/land use committees; EQAC; county staff; and others. A review opportunity was also provided through the committee’s website. Comments were accepted through January 30, 2015. Comments were received from three individuals: Ross Shearer; Eric Goplerud (forwarding thoughts provided by Ivy Main); and Linda Burchfiel. In addition, the Environmental Quality Advisory Council forwarded comments on February 16, 2015.

Brief summaries of stakeholder comments are provided later in this report, and a document providing more detailed excerpts from the stakeholder comments is included as Appendix B. EQAC’s correspondence to the Planning Commission is included as Appendix C.

The stakeholder comments focused largely on specific recommendations from the MITRE report—these are summarized within the discussions of each of the recommendations within the next section of this report. There were, though, several broader issues and key themes within the comments, including the following:

- There was a call for better county leadership on energy policy and a related general recommendation to go beyond current levels of energy efficiency in county policy.
- There was a concern that, in the staff perspectives document, staff was overstating the costs of solar installations.
- Two of the commenters stressed the need for better county leadership on energy policy by going beyond current efforts—one commenter identified a number of recommendations in the MITRE report as supporting a transformation to even greater sustainability efforts into the future and stressed the need for the county to seize this opportunity. Another commenter stressed that the county should encourage energy efficiency in every way it legally can.
- Another commenter felt that the MITRE report was put together by people without specialized energy knowledge and with a private sector bias against the setting of any rules. While the commenter felt that the staff perspectives document was better, there was concern about county staff’s views on solar (see recommendation 2c).
- There was a view that LEED is insufficient to address energy conservation and that it only guarantees a minimal benefit in energy efficiency. There was support for

augmentation of LEED with a performance-based approach focusing specifically on energy—ENERGY STAR, ASHRAE and LEED energy optimization points were identified as possible approaches.

- There was support for building energy tracking and collection and reporting/public disclosure of building energy performance data.

EQAC's comments did not address specific recommendations from the MITRE report but instead provided general views of the report and the staff perspectives document, as follows:

- EQAC indicated that the MITRE report provides some insights in the development of an energy policy for the county and that the staff perspectives document adds an important perspective on the practicality of the recommendations.
- EQAC also noted a continuing evolution of technological advances and stressed that flexibility is needed in developing county policy.
- EQAC also noted that the MITRE report deals primarily with high rise development planned for Tysons and noted that some of the statements regarding renewable energy may not be applicable to other areas of the county.
- EQAC expressed general support for reporting, renewable energy and energy efficiency efforts and also expressed interest in reviewing and contributing to follow-up steps.

The Environment Committee has reviewed and discussed the MITRE recommendations and associated staff perspectives and stakeholder comments; summaries of each of these items, along with the committee's recommendations, are presented in the next section of this report.

Staff Perspectives, Stakeholder Comments and Environment Committee views on MITRE's Recommendations

Each of the 12 recommendations from the MITRE report is copied/excerpted from the report and is presented within a text box below. Please note that many of the citations are excerpts and not the complete text provided by MITRE. The reader is advised to consult the MITRE report for more complete discussions.

The Environment Committee coordinated with staff on the categorization of MITRE's recommendations. The numbering system that has been applied to the recommendations was developed by staff based on the structure of MITRE's summary of recommendations from Section 6 of its report. While the MITRE report's summary identified five recommendations, the staff perspectives document, as well as this report, identify several more specific recommendations within the five broad categories, for a total of 12 recommendations.

Each of the recommendations from the MITRE report is followed by the staff perspectives on that recommendation, largely as presented within the June 18, 2014 staff perspectives document. Where staff's perspectives have been refined subsequent to the issuance of that document, this is noted. The stakeholder comments relating to the particular recommendation (if any) are then

summarized briefly, and the committee's views/recommendations pertaining to the particular recommendation are then provided.

MITRE Recommendation 1: Building Technologies

[From Section 3.3.1.2 of the MITRE report]

To the extent that this document is to help FCG [Fairfax County government] encourage proffers for particular designs or technologies, this section should show that much of what determines a building's energy consumption is simply beyond FCG's direct influence. To constructively specify energy-efficient building form, FCG would have to be intimately involved in design, construction, and operations. FCG does not have the manpower to do that for every project even in just Tysons Corner, and this alone is reason enough to jettison the idea of doing so. We, therefore, recommend that FCG take no action directly on building form, integration, construction, or operations.

Instead, in Section 5, we propose that FCG attack the issue indirectly. It can (and we heartily argue that it should) affect energy consumption for every building in the region by specifying overall energy performance standards and encouraging public reporting of consumption.

[From Section 3.3.3.2 of the MITRE report]

For FCG, as we did with the discussion of building form, we strongly recommend that FCG continue its practice of not prescribing technologies or designs to developers. A building is a complicated system. Such prescription addresses only part of the energy efficiency, does so usually to negative cost and environmental effects, and places a huge burden on FCG itself. . . .

[From Section 6.1 of the MITRE report]

We strongly recommend the FCG continue its practice of not employing a prescriptive approach to building technologies or components. This holds for both for technologies included at initial construction and for technologies for which a developer might provision in anticipation of future installation. This is because a building is a system. Its energy consumption is function of its design, its construction, its relation to its surroundings, and its operations. The prescriptive specification of technology ignores primary energy efficiency drivers and imposes a huge administrative, technical, and personnel burden on FCG itself. These are recognized difficulties, and indeed, they are why design certification and performance standards were originally created. . . .

Staff Perspective

Staff has expressed its appreciation for MITRE's guidance regarding the need to avoid establishing technology prescriptions for development proposals and has indicated that it views the recently-revised green building policy as being consistent with this view.

However, staff does support engagement of zoning applicants in discussions regarding specific technologies that they may have interest in and does not support discouragement of proffered commitments to particular energy technologies should an applicant express such interest.

With respect to specific green certifications and tracking and reporting of energy consumption, please see the staff perspectives on MITRE's recommendations 4 (a through d) and 5.

Stakeholder Comments

There were no comments that were limited to the concern about building technologies vs. broader certifications, but there were several comments regarding the need to augment LEED with energy-specific performance. See the discussion under recommendation 4c.

Environment Committee Views and Recommendations

The Environment Committee supports the staff perspective on this recommendation.

MITRE Recommendation 2a: Individual Technologies/Data Collection--Wind

[From Section 3.1.1.2 of the MITRE report]

Wind generation requires fairly constant and strong prevailing winds (utility-scale generation currently requires annual average wind speed greater than 6.5 meters per second (DOE, 2013)). This holds true for both traditional external turbine systems as well as those inside buildings. In the former case, the blades are placed directly into the prevailing wind. In the latter (think of China's Pearl River Tower), prevailing wind is channeled (increasing speed, decreasing volume, and taking friction losses) into the building where smaller turbines are spun to generate electricity. In both cases, the prevailing winds must have enough kinetic energy to make harvesting it worthwhile.

The Virginia NREL map shows that Tysons Corner (and most of Virginia generally) simply does not have the wind potential to make wind generation practical. Relative to rest of Virginia, Fairfax has regions of relatively strong winds, but even here, we are at least 15% under the practical threshold. We recommend that FCG not encourage installations unless a developer has himself proposed the project.

If, however, FCG wishes to explore the option further, it could use the proffer process to map the prevailing wind fields over Tysons Corner. High-quality logging anemometer systems can be purchased and installed for a few thousand dollars. Aesthetically, they are unobtrusive, and they require little training to generate useful, long-term data sets.

Staff Perspective

Staff has indicated that it has looked into the feasibility of implementing wind-generated energy systems in the county and, based on the findings, agrees with MITRE's conclusion that the Northern Virginia area would be on average below the minimum rules of thumb for installation of residential or commercial wind energy systems. Staff also expressed its support for MITRE's recommendation that staff not encourage installation of wind energy technology as part of the zoning process unless a developer proposes the project, in which case the developer would likely conduct a site-specific analysis to assess the costs and benefits of the proposal. Staff expressed its view that it would not be a good use of resources to map the prevailing wind fields over Tysons Corner.

Stakeholder Comments

There were no specific comments on this recommendation.

Environment Committee Views and Recommendations

The Environment Committee supports the staff perspective on this recommendation.

MITRE Recommendation 2b: Individual Technologies/Data Collection--Geothermal

[From Section 3.1.2.2 of the MITRE report]

The envisioned density and heights of development in Tysons Corner will dictate that any geothermal installation uses vertical loops and that the loops will be under the buildings themselves. The primary expenses of vertical systems are found the boring and planting of the piping, not the above-ground components. This precludes retrofit, and so FCG's only concern with GSHP is installation during initial construction. There are no provisions for later installation of such systems.

Instead, FCG should concern itself with new installations. The problem is that an engineering study is necessary to determine the general suitability of the GSHPs in Tysons Corner. We are aware of no such general study, and so we recommend against FCG encouraging the installation of GSHP if the developer does not support the idea.

If FCG wishes to pursue this avenue for the future, however, a comprehensive engineering study of the issue may be of interest. We cannot provide a cost estimate for such an effort, however. Indeed, we expect that it is cost prohibitive for a single developer on a single project. Instead, it may be feasible to encourage developers to augment DPWES and DMME databases if a general engineering study cannot be completed from their existing stores.

Staff Perspective

Staff has expressed its view that ground source heat pump systems are a proven technology and would be evaluated by the developer on a case-by-case basis for his or her project. Staff has noted that many systems have been installed in the county and has indicated that the county would not be involved in the internal evaluation process. Staff has also noted that there are a wide variety of soils in the county and a soils map is available on the county website.

Stakeholder Comments

There were no specific comments on this recommendation.

Environment Committee Views and Recommendations

The Environment Committee supports the staff perspective on this recommendation.

MITRE Recommendation 2c: Individual Technologies/Data Collection--Solar

[From Section 3.1.3.2 of the MITRE report]

Specific to the case of individual buildings in Tysons Corner, however, the application of solar devices is likely limited. Photovoltaic generation and active systems are best employed where the roof surface area is large relative to the building's floor area. That is not the case in Tysons Corner where urban density and vertical development will be the rule.

Passive systems are generally functions of design, rather than technology implementations, so while insolation management will be a core concern for energy efficiency design, FCG will likely find it difficult, at best, to negotiate proffers on the subject.

As with wind and GSHP, we recommend that FCG encourage the adoption of solar systems only if the developer originally proposes and supports the installation.

We do not, however, follow the same path on the subject of data collection. Insolation is well-known and easily available from NREL (NREL, 2010); there is nothing to be gained from a proffer of data collection on this subject.

Staff Perspective

Staff has expressed its support for MITRE's perspectives on photovoltaic generation. Staff has noted that, in 2008, it was directed by the Board of Supervisors to look into the feasibility of implementing solar photovoltaic generation on county property (roof top as well as ground mount). Staff followed up this initial study in 2011 to address a budget related question during the FY 2012 budget process.

Staff has indicated that, based on careful review, which included state regulatory requirements, legal considerations, legislative authority as well as costs and incentives, it concluded that photovoltaic generation is a relatively expensive way to generate electricity or reduce greenhouse gas emissions. Staff provided, as an example, the 3 kW photovoltaic demonstration project installed on the roof at the Thomas Jefferson High School for Science and Technology, noting that this project, which was the work of a student club and which was funded with private contributions, cost \$56,000 even with discounted pricing from the installer. Staff indicated that, while it considers the system to be an excellent teaching tool, it only generates approximately one thousandth of the power consumed at this high school.

Staff noted that Solarbuzz.com tracks the current market prices for solar systems and that the March 2012 index for large flat roof commercial systems in a sunny climate was 19.41 cents per kWh. Staff compared this to the current commercial grid electricity rate of 10 cents per kWh, noting the cost of commercial solar systems as being just under twice as expensive per kWh. For residential projects, staff noted an equivalent residential index as being 28.91 cents per kWh, compared to the current residential grid electricity rate of 12 cents per kWh. Staff noted that these costs do not take into consideration net metering or standby charges.

Staff notes that the perspective presented above was prepared in 2014 and that costs for solar systems have gone down considerably since then. However, staff's views have not changed in regard to the relative expense of solar systems.

Stakeholder Comments

A number of comments took issue with staff's concerns about the expense of photovoltaic systems and, in particular, the reference to the cost of installation of a photovoltaic demonstration project at Thomas Jefferson High School. There was also concern about the need to consider the broader environmental and societal benefits of solar compared with electrical generation from coal and natural gas.

Environment Committee Views and Recommendations

With respect to solar energy systems, the Environment Committee supports the MITRE perspective on this recommendation at this time, although the committee notes that the concern raised by MITRE regarding limited roof areas related to overall building square footage in Tysons would not be a concern throughout much of the county. The committee concurs with the view that the county should be receptive to, and should not impede, proposals to apply solar

energy technology in development proposals but that the county should not, at this time, pursue such commitments proactively. The committee concurs with MITRE's central premise that overall building performance should be emphasized over specific technology prescriptions. However, the committee recommends that the county continue to keep track of this technology, particularly as it relates to changes in costs and the potential for this technology to become more cost-competitive in the future. If future conditions warrant, the committee would support a reconsideration of this issue.

With respect to passive solar design, the committee notes a large number of factors influencing site design decisions and recognizes that there would be a need to place any consideration of passive solar design within the broader contexts of these factors as well as applicable area-specific and countywide Comprehensive Plan policy. Building and development designs that take advantage of passive solar opportunities should, however, be supported and pursued within these contexts, and opportunities for passive solar design benefits should not be impeded by rigid policy interpretations. There may be specific cases where, for example, flexibility in application of building setback requirements should be considered where supportive of passive solar design and where such flexibility would not create adverse impacts.

The committee is aware of innovative solar technologies such as solar sidewalks and solar roads that may not, for any of a number of reasons, be likely to have the potential for broad application. Likewise, it is anticipated that opportunities to pursue solar fields during the zoning process will be limited by a number of factors. These technologies should, though, be given careful consideration if and where they may be proposed and should not be impeded if and where they could be provided without causing adverse impacts.

MITRE Recommendation 2d: Individual Technologies/Data Collection—Storage for Load Shifting

[From Section 3.2.3 of the MITRE report]

We recommend that Fairfax remain neutral on the implementation of load-shifting in an individual building. Environmentally, a net increase in energy consumption is specifically counter to FCG's carbon-neutrality objective, and the implications on the form of the grid in Tysons Corner are murky. Economically, we foresee the benefit of storage for load shifting as diminishing over time. The result here is like that for generation technologies: we recommend that FCG only pursue energy storage systems only if they are originally proposed and supported by the developer.

Staff Perspective

Staff has noted: that load-shifting allows building owners or operators to shift loads from high-cost peak periods to low-cost off-peak periods to achieve benefits including cost

savings; that MITRE's discussion focuses primarily on one load-shifting technology and application (thermal storage for cooling); and that the report acknowledges that the financial case for thermal storage "is highly specific to a particular site and implementation" and raises numerous issues including electricity price trends and equipment efficiency that contribute to the difficulty of drawing firm conclusions regarding benefits.

Section 3.2.2 of the report questions the environmental benefits of load shifting and concludes that "it *seems wisest to assume* that load shifting is an environmental minus." (Emphasis added.) Staff suggests that this conclusion is not premised on a review of the literature but appears to be based primarily on speculation (e.g., "it *seems reasonable to guess* the load shifting increases overall consumption" (emphasis added)). To the extent MITRE is simply suggesting that the environmental benefits of each proposal be evaluated on its own merits, staff has concurred. Staff has not agreed, however, that load-shifting should be presumed to have net negative environmental consequences and has expressed its view that load-shifting has demonstrated benefits in appropriate circumstances. Staff noted that ice thermal storage and its benefits were the subject of a September 8, 2011 presentation before the Planning Commission (<http://www.fairfaxcounty.gov/planning/minutes/minutes090811.pdf>, see page 9).

Staff has expressed its support for the MITRE recommendation stated in Section 3.2.3 that the county should remain neutral on the implementation of load-shifting technology in an individual building, but address it when proposed and supported by a developer. It is the view of staff that the Comprehensive Plan's green building policy provides room to consider the implementation of load-shifting technologies should the idea be proposed by an applicant during the zoning process.

Stakeholder Comments

There were no specific comments on this recommendation.

Environment Committee Views and Recommendations

The Environment Committee supports the staff and MITRE perspectives on this recommendation.

MITRE Recommendation 3: District Energy

[From Section 3.4.2 of the MITRE report]

... The combination of these two recommendations [Metropolitan Washington Council of Governments and Northern Virginia Regional Commission] simplifies FCG's available decisions relative to proffers concerning district energy. The sure determination of economic feasibility requires a detailed engineering, financial, and legal analysis. The form of the plant, its power output, its heat output, its fuel, its location, its profit distribution, its environmental constraints, its financing terms, its potential customers, market energy costs, zoning restrictions, legal authorities, and state regulation all must be analyzed specifically for the particular application.

We therefore recommend that, in light of such significant uncertainty, unless an applicant is proactively pursuing a district energy approach (or similar effort), the county not seek proffers on the subject of district energy in favor of seeking proffers with more certain benefit. Doing otherwise incurs a certain opportunity cost for an unquantifiably uncertain gain of uncertain magnitude.

If FCG wishes to proceed towards district energy, we recommend that it first seek help from federal resources to identify appropriate private sector partners and to identify most relevant case studies for comparison. EPA's Combined Heat and Power Partnership (EPA, 2012) and DOE's Mid-Atlantic Clean Energy Application Center (DOE, 2012) are good starting points.

Staff Perspective

Staff has provided the following perspective in response to the above:

“The MITRE report notes that ‘District energy... may offer the biggest source of energy and environmental gains in Fairfax, and is a tantalizing target as a result.’ However, this statement is based on a comparison to large-scale coal fired base load plants, which are no longer a commercially available technology comparative source for generating electricity. Virtually all new generation facilities in Virginia are now natural gas-fired, are highly efficient (upwards of 50%), and exhibit very low emissions.

The MITRE study assumes that district energy benefits are attributable to the utilization of waste heat, presumably generated from industrial sources. The Tysons area economy is primarily based on the commercial and office building markets, and there are no industrial production facilities in the area to be able to capture high grade waste heat. A district energy system in Tysons would likely therefore have to utilize

conventional fuel sources as its process fuel, thus minimizing the chance for efficiency gains.”

Staff has agreed with the MITRE report that the District Energy systems encompass “a certain opportunity cost for an unquantifiable uncertain gain of uncertain magnitude,” and that Fairfax County “should not seek proffers on the subject of District Energy in favor of seeking proffers with more certain benefits.”

Stakeholder Comments

There were no specific comments on this recommendation.

Environment Committee Views and Recommendations

The Environment Committee supports the concept of district energy but recommends against proactively pursuing it at this time in light of impediments to its implementation. There may be future application of this technology as it evolves.

MITRE Recommendation 4a: Third-Party Certifications and Performance Guidelines--LEED

[From Section 5.4 of the MITRE report]

FCG already pursues certification-based approach with its use of LEED. We recommend that it continue this course, rather than looking for more direct influence over the technology particulars of a building. Building code already specifies energy efficient installation standards; FCG does not need an additional layer of prescriptive specifications. We recommend continued use of LEED. Even if it does not guarantee energy efficiency, as a general environmental stewardship tool, it offers wider benefit.

Staff Perspective

Staff has expressed appreciation for MITRE’s guidance regarding the need to avoid establishing technology prescriptions for development proposals and its support for LEED. Staff views the recently-revised green building policy as being consistent with this view, although the policy incorporates flexibility to provide for the consideration of other established green building rating systems. The policy also provides broad support for a range of energy conservation, water conservation and other green building practices. As noted earlier, staff would also support engagement of zoning applicants in discussions regarding specific technologies that they may have interest in and in acceptance of proffered commitments to particular energy technologies should applicants have such interest.

Stakeholder Comments

There were no specific comments on this recommendation.

Environment Committee Views and Recommendations

The Environment Committee supports the staff perspective on this recommendation.

MITRE Recommendation 4b: Third-Party Certifications and Performance Guidelines— Designed to Earn the ENERGY STAR®

[From Section 5.4 of the MITRE report]

To complement LEED, we recommend that the county encourage Designed to Earn the ENERGY STAR certification . . . ENERGY STAR augments existing prescriptive building codes (VA 2009) by requiring building owners to report and compare actual energy use. We recommend DEES certification, rather than ENERGY STAR certification for two reasons. First, a new development may not neatly align with the ENERGY STAR categories. A campus-style multi-building design, for example, is not applicable, though may offer lower overall energy consumption. Most new development will fit into DEES, but all cases will not, and FCG should therefore be judicious in its encouragement of DEES. Second, because the ENERGY STAR cannot be awarded until after a year of operations, certification cannot be guaranteed from design itself. If the proffer is for ENERGY STAR certification, but the building operator fails to achieve the label, we assume that FCG has little recourse, absent incorporation of an enforcement mechanism into the proffer.

The intent is to improve the efficiencies of the individual buildings, pave the way towards net-zero measurement, grow the ENERGY STAR databases, and improve the LEED rating systems themselves. In the former two cases, the benefits accrue to the building owner. He is hopefully able to use the benchmarking to reduce energy costs, and use of Portfolio Manager helps to pave the way to net-zero measurement as it becomes available. In the latter two cases, the practice means that Tysons Corner development helps to improve the state of the art and, therefore, has a longer and further reaching effect greater than just the new development itself.

[From Section 6.4 of the MITRE report]

. . . because LEED only considers design, FCG should also encourage at least Design to Earn ENERGY STAR certification . . .

Staff Perspective

Staff has noted that the Designed to Earn the ENERGY STAR® designation can be pursued for residential projects as well as for those nonresidential projects that are eligible for the ENERGY STAR designation.

For residential projects, the Designed to Earn the ENERGY STAR certification process involves a review by a certified Home Energy Rater of construction plans to ensure that they include the energy efficiency features and construction details necessary for attainment of the ENERGY STAR designation. Additional testing and inspections are needed for the home to earn the ENERGY STAR designation.

For certain nonresidential buildings, the ENERGY STAR score is a number between 1 and 100 that compares the energy use of a building against similar buildings. The higher the score, the higher the energy performance—a score of 30, for example, indicates that the building is performing better than 30 percent of like buildings nationwide, while a score of 90 indicates that the building is performing better than 90 percent of like buildings. A score of 75 is needed to qualify for ENERGY STAR certification. While the ENERGY STAR Portfolio Manager tool is available for tracking energy use of all buildings, ENERGY STAR scores are only available for specific types of commercial buildings and industrial plants. As ENERGY STAR certification relies on actual building energy use, the ENERGY STAR score and certification process are available only for existing buildings. The Designed to Earn the ENERGY STAR program is, however, available for buildings that are being designed (for the same types of buildings eligible for the ENERGY STAR score).

To pursue the Designed to Earn the ENERGY STAR designation for non-residential buildings, the project's architect of record (who must be an ENERGY STAR partner) must select an energy performance target and project future energy use, using Portfolio Manager, such that the project would attain an ENERGY STAR score of 75 or better. The architect must also complete a Statement of Energy Design Intent (stamped and signed by a Registered Architect or Professional Engineer) and submit letters of intent, both from the architect of record and building owner. Additional supporting information may also be provided with the application. Except for core-and-shell projects, the construction documents for the project must be at least 95 percent completed. There is no requirement, though, for the building to attain an ENERGY STAR score of 75 or greater once it has been constructed and occupied.

Staff has noted that, when the green building policy in the Policy Plan was being developed in 2006-2007, the Designed to Earn the ENERGY STAR program was relatively new, and most projects that had attained that recognition had not yet been completed. Because of the aspirational nature of the program and lack of a track record, staff did not recommend explicit recognition of this program in the green building policy. However, both the Plan language that was adopted at the time and the current language "encourage commitments to the attainment of the ENERGY STAR rating," and it is staff's view that this guidance, by extension, supports related Designed to Earn the ENERGY STAR aspirational efforts. Staff has indicated that the Environmental Protection Agency suggests that there is at least some track record in regards to nonresidential projects that have both earned the Designed to Earn ENERGY STAR recognition and the ENERGY STAR designation for one or more years of operation.

Staff notes that, when the Planning Commission Environment Committee was considering the green building Plan amendment, there was discussion regarding whether any particular

aspects of green building design should be emphasized. The committee ultimately recommended that flexibility be retained to allow for applicants to determine appropriate areas of emphasis, while identifying a series of green building practices that could be emphasized for residential proposals at or above the mid-point of the Plan density range.

Staff has concluded that, if it is the desire of the Environment Committee to consider additional emphasis on energy efficiency as part of green building design, there may be merit in discussing whether the Designed to Earn the ENERGY STAR designation should be emphasized in light of the track record noted above. Staff would not, however, support Designed to Earn the ENERGY STAR recognition as an alternative to other green building commitments recommended by the green building policy; rather, it is staff's view that this recognition should be considered as a complementary effort. Staff considers the Designed to Earn the ENERGY STAR program, at least as it relates to nonresidential development, as a statement of intent that can lead to operational benefits, as opposed to a comprehensive green building rating system for the design and construction of a building.

Stakeholder Comments

- The comments received on this issue were supportive of MITRE's recommendation, stressing that LEED does not require more than a minimal increase in energy efficiency of buildings.
- One commenter noted that Designed to Earn the ENERGY STAR certification would not be the only option available to strengthen energy performance of buildings. There are green codes, ASHRAE guides, and LEED energy optimization points that could be pursued.

Environment Committee Views and Recommendations

The Environment Committee spent a considerable amount of time discussing and debating this issue and identified two distinct questions that need to be answered:

1. Should the Comprehensive Plan's green building policy be revised such that it would establish a greater emphasis on energy efficiency over other green building design strategies?
2. If so, should the Designed to Earn the ENERGY STAR program be the preferred mechanism to implement this recommendation?

The committee notes that MITRE's recommendation is implicitly focused on the component of the county's green building policy that addresses nonresidential development and multifamily residential development proposals that would be eligible to attain the LEED-NC (New Construction) or LEED-CS (Core and Shell) Certification. The policy addressing other residential development proposals (e.g., single family and low-rise multifamily) already includes an energy emphasis, in that it supports certification under an established residential green

building rating system that incorporates multiple green building concepts and that includes an ENERGY STAR Qualified Homes designation or comparable level of energy performance. This emphasis on energy efficiency was established within the original policy as adopted in 2007 because, at that time, comprehensive residential green building rating systems were not widely available while the ENERGY STAR Qualified Homes program was. In its development of recommendations leading to the 2014 revision of the green building policy, the committee recommended a broadening of the residential policy to recognize that such comprehensive residential green building rating systems were now available, but it did not wish to do this at the expense of the adopted emphasis on energy.

The component of the green building policy addressing projects eligible to attain the LEED-NC or LEED-CS Certification has not, to date, emphasized any one particular green building design strategy, although the committee notes that stormwater management guidance that has been adopted within Area Plans for a number of the county's growth centers does provide explicit support for the stormwater-related LEED credits (or equivalent). During the committee's recent deliberations on the revision of the green building policy, there was considerable discussion as to whether any particular green building strategies should be emphasized over others, and the committee ultimately recommended against establishing such emphases within the Policy Plan guidance. MITRE has effectively asked the county to revisit this approach.

In considering the questions above, the committee sees merit to a range of perspectives—it acknowledges that energy efficiency and conservation are increasingly critical needs in light of global climate issues and also notes that the public comments it received during its review were supportive of a policy emphasis on energy. However, the committee also recognizes that all components of green building rating systems have merit and that, if an emphasis on energy were to be established, it would likely come at the expense of other meritorious green building strategies. The strong merits of differing perspectives caused the committee to have considerable difficulty in addressing these questions.

After considerable discussion and review, the committee has reached the following conclusions:

- There would be merit in revising the green building policy in the Policy Plan volume in order to establish more emphasis on, but still general support/encouragement for, energy efficiency and conservation efforts.
- Applicants and their development teams should be encouraged to emphasize energy efforts within their green building strategies. However, there should not be a prescription or expectation set for any additional specific levels of energy performance.
- While a general emphasis on energy efforts should be encouraged, the Policy Plan guidance should not establish a preference for any particular approach or certification system (e.g., Designed to Earn the ENERGY STAR) relating to energy efficiency/conservation. Rather, the Policy Plan should be amended to provide general encouragement for such efforts, applicants should be apprised of this preference, and applicants should then decide, if, how, and to what extent they should incorporate such an energy emphasis into their green building commitments. An applicant's energy and green building commitments could then be considered within the broader context of the application's proffer package.

**MITRE Recommendation 4c: Third-Party Certifications and Performance Guidelines—
Benchmarking with Portfolio Manager**

[From Section 5.4 of the MITRE report]

To complement LEED, we recommend that the county . . . encourage annual benchmarking with Portfolio Manager.

The intent is to improve the efficiencies of the individual buildings, pave the way towards net-zero measurement, grow the ENERGY STAR databases, and improve the LEED rating systems themselves. In the former two cases, the benefits accrue to the building owner. He is hopefully able to use the benchmarking to reduce energy costs, and use of Portfolio Manager helps to pave the way to net-zero measurement as it becomes available. In the latter two cases, the practice means that Tysons Corner development helps to improve the state of the art and, therefore, has a longer and further reaching effect greater than just the new development itself.

[From Section 6.4 of the MITRE report]

. . . because LEED only considers design, FCG should also encourage at least Design to Earn ENERGY STAR and then annual reporting in ENERGY STAR Portfolio Manager to ensure energy-efficiency in practice. FCG should also strongly encourage building owners to help improve LEED by using Portfolio Manager to report energy performance back to the U.S. Green Building Council.

Staff Perspective

Staff has noted that Portfolio Manager is a free online tool that is offered by the ENERGY STAR program to enable a building owner/manager to track the energy and water use of his/her building over time. The owner/manager of a building can use Portfolio Manager to benchmark the energy and water use of the building against a national median for a similar building type (with the caveat that comparisons may be difficult absent normalization for climate and other factors) and can identify trends over time, which can highlight potential problems if a sudden increase in energy and/or water use is noted. Owners/managers of several buildings in a portfolio can compare energy and water use among the various buildings in their portfolios and can use this information to detect possible problems (e.g., a building in the portfolio that is performing notably worse than other similar buildings). The ENERGY STAR recognition (see the discussion of the “Designed to Earn the ENERGY STAR” program above) is one benchmarking method.

Staff supports the tracking and evaluation of energy use for all buildings and has therefore expressed agreement with MITRE that building owners and managers should be encouraged to track and benchmark their energy use, whether that be done through Portfolio Manager or another similar tool. Staff has noted that the Facilities Management Department uses EnergyCAP software; FMD does not currently apply a module in that software that reports to Portfolio Manager.

The Environment Committee has already considered, in its review of the green building policy, this issue of energy performance monitoring and ultimately recommended the addition of the following policy guidance to the green building policy:

Encourage and participate in periodic regional and local evaluations of the outcomes achieved through the application of sustainable land use principles and technology, in coordination with the energy and resources providers and industry. Such evaluations should be based on pooled, anonymous-source data, and should provide information helpful in decisions regarding the costs and benefits of green practices, including evaluations focused on innovative approaches and technology.

This guidance was included within the Plan text associated with the revision to the green building policy that was adopted by the Board of Supervisors on July 1, 2014.

Staff has noted that, to date, a number of proffered commitments have been received in conjunction with zoning applications in the Tysons Corner Urban Center for the provision to the county (typically on an as-requested basis) of aggregated, non-proprietary energy and water consumption data. These data would not necessarily be provided through the Portfolio Manager program and would not necessarily be provided in terms of benchmarking, either through ENERGY STAR or other approach (e.g., an energy use index).

Staff has indicated that it recognizes that there may be interest, per MITRE's recommendation, in the pursuit of proffer commitments to monitoring and reporting to the county (directly or through county access to Portfolio Manager data) of building energy use; MITRE has further recommended that the county report these data publicly (see MITRE recommendation 5). Staff also has noted that, in light of (1) the request from the Board of Supervisors for a Planning Commission review of the MITRE recommendations and (2) interest in energy performance monitoring and reporting that was expressed in testimony received during the Planning Commission's public hearing in 2014 on the green building policy revision, there may be interest in revisiting this issue. While staff has expressed support for energy tracking and benchmarking, staff has expressed reservations in the past in regard to the idea of pursuing commitments during the zoning process for energy monitoring and reporting to the county. Staff initially expressed the following concerns in its response to this recommendation:

- There are many variables that can affect building energy performance, including the character of operations of buildings (e.g., business hours only vs. 24-hour operations; intensity of information technology uses). It may therefore be difficult to draw

conclusions from an individual building's data or to provide for useful comparisons among buildings—with the exception of buildings with ENERGY STAR scores, there could be an “apples to oranges” comparison problem in attempting comparisons of energy use among buildings.

- Proffers are voluntary in nature, and staff anticipates that there may be unwillingness among applicants to commit to disclosure of energy use information without a broader mandate to do so—there may be particular reluctance to agree to the provision of data if the data were to be reported publicly (see MITRE recommendation 5). The result may be a patchwork of information that is provided to the county.
- While the county could negotiate commitments to the provision of energy monitoring data, the county cannot ensure the accuracy of the information that is provided.
- It may be difficult for the county to enforce commitments to the provision of energy use data, since the data cannot be provided until after occupancy permits will have been issued, and perhaps subsequent to bond release.
- Staff resources would be needed to collect the requested data. These resources are currently lacking.

Staff again stressed its support for the pursuit of energy use tracking and benchmarking for all buildings; staff questioned, though, the extent to which negotiations of proffers for such efforts would be an effective or efficient mechanism through which such efforts should be encouraged. Staff suggested that broader public outreach efforts to owners/managers of buildings throughout the county may hold more promise in spurring voluntary tracking and benchmarking efforts (for both newer and older buildings alike); staff noted that it has been hoping to expand energy outreach efforts more broadly within the county and supports an emphasis on such efforts at this time.

Stakeholder comments that were received regarding this issue (see below) caused staff to reconsider its perspectives on this issue. While staff continues to have reservations about the idea of publicizing energy use data, there is considerable support for energy benchmarking and tracking, and the use of Portfolio Manager, in particular, seems to hold promise as an easy, free tool that's available to track building energy use.

One idea that has been discussed would be to encourage proffers or conditions that would require building owners to maintain building energy tracking data on Portfolio Manager (or an equivalent) for at least a certain number of years subsequent to building occupancy and to provide a specific entity or department within the county government with rights to access Portfolio Manager for those buildings on a read-only basis. Through this approach, building owners would not be compelled to prepare reports to the county, but they would be compelled to track their own energy usage. If/when the county would want to evaluate building energy performance of its green buildings, county staff could then access those data for that purpose.

While it is staff's view that this idea would seem to merit consideration, it does generate a series of questions about how the county could enforce such proffers and conditions and whether it would be likely, absent active review and enforcement efforts for which staff resources are lacking, that these commitments would be forgotten and the resulting data that would be compiled would be limited or, at best, inconsistent.

In conclusion, staff is more receptive to the idea of pursuing proffers or development conditions for building energy tracking after occupancy, but it continues to have concerns about effectiveness of implementation. In staff's view, unless and until there would be staff resources dedicated to tracking these commitments, it may be an idea that is not workable in practice.

With respect to MITRE's recommendation for the county to encourage building owners to report their energy performance to the U.S. Green Building Council (and it is assumed that this recommendation is intended for LEED certified buildings), staff has noted that projects attaining LEED certification are now required by the U.S. Green Building Council to provide energy and water usage data for at least five years, so there is no need for the county to encourage owners of LEED projects to do this.

Stakeholder Comments

- In addition to the general support for reporting that was expressed by EQAC, the following comments were offered:
 - Public access to energy use data is a consumer information need that should be a market consideration.
 - Even a limited number of energy tracking reports from buildings in Fairfax County will spur similar efforts as well as public demands for broader reporting.
 - With an increased number of buildings reporting to Portfolio Manager, the apples-to-oranges problem should improve, particularly if we add to the data set.
 - Other localities are requiring energy tracking information, so we should be able to overcome our objections.
 - It should not be difficult for county staff to collect these data.

Environment Committee Views and Recommendations

The Environment Committee agrees with staff that the tracking and evaluation of energy use for all buildings should be supported and that all building owners and managers should be encouraged to track and benchmark their energy use. The committee recognizes, though, that there are differing perspectives on the extent to which, if any, the county should be asking zoning applicants to provide building energy tracking information to the county, either directly or through access to Portfolio Manager accounts. The challenges and limitations identified above by staff have caused the committee to question, at least at this time, the merits of compelling zoning applicants to provide this information/access to the county through proffered commitments. Of particular concern to the committee is the amount of the staff resources that

would be needed both to enforce such proffered commitments and to proactively collect and evaluate energy tracking data; absent such resources, it is not clear to the committee whether any meaningful use would or could be made of information that would be made available through such proffered commitments. Further, the committee does not support the idea of publicizing the energy tracking data that would be available through such commitments and has concerns about the county's ability to protect any such information it may collect. For these reasons, the committee is not, at this time, supporting the pursuit, either directly or through access to on-line data, of commitments from applicants to the provision of energy tracking information to the county. The committee wishes, though, to leave the door open to reconsideration of this idea in the future, particularly if staff resources could be dedicated to the collection and review of energy tracking data, and particularly if the federal government were to require the collection of, and make publicly-available, energy tracking/benchmarking information for individual leased buildings.¹ In addition, the committee wishes to stress that its position on this issue should not be interpreted to be in opposition to building energy tracking and benchmarking; to the contrary, the committee supports such efforts and encourages the county to pursue broader education and outreach efforts to encourage all building owners and operators to track and benchmark their energy use.

The committee also wishes to stress that, if the energy tracking data issue is to be reconsidered in the future, it would only support consideration of this idea for commercial and multifamily residential buildings. The pursuit of commitments to energy tracking data should not be considered for single family detached or attached residences.

¹ There are federal requirements (Energy Independence and Security Act) that require the tracking/benchmarking and reporting of building energy use for federal facilities. In regard to privately-owned buildings that are leased by the federal government, the requirements apply to buildings for which the federal government is paying the cost of utilities. If the federal government is not paying the cost of utilities for a building, that building is not subject to this requirement. Many federal leases are structured such that tenants pay flat monthly fees for energy rather than paying for actual measured use; others require direct payment for utilities. The Environment Committee would have interest in revisiting the issue of tracking of building energy use should the federal requirement be expanded.

**MITRE Recommendation 4d: Third-Party Certifications and Performance Guidelines—
Net Zero and Passive House**

[From Section 5.4 of the MITRE report]

Now we turn to net-zero. Pilot efforts are underway to develop such buildings, but consensus has not yet emerged around appropriate measures or acceptable scores for good use as policy instruments. We recommend that Fairfax closely monitor developments pertaining to net-zero, and we presume that, in time, net-zero measures will be the best means of specifying performance - just not yet.

[From Section 6.4 of the MITRE report]

We also recommend that FCG pay close attention to the evolution of Passive House and net-zero methodologies, and as these practices mature, we recommend FCG use them to specify building performance targets.

Staff Perspective

Staff has expressed agreement with MITRE's recommendation to keep aware of developments pertaining to both net-zero² and Passive House design.³ Staff has also noted that both designs meet and exceed the current statewide building code as it pertains to energy.

Staff has noted that, in 2012, the county's Energy Efficiency and Conservation Coordinating Committee invited two local architects to present on the topic of Passive House Design. At the time, one of the architects was actively building a passive house in the county.

More recently, county energy staff members have participated in Passive House tours.

Stakeholder Comments

There were no specific comments on this recommendation.

² **Net-zero** refers to a building with zero net energy consumption used by the building on an annual basis, i.e., the amount of conventional grid-energy consumed is roughly equal to the amount of renewable energy created on the site. These buildings use conventional grid energy on cloudy or non-windy days, or at night when the sun isn't shining.

³ The term **Passive House** refers to a rigorous design standard, for which thermal comfort can be achieved by a super-insulated and air tight building envelope coupled with energy efficient heating and/or cooling of the fresh air mass, which is required to fulfill sufficient indoor air quality conditions without a need for recirculated air. This results in ultra-low energy buildings that require little energy for space heating or cooling.

Environment Committee Views and Recommendations

The Environment Committee supports the staff and MITRE perspectives on this recommendation. The committee sees future promise in this approach and supports the revisitation of this recommendation in the future if/when this concept blossoms.

MITRE Recommendation 4e: Innovative Energy Proposals

[From Section 5.4 of the MITRE report]

We understand and fully support FCG's goal of making Tysons Corner an innovation center that drives improvement of building energy technologies, and so we recommend that FCG allow risk to trump certification. If a developer acting in good faith proposes a project with new, risky technologies that may offer a chance at breakthrough energy performance, and if that riskiness is enough to jeopardize FCG's usual preferred form of certification, then we suggest that the county accept a commitment to proceed with the risky process in lieu of a commitment to the certification (though maintaining a reporting component to the commitment) and proceed with the risky project. Even if the project fails to bring the hoped-for effect, the learning is still more valuable than the effects of a single certified building. If Fairfax indeed wants to be a leader here, it will have to support experimentation (which can fail to meet objectives), and sometimes it will have to be ahead of standards.

[From Section 6.4 of the MITRE report]

We do note, however, that certification guidelines (though not Portfolio Manager reporting) should not be applied rigidly if a developer wishes to be a test case for unproven energy-efficiency techniques or technologies. FCG wants Tysons Corner to be a center for building technology innovation, to do that it must give developers the freedom to experiment. FCG should coordinate with DOE programs to recruit suitable experimentation developments, and it should apply flexibility to its guidelines so that policies meant to encourage a minimum level of environmental stewardship do not hamper attempts to exceed it.

Staff Perspective

Staff has expressed agreement with the general approach outlined above as it relates to innovation and flexibility. As the Comprehensive Plan is a guide, it can therefore support such an approach. Staff has recommended that it, the Planning Commission and the Board of Supervisors should remain open to this idea, should such an opportunity for innovation present itself during the zoning process.

Staff has noted that Fairfax County has a long history of implementing innovative, cutting-edge concepts and technology and that the county's innovative and successful efforts to implement its environmental and energy goals consistently attract national recognition. For

example, in 2011 the county received the American Planning Association's Daniel Burnham Award for its Comprehensive Plan for the Tysons Corner Urban Center. Its energy-specific awards include designation by the U.S. Environmental Protection Agency as an *Energy Star Partner*, a *Green Power Partner* for its green purchasing, and a *Landfill Methane Outreach Program Community Partner of the Year*; it also has received the Public Technology Institute's *Solutions Award* in the Sustainability category for its plug-in hybrid vehicle fleet trial.⁴

Stakeholder Comments

There were no specific comments on this recommendation.

Environment Committee Views and Recommendations

The Environment Committee supports the staff and MITRE perspectives on this recommendation. The committee supports the case-by-case consideration of innovative proposals. While each of these proposals should be scrutinized carefully to ensure that it would not cause undue adverse impacts, innovative proposals should not be impeded by rigid policy interpretations.

The committee wishes to clarify that the use of the term "risky" within the context of this recommendation is intended to reflect technologies that are unproven or emerging and is not intended to suggest that these are technologies that may cause physical harm to life and/or property.

⁴ Staff has noted that Fairfax County was the first county government in the U.S. to retrofit one of its hybrid vehicles to that of a plug-in hybrid.

MITRE Recommendation 5: Public Reporting

[From Section 5.4 of the MITRE report]

Since reporting is a requirement for ENERGY STAR participation, we also recommend that FCG encourage building owners to make public their energy consumption performance. From developers, FCG should negotiate access to the consumption data through Portfolio Manager, and the County should post the annual benchmarking results publicly online. DC already has similar laws on the books, so Fairfax would be well within the mainstream with the policy. Additionally, each facility should have posted its ENERGY STAR scores from each benchmarking along with its LEED Certification. The point is to encourage public pressure for improved energy-efficiency.

[From Section 6.5 of the MITRE report]

We assert that public reporting of energy consumption data and ENERGY STAR ratings will boost public awareness of the issue and, in turn, further encourage building operators to reduce consumption. We recommend that FCG take advantage of the reporting into Portfolio Manager and make that information public. FCG should post on its own web site the consumption data and comparison scores for all buildings in Tysons Corner that are being reported in the tool. Building owners should display their own results (raw data and performance scores to allow comparison) at the entrance of the building.

Staff Perspective

As stated in the discussion of MITRE recommendation 4c above, “staff supports the tracking and evaluation of energy use for all buildings and has therefore expressed agreement with MITRE that building owners and managers should be encouraged to track and benchmark their energy use, whether that be done through Portfolio Manager or another similar tool.” Staff’s perspectives on recommendation 4c identified, however, a series of concerns that staff has had regarding the idea of seeking proffers to building energy monitoring (although staff has reconsidered its perspective, as noted earlier). Staff has indicated that it has similar concerns regarding MITRE’s recommendation for the county to post on-line the energy benchmarking results from privately-owned buildings.

In addition to the concerns identified in the staff perspective on recommendation 4c, staff has noted the following:

- MITRE relates that “DC already has similar laws on the books, so Fairfax would be well within the mainstream with the policy.” Washington, D.C. and Fairfax County have very different legal authorities. While Washington, D.C. may have full authority to require building owners to submit energy monitoring data and to publicly disclose this

information, Fairfax County cannot adopt building regulations independent of the state building codes. Staff has not conducted a legal review of the question as to whether the county would have authority to impose monitoring and/or reporting requirements, but staff has questioned if there is such authority.

- While it is possible that the county would lack the authority to impose energy monitoring and reporting requirements, the county can accept proffered commitments to such efforts. However, staff has noted that proffers are voluntary in nature, and staff anticipates that there may be particular reluctance among applicants to commit to public disclosure of energy use information (or to the provision to the county of access to Portfolio Manager data for the purpose of disclosure). Absent such commitments, staff is not aware of a mechanism through which public disclosure of energy use in privately-owned buildings could be required.
- Staff has expressed the same concerns regarding enforceability of commitments relating to public disclosure of energy use as it expressed regarding commitments to building energy monitoring.
- Staff has noted a lack of staff resources to maintain and publicize energy use data.

Staff has suggested that public awareness and leasing interest across the metropolitan Washington, D.C. region may increase marketplace pressure for public disclosure of energy use--some building owners may decide to report their ENERGY STAR scores, Portfolio Manager profiles or other aspects of their operations in response to public pressure. MITRE recommends that the county take advantage of the reporting in the Portfolio Manager; for the reasons outlined above and in staff's perspective on recommendation 4c, staff has expressed that it does not support the pursuit of this recommendation.

Stakeholder Comments

See recommendation 4c.

Environment Committee Views and Recommendations

The Environment Committee shares the concerns identified by staff and does not support the publication of energy tracking data from privately-operated buildings through the zoning process.

**Summary of Planning Commission Environment Committee Recommendation for Action
by the Board of Supervisors**

A table summarizing each of the 12 MITRE recommendations, related staff perspectives, applicable stakeholder comments and Environment Committee positions is provided in Appendix D of this report.

The following action is recommended per the Committee's conclusions relating to Issue 4b (Designed to Earn the ENERGY STAR), as presented on page 19 of this report:

- The green building policy in Objective 13 of the Environment section of the Policy Plan should be amended such that there would be an increased emphasis on energy efficiency and conservation efforts. The related policy (Objective 13, Policy b) addressing nonresidential development and multifamily residential development proposals that would be eligible to attain the LEED-NC (New Construction) or LEED-CS (Core and Shell) Certification should incorporate guidance that would encourage applicants and their development teams to emphasize energy efforts within their green building strategies without establishing a prescription or expectation for any additional specific levels of energy performance. Further, this guidance should not establish a preference for any particular approach or certification system relating to energy efficiency/conservation. There should instead be general guidance encouraging such efforts. Note that this proposed action would not apply to single family detached or attached residential projects, for which the green building policy in the Policy Plan (Environmental Objective 13, Policy c) already has established an energy focus.

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MITRE TECHNICAL REPORT



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McLean, VA

Building energy technology recommendations to Fairfax County

Tasks 1-4 of sustainability study under Proffer #9, RZ 2008-PR-011

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March 15, 2013

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Executive Summary

Environmental stewardship and growth are key Fairfax County Government (FCG) objectives as it guides the evolution of Tysons Corner from suburban edge-city to a more livable, sustainable, mixed-use urban center. The Comprehensive Plan estimates the number of jobs in Tysons Corner to nearly double in the next forty years and the number of residents to more than triple, yet FCG seeks to achieve carbon neutrality by 2030.

As FCG leads this transformation, it is working with developers to assure environmentally responsible growth with new construction. MITRE fully supports FCG's objectives for Tysons Corner, and as part of Proffer #9, RZ 2008-PR-011, we have considered how FCG negotiates with developers on the subject of energy conservation.

The proffer was originally intended as a guide to both developers and FCG about energy efficient building technologies. We offer references on individual technologies, but find that since energy efficiency is a function of design, integration, construction and use, the determination of a particular technology's general effect (in terms of energy and economics) on future Tysons Corner buildings is largely infeasible.

This does not mean that FCG is powerless to ensure energy efficiency in Tysons Corner – far from it, in fact. Instead, we find that FCG is already pursuing a strategy that will yield the best environmental and economic results. We recommend only minor additions to current proffer policy (we do not recommend any change to code).

1. We recommend that FCG continue its practice of using design and performance guidelines to set environmental goals while allowing developers to choose the best means of achieving them. We recommend continued use of LEED. To bridge the gap between energy-efficient designs and energy-efficient operations, we also recommend that FCG apply components of the ENERGY STAR program. In particular, we recommend that when a proposed development fits into an ENERGY STAR building profile, FCG encourage developers to earn Designed to Earn the ENERGY STAR (DEES) certification. And for all facilities (regardless of DEES certification), we recommend that FCG encourage continued reporting of operational energy consumption through the ENERGY STAR Portfolio Manager.
2. We recommend that FCG make public the data and results of ENERGY STAR benchmarking to the extent possible. Such reporting can create public pressure on building owners to rigorously pursue energy efficiency.
3. We recommend that FCG continue its investigation of district energy – specifically combined heat and power – but we note that this investigation should be completed before encouraging any related proffer for normal developments.
4. We strongly recommend that FCG continue its practice of not prescribing technologies as part of the proffer process. Such a strategy increases building costs without improving environmental benefit. It ignores primary determinants of a building's energy efficiency, and it unnecessarily burdens FCG itself.
5. We note that some data collection may benefit future consideration of wind and geothermal installations.

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1 Introduction

MITRE is pleased to support Fairfax County Government's (FCG) sustainability objectives for Tysons Corner with Proffer #9, RZ 2008-PR-011. We have studied building technologies to support FCG's interests in increasing energy efficiency and reducing greenhouse emissions. Specifically, this document satisfies the first four tasks defined in our proffer:

1. Describe emerging technologies that could, in the future, be added to buildings, facilities and sites and what accommodations may need to be made to these buildings, facilities and sites to implement these technologies. Identify those accommodations that could be economically incorporated during building design in anticipation of future adoption of these technologies.
2. Develop technical guidance, written for the educated lay person, for renewable energy supplies and distribution, efficient end use technologies, and operating methods suitable to our region, including active and passive systems, for new buildings and for retrofit of existing floor space. It is anticipated that this technical guidance will be used by staff to support recommendations made to developers during the zoning process, but there may be broader applications as well.
3. Describe the relative benefits and characterize the efficiency and emissions of technologies and systems and their lifecycle costs, including capital and operations and maintenance costs of these technologies.
4. Characterize market competitiveness of the technologies and systems, and the risks and uncertainties that affect investment decisions.

FCG intended these tasks to serve two purposes. First, the report was to give developers unfamiliar with energy efficiency technologies a primer on the subject for possible inclusion in future buildings. Second, the report was to help guide FCG's negotiations with developers – to help it steer developers toward energy efficient building designs.

To this end, we address the first two tasks, providing references to technologies, but note strongly that technology can be only a small determinant of efficiency. Form, integration with the environment, construction, and operations also figure into that calculus.

In all cases, the literature on building technologies shows that buildings are highly complex systems, and energy consumption is a function of site, design, construction, and use. The effects of particular building components are highly variable between installations and use profiles. The result is that we can enumerate energy efficiency technologies for buildings (Tasks 1 and 2), but we cannot offer general guidance on technology costs, payback periods, or market competitiveness (Tasks 3 and 4). A consequence of the inability to offer such guidance is that we explicitly recommend against FCG seeking general design accommodations for the possible retrofit of specific future technologies. We see no evidence of any future technology that is so promising in terms of potential energy (and long-term cost) savings and generally applicability to merit such an approach.

The fact that general cost-benefit rules are unavailable is a problem long known. The response has been the development of design guidelines, rating-systems, and benchmarks. These are the means of identifying energy efficient design and practice, and they are increasingly being employed as public policy tools by local and state governments to ensure energy efficiency so

that they need not expend resources considering individual technologies at individual installations. We therefore include an additional task.

- Describe building energy rating, certification, and benchmarking tools, and discuss their relevance to FCG’s environmental objectives.

We begin the discussion with a brief description of the future Tysons Corner – noting most especially the push toward dense, vertical development. We then step into the first two tasks. We break the discussion of individual buildings into three sections: renewable generation, energy storage, and conservation. Because FCG has expressed particular interest in district energy and because it blurs the boundaries of generation and conservation, we follow with a separate section on the subject. We follow this with a discussion of Task 3 and 4 where we show that general cost-benefit is unavailable, but reference the closest approximation of an answer for these questions. Our additional task follows. After that, though each section builds to its own recommendation, we close with a section that reviews all of the recommendations developed over the course of the document.

2 Background and Assumptions

2.1 The Future of Tysons Corner

As Tysons Corner evolves from an automobile-centric commercial edge-city to a mixed-use urban center, FCG intends to make the area, “... a model for environmental sustainability,” to achieve Tysons Corner carbon neutrality by 2030, and to support a regional greenhouse gas reduction of 80% by 2050 (FCG, 2011).

At the same time, however, the Comprehensive Plan foresees big increases in the number of residents and jobs as well as big increases in available floor space with vertical development around the four metro stops as the primary source of density increase.

| | | 2010 | 2050 | Growth Factor |
|-------------|-------------|------------|-------------|------------------|
| Jobs | | 112,600 | 201,600 | 1.79 |
| Population | | 18,500 | 66,100 | 3.57 |
| Household | | 9,300 | 33,000 | 3.55 |
| Square Feet | Office | 27,400,000 | 54,100,000 | 1.97 |
| | Hotel | 2,400,000 | 4,400,000 | 1.83 |
| | Retail | 6,200,000 | 6,900,000 | 1.11 |
| | Residential | 11,160,000 | 39,600,000 | 3.55 |
| | Total | 47,160,000 | 105,000,000 | 2.23 |

Table 1: Intermediate estimates for Tysons Corner in 2050 (GMU, 2008)

Our recommendations below are made in the context of densely packed, tall buildings that will stand for the next forty years or more.

2.2 Process

Throughout this document, we assume that if FCG adopts any of our recommendations, it will do so through the proffer process. At no point in this document do we recommend changes to code.

3 Tasks 1 and 2 – Available technologies

To address the first two tasks, we break energy technologies into three groups: on-site renewable generation, storage, and conservation. Because district energy spans at least two of these segments and because it is largely a function of systems beyond the control of an individual developer, we present it separately at the end of this section.

3.1 On-site renewable generation

In this section, we note the three means of renewable generation that may be technically possible in Tysons Corner: wind, geothermal, and solar. We are skeptical that wind is an economically viable path, but we do not have data to confirm that skepticism. Geothermal may offer some opportunity for gain, but we do not know if the available data on the geology of Tysons Corner supports even exploratory design of the underground vertical loop systems that would be necessary for dense, vertical development. Solar is likely the most plausible approach for renewable generation here, but again, dense, vertical development may limit its viability in individual buildings.

3.1.1 Wind

3.1.1.1 Technology and resource availability

The United States is one of the world leaders in wind power installations, and our wind power capacity has grown more substantially than any other renewable energy source with a sixteen-fold increase between 2000 and 2010 (DOE 2011). The lesson is that when wind energy is available, efforts are underway to exploit it. Specific to our concern of Tysons Corner though, Virginia’s onshore wind capacity is minimal. The National Renewable Energy Laboratory’s (NREL) wind capacity map (Figure 1 and Figure 2) indicates that this will not change, and so FCG does not need to take steps to encourage wind generation efforts by its developers.

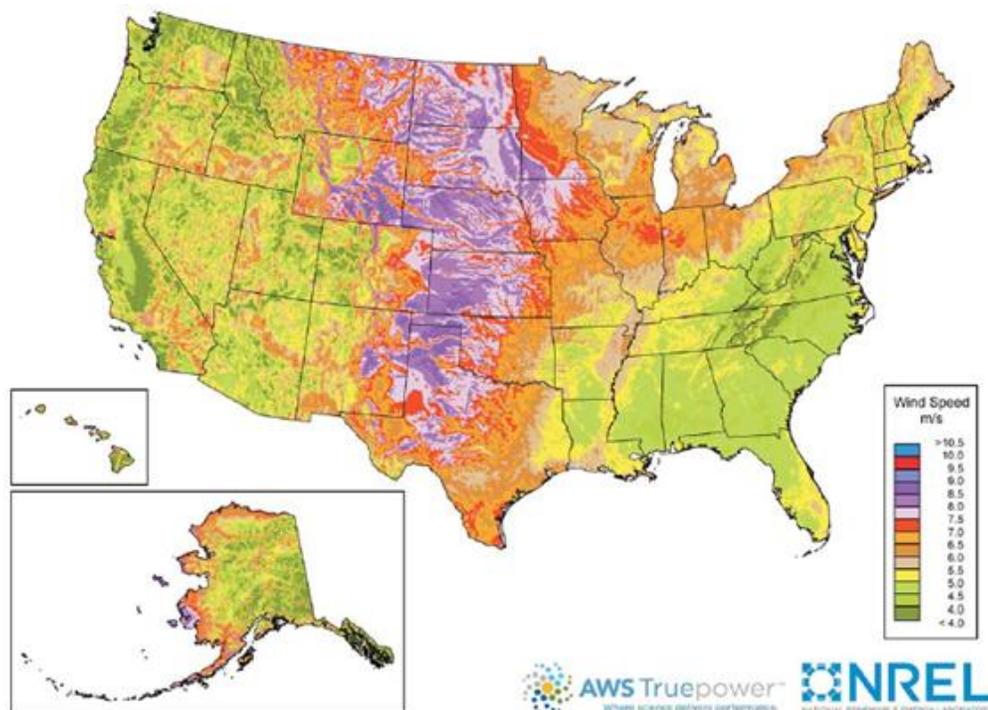


Figure 1: On-shore US wind resources (US Department of Energy, 2013)

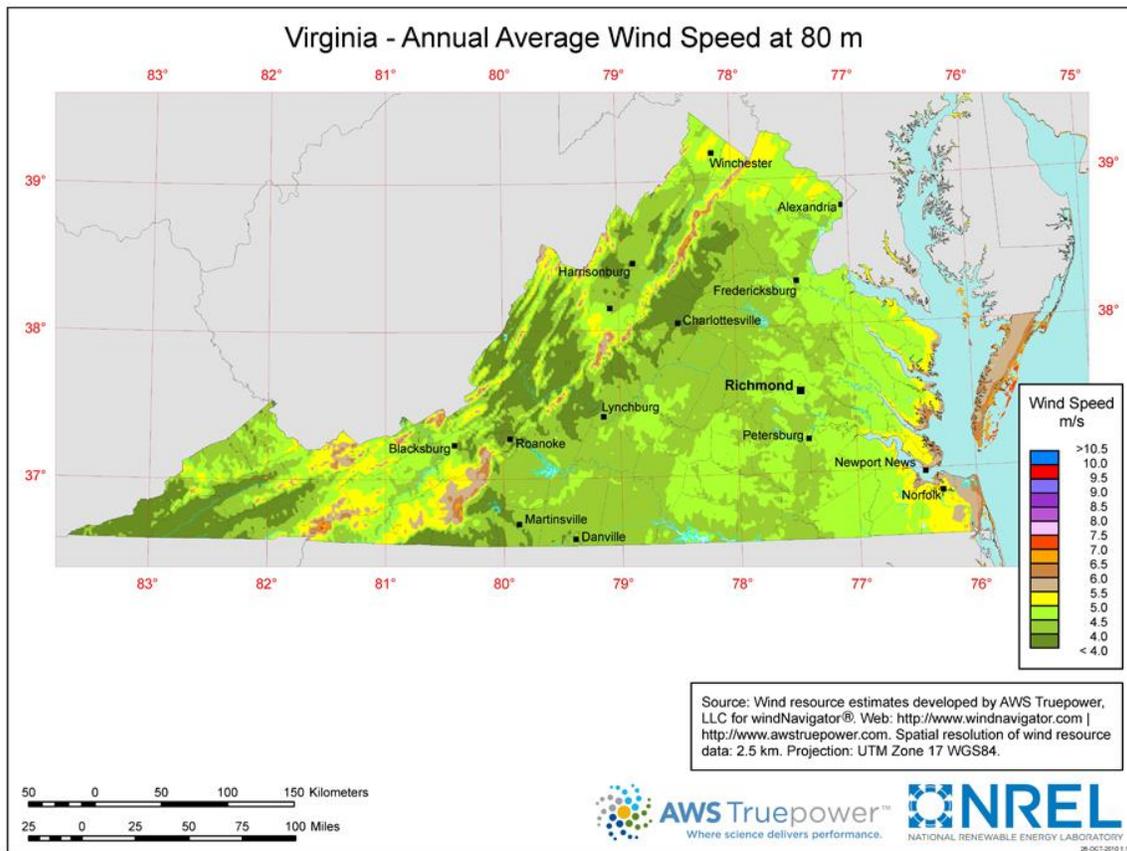


Figure 2: Virginia wind resources (US Department of Energy, 2013)

3.1.1.2 Recommendation

Wind generation requires fairly constant and strong prevailing winds (utility-scale generation currently requires annual average wind speed greater than 6.5 meters per second (DOE, 2013)). This holds true for both traditional external turbine systems as well as those inside buildings. In the former case, the blades are placed directly into the prevailing wind. In the latter (think of China’s Pearl River Tower), prevailing wind is channeled (increasing speed, decreasing volume, and taking friction losses) into the building where smaller turbines are spun to generate electricity. In both cases, the prevailing winds must have enough kinetic energy to make harvesting it worthwhile.

The Virginia NREL map shows that Tysons Corner (and most of Virginia generally) simply does not have the wind potential to make wind generation practical. Relative to rest of Virginia, Fairfax has regions of relatively strong winds, but even here, we are at least 15% under the practical threshold. We recommend that FCG not encourage installations unless a developer has himself proposed the project.

If, however, FCG wishes to explore the option further, it could use the proffer process to map the prevailing wind fields over Tysons Corner. High-quality logging anemometer systems can be purchased and installed for a few thousand dollars. Aesthetically, they are unobtrusive, and they require little training to generate useful, long-term data sets.

3.1.2 Geothermal

3.1.2.1 Technology and integration

The Ground Source Heat Pump (GSHP) uses the thermal capacity of the Earth to help heat and cool buildings. Such systems pump water (perhaps mixed with antifreeze) into underground pipe loops for thermal transfer and then pull it back out of the ground into building mechanical systems. In winter, the ground is warm relative to the atmosphere and the water pumped out is warmer than the water pushed in. In summer, the reverse holds. The water pumped out is cooler, and the water pumped in is warmer. That temperature difference can be exploited to do work or to eliminate work that otherwise induces electrical load.

Geothermal systems are relatively simple with few components to maintain, and they can reduce HVAC electrical load 25%-50%. They are, however, expensive to install (IEA 2011, 23), and like every building component, their effectiveness is a function of the specific implementation. Building size, thermal load, thermal properties of both the ground and ground water formations all influence loop design. In Tysons Corner, the density and vertical development objectives will necessitate vertical loops (this is not the case for the whole of Fairfax County where development is less dense, and less expensive, horizontal system are possible). In large vertical installations, loops can reach multiple hundreds of feet in depth (Collins et al., 2002), and test bores are necessary to actually design the full loop field (McCray, 1997). This means that the final determination of feasibility requires a non-trivial investment, and any developer considering this initial expense will be looking to minimize the chances that the concept proves infeasible for his installation.

The first step in minimizing that risk will be gathering all available data describing the ground under Tysons Corner. To the extent that such data exists, it is likely held in three places. First, the County's own Department of Public Works and Environmental Services (DPWES) publishes the soil maps guide, which indicates that Tysons sits on top on a cap of unconsolidated sand, silt, clay, and gravel. This cap itself lies on metamorphic rock. Within the Commonwealth's Department of Mines, Minerals, and Energy (DMME), the Division of Geology and Mineral Resources serves as Virginia's geological survey and may have additional data. Metropolitan Washington Airports Authority may also have some information left over from the Silver Line tunnel excavation. Unfortunately, we have no information about any of the three agencies as to whether they have enough information to afford a developer enough confidence even to conduct exploratory boring on a new development site.

3.1.2.2 Recommendation

The envisioned density and heights of development in Tysons Corner will dictate that any geothermal installation uses vertical loops and that the loops will be under the buildings themselves. The primary expenses of vertical systems are found the boring and planting of the piping, not the above-ground components. This precludes retrofit, and so FCG's only concern with GSHP is installation during initial construction. There are no provisions for later installation of such systems.

Instead, FCG should concern itself with new installations. The problem is that an engineering study is necessary to determine the general suitability of the GSHPs in Tysons Corner. We are aware of no such general study, and so we recommend against FCG encouraging the installation of GSHP if the developer does not support the idea.

If FCG wishes to pursue this avenue for the future, however, a comprehensive engineering study of the issue may be of interest. We cannot provide a cost estimate for such an effort, however. Indeed, we expect that it is cost prohibitive for a single developer on a single project. Instead, it may be feasible to encourage developers to augment DPWES and DMME databases if a general engineering study cannot be completed from their existing stores.

3.1.3 Solar

Solar may be the most promising of the renewables here in Northern Virginia. Dominion confirms some potential of photovoltaic electricity generation (Figure 3) with its plan to rent roofs on commercial properties in Northern Virginia for the installation of solar arrays (FCG 2011). Its intent is to shed peak load and delay large infrastructure upgrades.

3.1.3.1 Technologies

For on-site generation in Tysons Corner, three solar technologies are relevant: photovoltaics, active systems, and passive systems.

Photovoltaic systems convert the solar energy into electricity. These are panels with which we are all familiar. Active systems heat a medium (generally water) that is mechanically moved through the building. If the medium is water, it can be used directly, thus reducing water heating requirements on the electrical system. Indirect use is also possible if the medium is used in a heat exchanger, rather than being consumed.

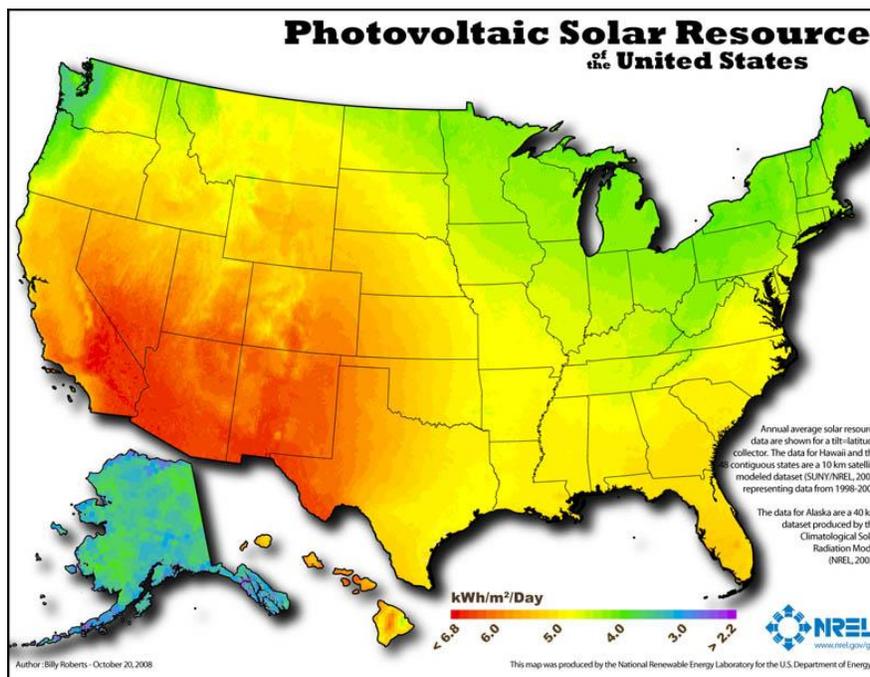


Figure 3 – Photovoltaic solar resources (annual average) (NREL, 2008)

Photovoltaic and active systems require maximum exposure to direct sunlight - an unobstructed, unshaded direct exposure to the southern sky. To maximize insolation – the rate at which direct solar radiation reaches a collection surface – its offset from the horizontal must vary over the course of the year as the sun crosses lower in the sky in winter and higher in summer. In Tysons Corner at about 38.9° N latitude, the offset will range roughly between 24° and 54° from the horizontal. This means that such collection panels systems have to go on the roof.

Vertical installation (a photovoltaic window, for example) is impractical. In the most advantageous case, only south-facing surfaces have unobstructed, day-long lines of sight to the sun, but because of their offset from the ideal, the maximum energy shone upon them is reduced 40%-80% depending on the season (it varies with the sine of the angle of solar incidence with the vertical). In the more practical case, the surface also has to be higher than the shadows cast by buildings neighboring to the south. This means design also has to account for future neighboring development, a task that may be impossible but for the southern boundary of vertical development. East and West-facing vertical surfaces receive direct light during the morning and afternoon respectively, but not all day. They, of course, are also subject to the same vertical losses and the difficulties with neighbors.

Passive systems are generally functions of design; they generally do not involve the installation of any particular technologies. These are systems that either minimize insolation or capture solar energy as heat for transfer into the building without mechanical assistance. This means the design can use building mass itself to capture heat during the day and then radiate it at night. More likely in our region, however, passive design is just a good orientation of windows and shading. In summer, the point is to minimize direct insolation while still capturing enough indirect light to minimize the need for electrical lighting. In winter, direct insolation helps to minimize heating load, but it may again be possible only for unshaded, unblocked south-facing surfaces.

3.1.3.2 Recommendation

Specific to the case of individual buildings in Tysons Corner, however, the application of solar devices is likely limited. Photovoltaic generation and active systems are best employed where the roof surface area is large relative to the building's floor area. That is not the case in Tysons Corner where urban density and vertical development will be the rule.

Passive systems are generally functions of design, rather than technology implementations, so while insolation management will be a core concern for energy efficiency design, FCG will likely find it difficult, at best, to negotiate proffers on the subject.

As with wind and GSHP, we recommend that FCG encourage the adoption of solar systems only if the developer originally proposes and supports the installation.

We do not, however, follow the same path on the subject of data collection. Insolation is well-known and easily available from NREL (NREL, 2010); there is nothing to be gained from a proffer of data collection on this subject.

3.2 Storage for load-shifting

Load shifting technology moves electricity consumption from one part of the day to another part of the day by storing the energy in some other form. This can be in response to intermittently available renewable electricity, or it can be employed as a means of exploiting the cost difference between peak and off-peak electricity prices. In Tysons Corner where renewables will be of little consequence, cost savings are the only driver.

3.2.1 Technologies

Energy storage technologies exist in various forms: thermal storage, batteries, kinetic storage with flywheels, capacitor storage, and superconducting magnetic energy storage.

Thermal storage for cooling is the form most likely to be proposed for use in Tysons Corner. In such systems, off-peak electricity is used to chill water (roughly 40°F) or make ice. Throughout the day, that low temperature source is used to boost the efficiency of traditional cooling systems. There is no general rule to the form of such system that best suits all needs. Instead, as we have noted above and throughout, the financial case of thermal storage is highly specific to a particular site and implementation (WSU 2003, 2).

In terms of financial effects, if there is near term benefit for a particular installation, then that benefit will diminish over time. First, if time-of-day pricing is ever employed with smart meters on a large scale, we can expect changes to the consumption load profile – indeed this change is the purpose of time-of-day pricing. Price sensitive consumers decrease peak load (expensive) consumption in favor of increased off-peak (cheap) consumption (all without the aid of any storage devices). The shift itself then raises off-peak demand relative to peak demand, and the price difference shrinks. Exacerbating the diminishing value of load shifting is the emergence of plug-in vehicles. These vehicles increase overall consumption, but they do so disproportionately at night. Again, off-peak demand rises faster than peak demand, and the value of shifting shrinks.

In terms of environmental effects, such systems may increase total emissions. If compressor efficiency is not so greatly improved by shifting compressor use from daytime (hot ambient temperatures) to nighttime (cooler ambient temperature) that it does not overcome the losses intrinsic in the cooling of the transfer fluid and its subsequent storage, then energy use increases. Compressor efficiency differences resulting from ambient air conditions are quite obviously functions of the particular systems; we offer no general rule as to whether this is the case. If energy use increases, then presumably emissions increase, though, of course, this is a function of generation fleet fuel mix and ambient temperature efficiency differences.

3.2.2 Consequences

For the Tysons Corner building operator, the financial benefit of an energy storage system is a function both of the consumption that can be shifted and the future difference of peak and off-peak electricity prices. That makes for two layers of cost-benefit uncertainty, and the anticipated general trend of the price difference makes such technologies less attractive over time.

From the perspective of FCG, storage for load-shifting brings two effects. First, it seems reasonable to guess the load shifting increases overall consumption (there are losses in thermal medium cooling and in storage) and emissions. Showing otherwise for a particular installation requires that FCG have expertise both with the cooling units themselves and with the emissions performance of the generating fleet serving the area. It is unreasonable to expect FCG to build and maintain this expertise for the purpose of encouraging the use of thermal storage systems, and so it seems wisest to assume that load shifting is an environmental minus, directly contrary to FCG's objectives.

The second environmental effect is the reduction of peak energy consumption. This reduces the need for increased transmission capacity into Tysons Corner and, therefore, decreases pressure for additional substations and power lines, which may be a beneficial result. Multiple means of limiting the need for additional transmission capacity exist, however, and so the prescription of storage for load shifting is complicating at best and counterproductive at worst. FCG may have the power to limit new transmission capacity through its zoning powers. Dominion already has incentive programs for peak load shedding and photovoltaic installations where appropriate, neither or which require new capacity and both of which actually reduce aggregate load.

Combined heat and power (CHP) is an answer itself, so constrained peak capacity may also work towards FCG's objectives with district energy.

3.2.3 Recommendation

We recommend that Fairfax remain neutral on the implementation of load-shifting in an individual building. Environmentally, a net increase in energy consumption is specifically counter to FCG's carbon-neutrality objective, and the implications on the form of the grid in Tysons Corner are murky. Economically, we foresee the benefit of storage for load shifting as diminishing over time. The result here is like that for generation technologies: we recommend that FCG only pursue energy storage systems only if they are originally proposed and supported by the developer.

3.3 Conservation

We finally turn to conservation. Given the likely unsuitability of renewables and thermal storage, we assumed that this is where FCG would find itself recommending the majority of technologies. That turns out not to be the case. Instead, a building is a system. It is not the additive collection of parts. We begin this section with a discussion of this concept and show that energy consumption is largely determined by factors that are largely independent of technology. We then point to references for insulation, windows, passive systems, lighting, and HVAC without adding to their content.

3.3.1 Building as a system

We began this effort with the stated proffer objective of defining a relationship between cost and benefit for various building technologies. Our literature review, however, returned again and again (and again and again) to the idea of a building as a system. Design, construction, commissioning, and operations are inseparably intertwined. A general prescription of technologies for use in Tysons Corner is infeasible. Analysis of a component is highly situation dependent. Nowhere is this more pronounced than in the consideration of individual building components. We have seen no example of any literature showing estimates precise and accurate enough for the general case that they are appropriate for technology prescription by FCG. The literature that does show precise comparison between technologies is highly specific to the particulars of the test environment.

3.3.1.1 Form, Integration, and Operations

Emphasis of the building as system notion begins most intuitively with discussions of building design and relationship with the surrounding environment. Solar thermal gain is a huge determinant of cooling and heating load. A building with its long axis running from East to West maximizes thermal gain in the winter, and (assuming its south-facing windows are appropriately shaded with external overhangs) minimizes summertime gain. Exhaust vents situated to blow in the direction of local prevailing winds makes HVAC more energy efficient. Landscaping to prevent snow buildup against the building reduces wintertime heating load. Well-placed windows reduce the need for lighting which in turn reduces HVAC need. Combined with good interior shading and interior surface reflectivity, the effect can be amplified further. Advantageously positioned (and used) operable windows can allow the use of natural airflow to reduce HVAC load. Good design practices fill books (LANL, 2002), and they can be employed without anything more than commonplace building components.

Less intuitive is the fact that the integration of design, construction, and operation also play an outsized role in the determination of a building's energy efficiency. The Net-Zero Commercial Building Consortium (CBC) states explicitly that, "integrated design is more critical to the development of low/zero-energy buildings than is any given technology. Tremendous efficiency opportunities... can be accomplished with today's technology," (CBC 2011, 11). This integration begins with design and proceeds through operations. The effects of building form need to be estimated for the specific instance over the course of design to allow continuous improvement of the design, and the estimation is best done with building information modeling systems so estimation reflects the building as a system. This, however, pertains to the design process, not the technology actually employed in the building.

The alternative – simply including a particular technology early in design without assessing its impact – leaves the architect blind to any shortcomings until the very end where fundamental re-design is more expensive. This opportunity for energy gain is a function of good design and engineering practice. The only technology recommended here is building information modeling, and this isn't even part of the building.

Integration flows into construction. In any construction effort, time and budget are the developer's primary concerns, yet construction is an intricate dance between the builder, his sub-contractors, and the various supply chains feeding the building. The substitution of a component – a low performance window on a south-facing unshaded wall, for instance – may be necessary to maintain the critical build path, but its operational effects will ripple through the HVAC system and will derail carefully-laid plans to achieve a particular energy consumption target. Design and scheduling must account for such possibilities and build flexibility into the construction process. Again, this is practice – not technology.

Even once the building is constructed, the notion of integration extends into commissioning and operations. The systematic monitoring and maintenance of the building to make sure it meets design specification and performance estimates can add 1% to initial construction costs, but it can save 8-20% in ongoing operations costs. The building's design, however, impacts the ability of a building manager to effectively commission the building immediately and then provide similar such services over its lifetime. The architect must design with such activities in mind years in advance (LANL, 2002), but yet again, this is practice, rather than technology.

3.3.1.2 Recommendation

To the extent that this document is to inform developers, the Los Alamos document is a good source for general design practices (LANL, 2002).

To the extent that this document is to help FCG encourage proffers for particular designs or technologies, this section should show that much of what determines a building's energy consumption is simply beyond FCG's direct influence. To constructively specify energy-efficient building form, FCG would have to be intimately involved in design, construction, and operations. FCG does not have the manpower to do that for every project even in just Tysons Corner, and this alone is reason enough to jettison the idea of doing so. We, therefore, recommend that FCG take no action directly on building form, integration, construction, or operations.

Instead, in Section 5, we propose that FCG attack the issue indirectly. It can (and we heartily argue that it should) affect energy consumption for every building in the region by specifying overall energy performance standards and encouraging public reporting of consumption.

3.3.2 Conservation technologies

Now we finally arrive at a discussion of conservation technologies. The previous discussion shows that technology is only one of many drivers of energy efficiency. It is, of course, an active area of research however, and it comes in two general classes: technology to reduce the need for electricity consumption and technology to make that electricity consumption more efficient. In all cases, we refer to source material. It is voluminous, and we have no technical additions. Again, however, the literature emphasizes that it is the building system, not the component that yields the energy-efficiency effect.

3.3.2.1 Reducing the need for consumption

Investigation into shell insulation (PNNL, 2009), passive thermal systems, phase change materials (CBC 2011; DOE 2011), and windows (CBC 2011; LBNL 2010; Jelle, et al., 2012); are all attempts at energy efficiency by reducing the need for HVAC loading and electrical lighting (NREL 2007). All are measured in terms of heat transfer per unit of surface area, but of course, on their own, no estimate of the resulting building performance is possible without explicit modeling of the whole building system. No general cost-benefit analysis is available.

3.3.2.2 Reducing direct load

Direct energy consumption in the building comes in the form of lighting, thermal control (ambient air, water, and refrigeration), and miscellaneous plug loads.

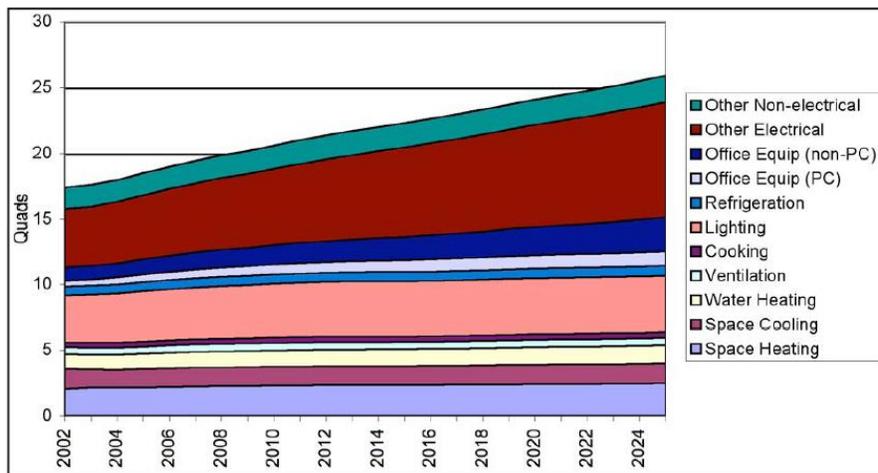


Figure 4: Commercial building energy consumption by use (ORNL, 2004)

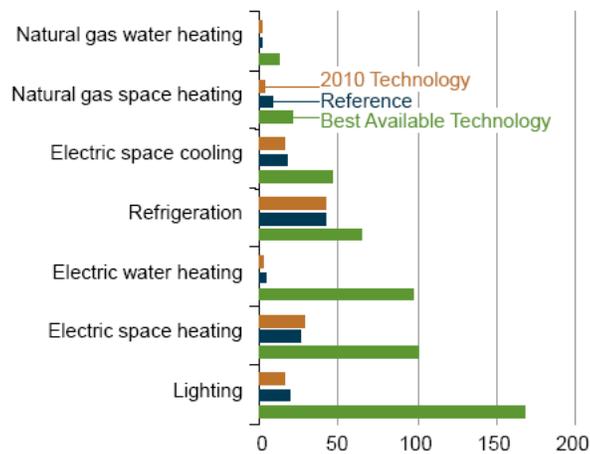


Figure 5: Estimated energy consumption reduction by 2035 (EIA 2011)

3.3.2.2.1 Lighting

Lighting both is the primary electrical draw in a building and presents the biggest opportunity for system-gain (its potential is greater than 100% because lighting itself induces loads on an HVAC system). The Clean Building Consortium estimates that good use of existing lighting control technology can reduce electricity consumption by 40-60% or more (CBC, 2011) emphasizing that even lighting itself is a system to be managed as such. In the case of new installations, the group recommends high-efficiency fluorescent systems for general lighting and improved performance metal halide for higher ceilings. In time, further improvement may come from longer life metal halide (MH) lamps with low wattage and dimming, improved white light LED and OLED efficacy, improved solid state lighting (SSL) standards; and improved sensor integration. Again, since lighting is a system within the larger building system, its specific effect cannot be determined without close inspection of the design itself (ORNL, 2004; DOE 2011).

3.3.2.2.2 Thermal control – mechanical and plumbing

To achieve net-zero goals, experts state that HVAC systems must drastically increase the level of integration and interoperability (CBC 2011). Commissioning, or the quality-oriented process of verifying and documenting the performance of facilities and systems, is traditionally performed right before initial building occupancy. Increasingly, building professionals are realizing that significant initial and continuous commissioning is required for high performance buildings (CBC 2011). Advanced controls and sub-metering will be increasingly necessary to ensure buildings perform as designed. While improved operator education will continue to play a large role, intelligent controls will increasingly be programmed to recognize energy-wasting conditions and notify or correct the situation.

The CBC Mechanical Systems and Controls working group has identified the underutilization of existing HVAC technologies as a major barrier to near-term energy-efficiency (CBC 2011). Much research is available as reference with architects, developers, and operators as the intended audiences (DOE 2001, DOE 1999; DOE, 2002; DOE 2009; EPA 2010). In all cases, however, the effects of particular technologies are highly variable based on their specific implementation. The documents make no attempt to define a general “right answer” for any of the technologies or their use.

3.3.2.2.3 Miscellaneous Electric Loads

Commercial Miscellaneous Electric Loads (C-MELs) are defined as plug load besides those related to HVAC, water heating, and lighting. Unfortunately, this category is projected as the largest growth end-use of commercial source energy use as buildings become tighter systems (TIAX, 2010). These loads are non-standard and difficult, if not impossible, to integrate into building-wide energy efficiency efforts. Additionally, they are beyond the scope of a study of building energy efficiency technologies, but we strongly suspect that there can be no prescriptive approach here. Instead, as we will recommend below, we suggest that that continued benchmarking and public reporting of consumption may be a means of addressing them indirectly.

3.3.3 Recommendations

3.3.3.1 For the developer

The references above provide starting points for any investigation into a conservation technique or technology – both its (very) general applicability and its technical implications. The determination of its suitability for a particular development in Tysons Corner, however, is specific to the particular development. Building information modeling tools are the best available means of assessing and evolving a design for maximum energy efficiency.

3.3.3.2 For FCG

For FCG, as we did with the discussion of building form, we strongly recommend that FCG continue its practice of not prescribing technologies or designs to developers. A building is a complicated system. Such prescription addresses only part of the energy efficiency, does so usually to negative cost and environmental effects, and places a huge burden on FCG itself.

First and foremost, technology prescription ignores huge opportunities for environmental gain. It cannot affect the form of a building – whether it is positioned and designed to minimize the need for lighting, cooling, or heating. It cannot integrate the design, build, and operate lifecycle – whether the architect has carefully modeled energy consumption and worked with the general contractor to ensure that sourced components actually complement each other as expected. It cannot affect the building's use. Sure, sensors can be installed to automatically dim lights, but if occupants simply prefer to always have the lights on, the prescription is useless in the end.

Second, even as it addresses design elements directly, it does not directly address the energy efficiency of the whole system. In doing so, if FCG is to do this with the intended effect, this is a hugely increased burden on FCG. The purpose of technology prescription is to satisfy an energy consumption target for a building, not to put a particular technology into the building for the sake of putting a particular technology into the building. We see above that the estimation of a particular component's effect is error-wrought without installation specifics and without sophisticated modeling tools. This means that in order to most effectively prescribe technologies, FCG must maintain the modeling and design capability to identify opportunities for technology specification, and it must maintain a constant watch over the design as it evolves. If the building is subject to an overall energy consumption performance expectation, this further means that FCG's modeling and design capabilities must be superior to that of the architect as he will also be looking for the most cost-effective means of satisfying the consumption objective.

FCG does not maintain the skill and manpower to make this feasible even for a single building, let alone all new construction in Tysons Corner, nor should it. The result is that any specified

technology will in most cases be sub-optimal; the prescription is a constraint on the developer's feasible design options. If the developer is meeting an otherwise defined performance expectation, the prescription increases his costs. The same environmental effect could have been achieved for fewer dollars. If the developer has a fixed budget, the constraint results in degraded environmental performance. An improved environmental effect could have been achieved for the same cost. Neither result is a positive one for FCG or for the developer.

Happily, the shortcomings of the prescriptive approach are addressed entirely by a performance-based approach. This is the basis of our additional task. By specifying a performance objective, FCG achieves its environmental objectives with limited burden to itself, and it leaves the developer free to satisfy the objectives by the most economically efficient means – be they technology, design, or use. Even more happily is the fact that FCG already takes this approach.

3.4 District Energy

District energy, specifically in the form of combined heat and power (CHP), may offer the biggest source of energy and environmental gains in Fairfax and is a tantalizing target as a result. The Comprehensive Plan already acknowledges this potential with its support of community energy systems. Supporting this interest are two previous studies that generally consider district energy in the area (FVB, 2011; NVRC, 2011). By necessity, we draw heavily from these two reports, and refer the reader to them for further details. We cannot expand on their content. Expansion of the existing technical document would require additional details that simply don't exist yet (for instance, where would the generation plant even go?). Expansion of the legal discussion requires expertise beyond our skill set. Instead, we limit this discussion to their implication.

3.4.1 Potential benefit

The energy benefit of CHP lies in the fact that CHP combustion technologies are less emissions-intensive than large-scale coal-fired base load, that transmission losses are minimized, and that CHP captures and uses the waste heat from electricity generation. Where traditional coal-fired grid efficiencies range 30-45%, CHP systems typically operate at system efficiencies between 60-80% (EPA, 2007).

From a national perspective, Oak Ridge National Lab has estimated that that the heat energy lost through the traditional U.S. utility sector is greater than the total energy use of Japan (ORNL 2008). The same report estimates that expansion of CHP to 20% of domestic electricity generational capacity could save nearly half the energy consumed by all U.S. households and the CO₂ equivalent of removing 154 million cars from the road.

Locally, Metropolitan Washington Council of Governments recently sponsored a report on the potential of District Energy Systems (DES) in the region (FVB 2011). In that report, eight forms of district energy are evaluated. As in all general investigations, the authors make general assumptions and then find that CHP may deliver reductions in both source energy consumption and greenhouse gas emissions.

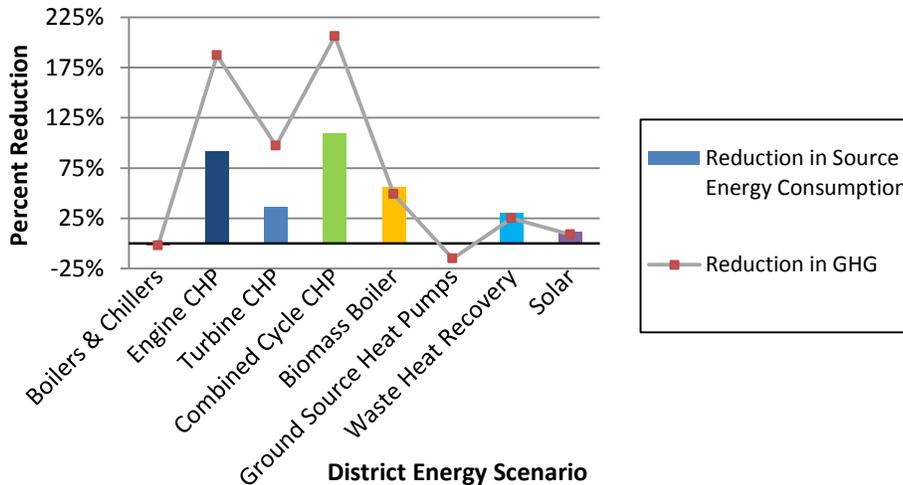


Figure 6: Source energy and GHG reductions under sample district energy implementations (built from FVB, 2011)

In the figure, reductions greater than 100% are possible because thermal demands typically exceed electricity demand and the surplus is sent back to the grid. In doing so, CHP systems reduce the GHG emissions implied by the waste heat and by the more GHG-intensive generation at centralized grid plants.

3.4.2 Recommendations

At the start its discussion of cost and benefit, the MWCOC report authors note, “It cannot be overstressed that the generalized characterization of technologies (including efficiencies and costs) in this report should not be applied to specific cases without a case-specific evaluation of loads, densities, fuel and electricity costs and other unique circumstances. Further, in order to fully assess a potential district energy system, a long-term economic proforma analysis of revenues and expenses, including a build-up of customer base and plant capacity is required to fully reflect the internal rate of return on the multi-year stream of investments.” The Northern Virginia Regional Commission report is a legal analysis (NVRC, 2011). The report predicts that, for non-campus applications, the most likely path to CHP (independent of Dominion providing such services itself) is a public-private partnership between the county and a private partner.

The combination of these two recommendations simplifies FCG’s available decisions relative to proffers concerning district energy. The sure determination of economic feasibility requires a detailed engineering, financial, and legal analysis. The form of the plant, its power output, its heat output, its fuel, its location, its profit distribution, its environmental constraints, its financing terms, its potential customers, market energy costs, zoning restrictions, legal authorities, and state regulation all must be analyzed specifically for the particular application.

We therefore recommend that, in light of such significant uncertainty, unless an applicant is proactively pursuing a district energy approach (or similar effort), the county not seek proffers on the subject of district energy in favor of seeking proffers with more certain benefit. Doing otherwise incurs a certain opportunity cost for an unquantifiably uncertain gain of uncertain magnitude.

If FCG wishes to proceed towards district energy, we recommend that it first seek help from federal resources to identify appropriate private sector partners and to identify most relevant case

studies for comparison. EPA's Combined Heat and Power Partnership (EPA, 2012) and DOE's Mid-Atlantic Clean Energy Application Center (DOE, 2012) are good starting points.

4 Tasks 3 and 4 – Cost, benefit, and market competitiveness

On Tasks 3 and 4, we fall short. The literature includes studies comparing particular technologies in particular controlled environments do exist, of course. The problem, however, is that there are no general cost or break-even analyses that provide enough certainty for use as policy instrument. The applications are simply too varied, and the technologies' effects confounded by the rest of the building system in which they are employed. Remember, each building is a system, and its eventual consumption is a function of the interplay between design, environment, construction, use, and maintenance. The effects of a single technology simply cannot be teased out to estimate their general effect on system consumption. A pair of neighboring buildings with equivalent design can have vastly different consumption profiles, showing that technology effects can be highly variable. Even for a single installation, engineering analyses to determine the effects of particular sub-systems or design elements are difficult and can be crude. Building information modeling software tools have eased this, but their results focus on a particular building, not the general fitness of a technology.

Compounding the difficulty of estimating energy consumption effect is the difficulty of estimating the financial effect. Buildings will have differing rate structures even from the same utility depending (at a minimum) on use profiles, installation size, existing contracts, and load shedding responsiveness. The financial benefit of energy efficiency investment accrues differently depending on ownership and tenancy. Financing terms differ between installation, location, building purpose, technologies, technology applications, owners, project duration, capital access, credit worthiness, interest rates, and market competition. Just as each project requires its own engineering analysis, each project requires its own financial analysis.

This is why general cost-benefit analyses simply do not exist. Case studies exist, yes, but no general solution exists. This is a problem that frustrates universally; FCG is not unique in this respect. It is also a problem that various groups, most notably the US Department of Energy, have been working to solve.

Most recently, DOE has launched a beta version of its Buildings Performance Database (DOE, 2012). The purpose of this database is to house and make available actual energy consumption profiles for buildings categorized by a number of different characteristics. As we might expect from the discussion above, these categories include general form, technologies employed, location, and building purpose. This is the closest resource available to addresses Tasks 3 and 4 of this study. If FCG is looking to provide general guidance on technologies for curious developers, this is where they should go for quick an easy analysis. The caveats, however, are that the tool is in beta and that its outputs cannot ever offer certainty.

We do note that the fact that this database exists is proof that FCG's problem is widely felt. The facts that it requires a user to characterize the entire facility and that its output is a range of possibilities further emphasize the notion of a building as a system, not an additive collection of components. The fact that the database is currently incomplete is evidence that general analyses are not available, and the fact that it is incomplete after two years of development indicates that it is indeed a difficult task.

5 Additional Task - Certification and Benchmarking

Though DOE's tool is new, the problem of designing for energy efficiency and even of identifying energy efficient buildings is an old one. As we have seen, the solution is not in the form of a general cost-benefit analysis of the various means of reducing energy. Instead, the solutions that have resulted are design certification and benchmarking tools. It turns out that these are the best tools by which FCG can ensure building energy efficiency. Given that the originally proposed cost-benefit analysis is not feasible, we include an additional investigation of these tools and strongly recommend them as means of encouraging energy efficiency in Tysons Corner.

Conveniently, such certifications form the basis of FCG's current approach with its use of LEED guidelines, rather than technology prescription. We contend that this is the correct approach for Fairfax. We, therefore, recommend that Fairfax continue with this approach, but we do recommend an extension from just a consideration of building design to a consideration of building use. To make that recommendation, we first discuss LEED and show that because energy consumption is also a function of use and site, it cannot ensure long term energy gains. We then offer ENERGY STAR to show that it offers FCG a mechanism to encourage energy efficiency over the long term. For completeness, we briefly discuss the idea of Net-Zero as a future alternative to ENERGY STAR. We close the section with a more complete discussion of the recommendation itself.

5.1 LEED

Fairfax County is already well acquainted with LEED ratings which are administered by the U.S. Green Building Council (USGBC). At its most basic level, LEED is a point-driven system that broadly considers a building's environmental footprint with five general categories: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, and Indoor Environmental Quality.

LEED certification likely on the average reduces overall energy consumption compared to a traditional building. Energy & Atmosphere, however, is only one category of the LEED scoring system. One study of 100 LEED certified commercial buildings showed an average 18-39% per unit floor area reduction in energy use (Newsham, Mancini and Birt 2009) relative to like uncertified buildings. The same study, however, noted LEED's shortcomings in that despite average improvement, a quarter to a third of LEED certified buildings actually used more energy than their comparable conventional counterparts.

Further, among buildings LEED certified at any level, the study could not show a statistically significant relationship between the level of certification and the reduction of energy consumption. Within the sample, mean energy use intensity drops with increased LEED rating, but the variability prevented a statistically significant indication of a general trend in the greater building stock.

The variability of LEED's effectiveness relative to the operational effects results from the fact that LEED is a set of best practices for design and construction before building occupancy. There is no component to monitor the building post-occupancy, despite the fact that operational energy savings often falls short of proposed savings.

This means that LEED certification is, on average, productive in terms of improving energy efficiency – and since the certification looks across a broad spectrum of concern, it is of broader environmental benefit – but it is not sufficient to ensure energy efficiency.

USGBC is well aware of the problem and is actively looking to develop remedies with its Building Performance Partnership. Under this partnership, LEED certified buildings feed their operational back to USGBC so that the rating system can be improved. In the meantime, to bridge the gap between design and operations, we turn to ENERGY STAR.

5.2 ENERGY STAR

ENERGY STAR is a program jointly administered by the Department of Energy and the Environmental Protection Agency to help protect the environment and reduce energy costs by improving energy efficiency. It has become the standard for assessing *operational* (remember LEED is a pre-occupancy rating system) energy efficiency and has become a common instrument of public policy for multiple federal agencies, states, and local jurisdictions (DOE, 2013).

The ENERGY STAR buildings initiative was a response to an EPA study in the early 1990s that demonstrated the difficulty of predicting a building's operational energy performance from technology specification alone (EPA 2009). ENERGY STAR's prevalence today suggests the study remains relevant today. Its lessons are two-fold. First, even experts doing detailed analysis of specific facilities with standard, repeatable tools find it very difficult to accurately predict either the overall energy consumption of a building or the effects of particular upgrade. Building Information Modeling tools have emerged and matured over recent years to better predict a specific design's energy consumption, but a gap remains with reality. Second, calculations based on a design specification alone are inadequate to ensure energy efficiency. Continuous monitoring of actual energy consumption is necessary to effect and maintain energy efficiency efforts. These are exactly the same problems USGBC is attempting to tackle with LEED, and in fact, it is using the ENERGY STAR reporting tool to collect the operational data to resolve the difficulty.

5.2.1 Effects and prevalence

The program is intended to offer two energy-specific benefits. First, for the individual building, it has been estimated that ENERGY STAR labeled buildings use about 40% less energy than their peers (CoStar 2008). The program also addresses existing buildings, which are often low-hanging fruit in achieving energy savings. Improved operational efficiencies of 8-12% are commonly reported after tuning building operations (BOMA, 2006). Both cases serve FCG's environmental objectives. The second benefit is the database of building energy consumption as it is a tool to drive improvements in the state of the art. External to the program itself, there are also indications that certification is beneficial indirectly by increasing resale and lease prices (CoStar, 2008).

EPA states that by the end of 2010, more than 12,600 buildings (2 billion ft² of building space) have been awarded ENERGY STAR certification and that over 200,000 buildings (18 billion ft²) representing more than a quarter of total market) have been assessed using Portfolio Manager, the ENERGY STAR reporting and calculation tool. EPA further estimates that commercial building improvements related to the ENERGY STAR Program have saved 112.9 billion kWh (roughly equivalent to about 4% of a year's non-industrial commercial use of energy in the US) since the program's inception in the early 1990s (EPA, 2010; LLNL, 2011).

5.2.2 Certifications and Portfolio Manager

The program offers two building certifications. The ENERGY STAR label is the primary mechanism. It compares peer buildings using operational energy consumption data. A building shown to be in the top quartile of its peers in terms of energy intensity (energy divided by floor space) can earn the ENERGY STAR designation (subject to occupancy, ownership, and indoor air quality restrictions). The Designed to Earn ENERGY STAR (DEES) certification is a bridge between design and operational performance. During development, the Architect of Record initiates the DEES process to help establish energy consumption goals with EPA's Target Finder tool. If the project appears to satisfy benchmarks, DEES certification is issued, and the developer can use the label on its plans and marketing materials.

Once the building has been occupied and operational for a year, it can earn the ENERGY STAR (as opposed to only DEES). Building owners report their consumption data and building characteristics with ENERGY STAR Portfolio Manager, which is a free online tool. The tool normalizes the inputs for a particular building and compares its consumption to peer facilities to determine the building's consumption percentile, which is its ENERGY STAR score.

Portfolio Manager itself is of particular interest to Fairfax for a pair of reasons. First, once an account has been established for a particular building, the tool allows for automated import from the utility (though FCG may have to work with Dominion and ENERGY STAR to make that functionality available for Tysons Corner buildings). The process of benchmarking, therefore, is a small burden on a building owner. And second, Portfolio Manager allows a building owner to share the consumption data with a third-party. This gives FCG the ability to monitor the on-going operations of buildings in Tysons Corner and, therefore, to judge and improve its negotiating position over time.

5.3 Net-zero energy performance indices

Net-zero energy indices are the next evolution in energy efficiency measures. Such measures are currently under development as part of Zero Energy Buildings (ZEB) initiatives, which are intended to encourage the development of buildings which on average over time require no input energy (in either fuel or electricity) beyond that which they can produce themselves from renewables for building operations, excluding plug loads.

The U.S. Energy Independence and Security Act (EISA) 2007 authorizes the Zero Energy Commercial Building Initiative (CBI) to work towards the goals of net zero energy for all new commercial buildings by 2030, 50% of commercial building stock by 2040, and 100% of commercial building stock by 2050. The European Union has set a much more aggressive target of 'nearly zero' energy consumption for all public-authority used buildings by 2018 and for all new buildings by 2020 with its Energy Performance of Buildings Directive (EU 2010; Marzal 2011).

Consensus has not yet formed around the most appropriate net-zero energy measures. The difficulty in such definition is the separation of the building's energy consumption from its occupants' energy consumption. HVAC, for instance, counts against the building and would be considered in a net-zero measure; miscellaneous electric loads are not as they are not intrinsic parts of the building system. The interplay between the two represents the grey area that is the trouble for net-zero definition.

Like ENERGY STAR, the zero-energy measure treats the building as a complete system and focuses on energy alone. While ENERGY STAR currently is based on a *peer* rating, net-zero

measures intend to provide a more absolute measure of building performance as an *asset* rating. While there is no standard measure yet, Department of Energy is in the process of defining one (Federal Register, 2011). The important part is that however the measure is eventually defined, the asset rating will be included in ENERGY STAR Portfolio Manager in parallel to the existing peer rating scale. When this happens, FCG need not revise the reporting procedures it encourages, but it can begin to specify performance as a function of a net-zero asset rating target.

5.4 Recommendations for certifications

LEED, ENERGY STAR, and NetZero all exist because of the problem with which FCG finds itself grappling. There are no general technology inclusions that ensure a design is energy efficient, and there is no guarantee that a building designed with efficiency as a priority will be energy-efficient in practice.

Employed as policy, these tools give a developer maximum flexibility to meet environmental objectives at minimum cost – be it through technology, design, operations, or some combination. This is why local and state governments are increasingly adopting them as public policy instruments to push energy efficiency (NRC 2010). Locally, the District of Columbia does the same and goes a step further with ENERGY STAR requirements (ENERGY STAR, 2008). Clearly, the District has different operating authorities than does FCG, but the point is that such an approach is not new to the region.

FCG already pursues certification-based approach with its use of LEED. We recommend that it continue this course, rather than looking for more direct influence over the technology particulars of a building. Building code already specifies energy efficient installation standards; FCG does not need an additional layer of prescriptive specifications. We recommend continued use of LEED. Even if it does not guarantee energy efficiency, as a general environmental stewardship tool, it offers wider benefit.

To complement LEED, we recommend that the county encourage Designed to Earn the ENERGY STAR certification and encourage annual benchmarking with Portfolio Manager. ENERGY STAR augments existing prescriptive building codes (VA 2009) by requiring building owners to report and compare actual energy use. We recommend DEES certification, rather than ENERGY STAR certification for two reasons. First, a new development may not neatly align with the ENERGY STAR categories. A campus-style multi-building design, for example, is not applicable, though may offer lower overall energy consumption. Most new development will fit into DEES, but all cases will not, and FCG should therefore be judicious in its encouragement of DEES. Second, because the ENERGY STAR cannot be awarded until after a year of operations, certification cannot be guaranteed from design itself. If the proffer is for ENERGY STAR certification, but the building operator fails to achieve the label, we assume that FCG has little recourse, absent incorporation of an enforcement mechanism into the proffer.

The intent is to improve the efficiencies of the individual buildings, pave the way towards net-zero measurement, grow the ENERGY STAR databases, and improve the LEED rating systems themselves. In the former two cases, the benefits accrue to the building owner. He is hopefully able to use the benchmarking to reduce energy costs, and use of Portfolio Manager helps to pave the way to net-zero measurement as it becomes available. In the latter two cases, the practice means that Tysons Corner development helps to improve the state of the art and, therefore, has a longer and further reaching effect greater than just the new development itself.

Since reporting is a requirement for ENERGY STAR participation, we also recommend that FCG encourage building owners to make public their energy consumption performance. From

developers, FCG should negotiate access to the consumption data through Portfolio Manager, and the County should post the annual benchmarking results publicly online. DC already has similar laws on the books, so Fairfax would be well within the mainstream with the policy. Additionally, each facility should have posted its ENERGY STAR scores from each benchmarking along with its LEED Certification. The point is to encourage public pressure for improved energy-efficiency.

Now we turn to net-zero. Pilot efforts are underway to develop such buildings, but consensus has not yet emerged around appropriate measures or acceptable scores for good use as policy instruments. We recommend that Fairfax closely monitor developments pertaining to net-zero, and we presume that, in time, net-zero measures will be the best means of specifying performance - just not yet.

We understand and fully support FCG's goal of making Tysons Corner an innovation center that drives improvement of building energy technologies, and so we recommend that FCG allow risk to trump certification. If a developer acting in good faith proposes a project with new, risky technologies that may offer a chance at breakthrough energy performance, and if that riskiness is enough to jeopardize FCG's usual preferred form of certification, then we suggest that the county accept a commitment to proceed with the risky process in lieu of a commitment to the certification (though maintaining a reporting component to the commitment) and proceed with the risky project. Even if the project fails to bring the hoped-for effect, the learning is still more valuable than the effects of a single certified building. If Fairfax indeed wants to be a leader here, it will have to support experimentation (which can fail to meet objectives), and sometimes it will have to be ahead of standards.

6 Recommendations

We have presented our recommendations throughout the document as they were developed. We present them here again to close the document and show them as a complete set. Again, we note that we make these recommendations with the assumption that if they were to be adopted, they would be implemented through the proffer process.

We also emphasize again that we think FCG is already pursuing an appropriate strategy to achieve its environmental and economic objectives. Our recommendations are only minor additions.

6.1 Building technologies

We strongly recommend the FCG continue its practice of not employing a prescriptive approach to building technologies or components. This holds for both for technologies included at initial construction and for technologies for which a developer might provision in anticipation of future installation. This is because a building is a system. Its energy consumption is function of its design, its construction, its relation to its surroundings, and its operations. The prescriptive specification of technology ignores primary energy efficiency drivers and imposes a huge administrative, technical, and personnel burden on FCG itself. These are recognized difficulties, and indeed, they are why design certification and performance standards were originally created. This is why we explored the additional task, and this is the basis for fourth and fifth recommendations.

6.2 Data collection

In section 3.1.1 we noted a lack of data to confirm or deny the utility of wide-spread wind generation in Fairfax County (though we are skeptical). In 3.1.2, we noted a possible lack of data on the geology under Tysons Corner. Wind data can be gathered easily and may represent an interesting proffer. Augmenting geology databases is certainly far more expensive (possibly to the point of exceeding the cost of a reasonable proffer). If the costs turn out to be reasonable, however, FCG may be interested in a proffer to coordinate with DPWES and the Commonwealth's DMME in an effort to expand their data sets to enable more exploratory investigation of GSHP in Tysons Corner.

6.3 District energy

We recommend that FCG not pursue proffers preparing the way for district energy with the reasoning that until more certainty exists on this subject, such proffers represent opportunity costs that can be spent with more definite results elsewhere.

6.4 Third-party certifications and performance guidelines

We recommend that Fairfax continue its current practice of performance-based guidance to Tysons Corner developers as it is a perfect mirror of FCG's own attempt to promote both environmental stewardship and economic growth. With the guidelines, FCG defines the recommended level of environmental performance, but the developer has the flexibility to meet those objectives at lowest possible cost.

FCG should continue to support LEED certification of projects. But because LEED only considers design, FCG should also encourage at least Design to Earn ENERGY STAR certification and then annual reporting in ENERGY STAR Portfolio Manager to ensure energy-efficiency in practice. FCG should also strongly encourage building owners to help improve LEED by using Portfolio Manager to report energy performance back to the U.S. Green Building Council.

We also recommend that FCG pay close attention to the evolution of Passive House and net-zero methodologies, and as these practices mature, we recommend FCG use them to specify building performance targets.

We do note, however, that certification guidelines (though not Portfolio Manager reporting) should not be applied rigidly if a developer wishes to be a test case for unproven energy-efficiency techniques or technologies. FCG wants Tysons Corner to be a center for building technology innovation, to do that it must give developers the freedom to experiment. FCG should coordinate with DOE programs to recruit suitable experimentation developments, and it should apply flexibility to its guidelines so that policies meant to encourage a minimum level of environmental stewardship do not hamper attempts to exceed it.

6.5 Public reporting

We assert that public reporting of energy consumption data and ENERGY STAR ratings will boost public awareness of the issue and, in turn, further encourage building operators to reduce consumption. We recommend that FCG take advantage of the reporting into Portfolio Manager and make that information public. FCG should post on its own web site the consumption data and comparison scores for all buildings in Tysons Corner that are being reported in the tool.

Building owners should display their own results (raw data and performance scores to allow comparison) at the entrance of the building.

7 Works cited

- BOMA. *Practical Intelligence for Real Estate, The Green Issue*. BOMA Kingsley Quarterly BOMA International and Kingsley Associates, 2006.
- CBC. *Analysis of Cost & Non-Cost Barriers and Policy Solutions for Commercial buildings*. Zero Energy Commercial Buildings Consortium (CBC), 2011.
- CBC. *Next Generation Technologies: Barriers & Industry Recommendations for Commercial Buildings*. Zero Energy Commercial Buildings Consortium (CBC), 2011.
- Collins, Andrew, Carl Orio, and Sergio Smiriglio. *Geothermal Heat Pump Manual*. City of New York Department of Design and Construction. August 2002.
<http://www.nyc.gov/html/ddc/downloads/pdf/geotherm.pdf>.
- CoStar. *CoStar Study Finds Energy Star, LEED Bldgs. Outperform Peers*. 03 26, 2008.
<http://www.costar.com/News/Article/CoStar-Study-Finds-Energy-Star-LEED-Bldgs-Outperform-Peers/99818>.
- DOE. *2010 Renewable Energy Data Book*. U.S. Department of Energy, 2011.
- DOE. "Building Technologies Program"
http://www1.eere.energy.gov/buildings/commercial/bpd_about.html, 2012.
- DOE. "Commercial Building Asset Rating Program." *Federal Register*, 08 08, 2011: 48152-48158.
- DOE. Federal, State, and Local Governments Leveraging ENERGY STAR.
http://www.energystar.gov/ia/business/government/downloads/State_Local_Govts_Leveraging_ES.pdf?2d87-203a, February 21, 2013.
- DOE. "Mid-Atlantic Clean Energy Application Center" <http://www.maceac.psu.edu/>, 2012.
- DOE. "Wind Powering America: Virginia 80-Meter Wind Map and Wind Resource Potential."
http://www.windpoweringamerica.gov/wind_resource_maps.asp?stateab=va, Accessed 2013.
- EPA. "Biomass Combined Heat and Power Catalog Technologies." 2007.
- EPA. *Celebrating a Decade of Energy Star Buildings: 1999-2009*. EPA Energy Star Program, 2009.
- EPA. "Combined Heat and Power Partnership" <http://www.epa.gov/chp/>, 2012.
- European Union (EU). *Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast)*. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF>, 2010.
- FCG. *Codes and Standards*. n.d.
http://www.fairfaxcounty.gov/dpwes/construction/codes_standards.htm (accessed 12 2011).
- FCG. *Fairfax County Energy Task Force Interim Report on Building and Energy Sources*. Fairfax County Government, 2011.

- . *The Comprehensive Plan*. 2011.
- FVB. "Opportunities for Implementing District Energy Systems in Virginia." NVRC / MWCOG, 2011.
- FVB. *Technical Support for Integrated Community Energy Solutions*. FVB Energy Inc., 2011.
- GMU. *Forecasts for Tysons Corner to 2050*. Fairfax, VA: George Mason University Center for Regional Analysis, prepared for Fairfax County, 2008.
- ICTSD. *Technology Mapping of the Renewable Energy, Buildings, and Transport Sectors: Policy Drivers and International Trade Aspects*. International Center for Trade and Sustainable Development, 2010.
- IEA. *Renewable Energy: Markets and Prospects by Technology*. International Energy Agency, 2011.
- Jelle, B., A. Hynd, A. Gustavsen, D. Arasteh, H. Goudey, and R. Hart. "Fenestration of Today and Tomorrow: A State-of-the-Art Review and Future Research Opportunities." *Solar Energy Materials & Solar Cells*, 2012: 1-28.
- LANL. *Sustainable Design Guide*. Los Alamos National Laboratory, 2002.
- LBNL. *Assessment of Energy Performance of Window Technologies for Commercial Buildings*. Lawrence Berkeley National Laboratory, 2010.
- LLNL. "U.S. Energy Flow." *Lawrence Livermore National Lab*. 2011.
<https://flowcharts.llnl.gov/energy.html>.
- Marszal, A.J., et. al. "Zero Energy Building - A Review of Definitions and Calculation Methodologies." *Energy and Buildings*, 2011: 971-979.
- McCray, Kevin. *Guidelines for the Construction of Vertical Boreholes for Closed Loop Heat Pump Systems*. National Ground Water Association.
http://intraweb.stockton.edu/eyos/energy_studies/content/docs/proceedings/MCCRA.PDF. 1997.
- Newsham, G.R., S. Mancini, and B. Birt. "Do LEED-certified buildings save energy? Yes, but..." *Energy and Buildings* 41, no. 8 (2009): 897-905.
- NRC. *Certiifiably Sustainable? The Role of Third-Party Certification Systems*. National Academy of Sciences, 2010.
- NREL. "Dynamic Maps, GIS Data, and Analysis Tools – Solar Maps". 2007.
<http://www.nrel.gov/gis/solar.html>.
- NREL. "Source Energy and Emission Factors for Energy Use in Buildings." Technical Report, National Renewable Energy Laboratory for the Department of Energy, Revised 2007.
- NREL. "National Solar Radiation Data Base" National Renewable Energy Laboratory for the Department of Energy. http://rredc.nrel.gov/solar/old_data/nsrdb/, 2010.
- NVRC. *District Energy Systems: An Analysis of Virginia Law*. McGuireWoods for North Virginia Regional Commission, 2011.
- ORNL. *Combined Heat and Power: Effective Energy Solutions for a Sustainable Future*. Oak Ridge National Laboratory, 2008.

- ORNL. *Emerging Energy-Efficient Technologies in Buildings: Technology Characterizations for Energy Modeling*. Oak Ridge National Laboratory, 2004.
- PNNL. *50% Energy Savings Design Technology Packages for Medium Office Buildings*. Technical Support Document, Pacific Northwest National Laboratory, 2009.
- TIAX. *Commercial Miscellaneous Electric Loads: Energy Consumption Characterization and Savings Potential in 2008 by Building Type*. TIAX LLC for U.S. Department of Energy, Building Technologies Program, 2010.
- Virginia Department of Housing and Community Development. *Uniform Statewide Building Code*, 2009. http://www.dhcd.virginia.gov/StateBuildingCodesandRegulations/Virginia_Uniform_Statewide_Building_Code.htm.
- WSU. *Thermal Energy Storage: Energy Efficiency Factsheet*. Washington State University, Cooperative Extension, Energy Program, 2003.

**MITRE Building Energy Technology Report and Fairfax County Staff Perspectives
Consolidation of comments received as of February 11, 2015
Prepared by Fairfax County staff, February 12, 2015**

Background

The Planning Commission's Environment Committee has been reviewing a report from the MITRE Corporation entitled "Building Energy Technology Recommendations to Fairfax County." The report was prepared per a proffered commitment from MITRE to the performance of sustainability-related work for the benefit of the county. This is the second of two reports that MITRE has provided to the county; the first was a report addressing electric vehicle charging infrastructure, which the Planning Commission Environment Committee is continuing to review. Like that first report, the building energy technology report was referred by the Board of Supervisors to the Planning Commission for its review and recommendation. The committee has met on several occasions to discuss this report and to engage county staff in discussions regarding staff's perspectives on the report's recommendations.

At the request of the Environment Committee, county staff prepared a document that provides its perspectives on the recommendations presented in MITRE's building energy technology report.

In November 2014, the Environment Committee invited any interested party to provide comments on the MITRE report and/or staff perspectives document. Comments were requested by January 30, 2015. Comments have been received from the following:

- Linda Burchfiel
- Eric Goplerud (forwarding thoughts from Ivy Main)
- Ross Shearer

All of these comments have been provided directly to the Environment Committee for its consideration. This document is staff's attempt to consolidate these comments within the context of the structure of the MITRE report and staff perspectives document. While staff has copied the comments verbatim in most cases, staff has at times paraphrased the comments for purposes of clarity.

The comments are presented within the context of the 12 recommendations from MITRE that were identified in the staff perspectives document. While each of the 12 MITRE recommendations is referenced, the recommendations are not repeated from the staff perspectives document. The reader is encouraged to reference the staff perspectives document for the specific language within the MITRE report relating to each recommendation. Comments that provide general guidance or that do not clearly address one particular recommendation from the MITRE report are presented first as "general comments."

Staff is anticipating that the Environmental Quality Advisory Council will transmit comments prior to the Environment Committee's February 18, 2015 meeting.

General Comments

- “One primary theme of the MITRE report is about leadership. In its recommendation 4c (See page 20 or page 10 of the staff perspectives) MITRE sees Tysons development as an opportunity for Fairfax to distinguish itself by participating in driving the national transition to sustainable living. Specifically MITRE recommends Energy Star as the tool for obtaining high energy efficiency in buildings and MITRE recommends findings ways for publicly reporting building energy use to prospective tenants and condo owners thus empowering the use of markets to help drive efficiency. MITRE explains that improving energy efficiency of buildings will ‘pave the way towards net zero development’ and Fairfax should participate. By helping ‘to improve the state of the art’ at Tysons, a more aggressive energy efficiency agenda would yield a civic ‘effect greater than just the development itself’. This is the stuff of leadership. Fairfax should seize it.” (Ross Shearer)
- “. . . County energy policy should be formed around a strategy that contributes to the transformation of our energy economy to a sustainable one based on renewable sources and efficiency and that deliberately pushes towards the absolute abandonment by 2050 of our current reliance on fossil fuel forms of energy production used for buildings. The leadership MITRE advocates for Tysons would contribute to this transformation.” (Ross Shearer) (see also Recommendation 2c, but this could apply to other renewable sources of energy as well)
- “I asked Ivy Main, the Virginia director of the Sierra Club, to review the Mitre report and staff responses, especially as they related to solar recommendations. She responded that the Mitre report seemed like it was put together by people without specialized energy knowledge and with a private sector bias against government setting any rules. She felt that the Fairfax County staff report was generally better, except as to solar, where it was at least very dated.” (Eric Goplerud)
- “In order to be seen as a leader in energy efficient technology, it is important for FCG [Fairfax County Government] to be on record as encouraging energy efficiency performance in every way it legally can.” (Linda Burchfiel)

MITRE Recommendation 1: Building Technologies

- No comments limited to building technologies vs. certifications, but several comments regarding the need to augment LEED with energy-specific performance. See recommendation 4c

MITRE Recommendation 2a: Individual Technologies/Data Collection--Wind

- No specific comments.

MITRE Recommendation 2b: Individual Technologies/Data Collection—Geothermal

- No specific comments.

MITRE Recommendation 2c: Individual Technologies/Data Collection--Solar

- “As to roof-mounted photovoltaic units, MITRE recommends Fairfax encourage the adoption of solar systems where the roof area is relatively large. Staff’s response cites the example of the high cost (\$56,000) of the small (3 kW) system installed at T. J. High School. That is one example. The same year, a friend of mine living near Herndon installed a \$4.1 kW system for a pre-tax credit cost of \$44,000. Staff also sites a March 2012 index for commercial (non-residential) solar of 19.41 cents per installed kWh about double our electrical rate. Costs for solar panels have declined substantially since 2009 and even since 2012. The latest residential trend is neighborhood bulk purchasing that reduces outreach and advertising costs for installers such that an additional 15 to 25% can be saved.” (Ross Shearer)
- “Staff’s exclusive reliance on market price comparisons ignores the health and environmental costs associated with conventional electrical production from coal and natural gas. Much more is at stake than the financial calculations of returns on investment. County energy policy should be formed around a strategy that contributes to the transformation of our energy economy to a sustainable one based on renewable sources and efficiency and that deliberately pushes towards the absolute abandonment by 2050 of our current reliance on fossil fuel forms of energy production used for buildings. The leadership MITRE advocates for Tysons would contribute to this transformation.” (Ross Shearer)
- “I asked Ivy Main, the Virginia director of the Sierra Club, to review the Mitre report and staff responses, especially as they related to solar recommendations. She responded that the Mitre report seemed like it was put together by people without specialized energy knowledge and with a private sector bias against government setting any rules. She felt that the Fairfax County staff report was generally better, except as to solar, where it was at least very dated. If indeed the solar panels at Thomas Jefferson High School cost \$56,000 for 3 kW at the time of installation, it would be reasonable to report that the same system today would cost less than \$10,000. The 19 cents/kWh seems to be outdated as well (see the attached Lazard analysis), and it does not reflect the federal ITC. The analysis of the Lazard report indicates that utility scale, commercial solar is cost competitive with conventional fuels on per kWhr and capital investment. Planning commission should get estimates from local or regional commercial and public utility solar installers to run the numbers for a commercial system. In Richmond, a residential solar installer is currently offering a price of \$2.90/watt for home systems, 18 cents/kWh before the ITC or 12 cents/kWh after. Given that commercial systems should cost significantly less, staff’s dismissal of solar on the grounds of economics alone may be

premature and unwarranted.” [A September 2014 document entitled “Lazard’s Levelized Cost of Energy Analysis—Version 8.0” was included as an attachment.] (Eric Goplerud)

MITRE Recommendation 2d: Individual Technologies/Data Collection—Storage for Load Shifting

- No specific comments.

MITRE Recommendation 3: District Energy

- No specific comments.

MITRE Recommendation 4a: Third-Party Certifications and Performance Guidelines--LEED

- No specific comments.

MITRE Recommendation 4b: Third-Party Certifications and Performance Guidelines—Designed to Earn the ENERGY STAR®

- “MITRE recommends the County address energy use in buildings indirectly by eschewing specific technologies, specifying reliance on Energy Star for attaining overall energy performance standards and encouraging public reporting of consumption. MITRE points out that LEED does not “guarantee energy efficiency” and urges that it be paired with Energy Star through the Design to Earn Energy Star program. Energy Star is a recognized brand.” (Ross Shearer)
- “The other high efficiency brand I know of is ASHRAE’s 90.1-2004 which lacks a marketing label, such as may be conveyed, ‘I live/work in an Energy Star building’ or ‘...a LEED Gold building.’ Thee (sic) latter claim may be gained where LEED is complemented with Energy Star.” (Ross Shearer)
- “The case for Energy Star: In their comments, staff defer to the current policy emphasizing flexibility to allow for appropriate areas of emphasis. The problem I see is that the basic levels of the green building practices under LEED and equivalent do little in the way of operational energy efficiency at their lower recognition levels. The newest version of LEED increased its basic requirement from 1% above code to 6%. While that is a 6-fold improvement and I assume it rides on top of recently adopted efficiency improvements to the commercial code, Energy Star’s 35% reduction gives a real push towards the net zero objective noted by MITRE that is the industry’s aim for 2030. If it is serious about its commitment to leadership, Fairfax should adopt policies that actively

abet the movement towards net zero. Under current policy Fairfax is condemning itself to wandering among the multitude of other reluctant players.” (Ross Shearer)

- “Over-weighting the Benefits of Design and Construction: Energy Star and the branded green building commitments such as LEED are complimentary, but staff’s preference for the design and construction benefits of a ‘comprehensive green building rating system’ (such as LEED’s) over the cost saving benefits of high energy efficiency through programs such as Energy Star, shows a bias that is not explained or self-evident. Energy Star’s historical average energy efficiency savings of 35% are nearly 6 times better than LEED’s 6%. This saves tenants money and often means a better experience for a building’s users and visitors. Current policy and staff’s defense of it, resembles lost money in view on the future Tysons sidewalk that current policy forbids us to pick up and save. Developers may have influenced this bias. Shouldn’t public policy in a democracy be in favor of what benefits the most people? When the public gives something up permanently, developers should be motivated to do much more than LEED Certified in exchange for increased density.” (Ross Shearer)
- “It’s worth noting in this context that Executive Order 13524 requires federal agencies to lease space in Energy Star certified buildings.” (Ross Shearer)
- “Other Energy Efficiency Options: The Planning Commission never considered setting a goal of its own. This could have been done along a straight line between the current energy use and the net zero objective for 2030. I appreciate that the County would want to avoid getting locked into a numerical system of its own making and also to avoid reinventing the energy efficiency wheel, but to ignore any of the versions of the available energy efficiency wheels seems foolish for a Fairfax that is serious in expecting its professed green credentials are perceived as authentic. The American Society of Heating Refrigerating and Air-Conditioning Engineers program (90.1-2004) noted above aims for a 50% energy reduction target. Also, the LEED scoring system offers from 1 to 10 points for reducing energy use on new construction by between 10.5% and 42% above code. Being green means a strong preference for significantly higher operational efficiency and the willingness to incur the additional investment costs of reduced energy needs.” (Ross Shearer)
- “Facilitating Green Washing: Favoring the design and construction benefits over higher operational efficiency seems to prime the markets for green washing. On its web site, the architect of Scotts Run Station South states the project’s new residential buildings will be “designed for energy efficiency” with LEED Certification. Perhaps the project will ultimately be built to a higher level, but if not, I think some prospective apartment renters could feel deceived when they learn their “designed for energy efficiency” apartment will save them but 6% on their utility bills over a built-to-code competitor, compared to an Energy Star facility’s 28% to 40% available in Arlington or Silver Spring. I certainly would, and the County’s position trading off Energy Star’s higher operational efficiency for the minimum in LEED’s design and construction benefits, enables the deception by a

developer who may have easily been persuaded to adopt higher energy efficiency if the incentives had been made compelling.” (Ross Shearer)

- “I agree with the Mitre recommendation to encourage DEES. While LEED has many advantages as a comprehensive environmental tool, it does not emphasize energy efficiency, which is the one component of LEED that provides the most direct benefit to the occupant because it lowers their bills. The main goal of DEES on the other hand is energy efficiency, and according to staff there are independent reviews to encourage developers to meet that goal. Staff notes that the EPA data suggest that non-residential DEES projects have a good track record for earning Energy Star. As Mitre comments, ‘there is no guarantee that a building designed with efficiency as a priority will be energy-efficient in practice,’ but this is the best means available to the FCG.” (Linda Burchfiel)
- “Another advantage to DEES over Energy Star is that DEES requires reporting into the Portfolio Manager from an early stage, and if the design earns a low score, the Portfolio Manager can offer suggestions to improve it. It should be noted that, by encouraging DEES, the Portfolio Manager data base will be expanded. If FCG is able to work with the building owner to get access to the Portfolio Manager data, there will be little additional workload for FCG staff.” (Linda Burchfiel)

MITRE Recommendation 4c: Third-Party Certifications and Performance Guidelines— Benchmarking with Portfolio Manager

- “Staff advocates a public outreach beyond Tysons to spur voluntary tracking and benchmarking, but staff’s objections to public access as consumer information abandons the power of the marketplace.” (Ross Shearer)
- In regard to staff’s concern that collection of building energy performance data may create “apples to oranges” comparison difficulties (in light of the many variables that can affect building energy performance), “forty percent of commercial buildings in the US use Portfolio Manager, so it already has a great deal of data on different types of buildings and is able to report on a granular level. And the level of detail in the Portfolio Manager will only improve as more building types participate; if use of the Manager is rejected because it is not complete enough, it will never become comprehensive.” (Linda Burchfiel)
- Staff has noted that proffers are voluntary in nature and that there may be willingness among applicants to commit to disclosure of energy use information without a broader mandate to do so, and staff has also noted that it may be difficult to enforce commitments to the provision of energy use data. There may be a concern that “probably the only applicants who would agree to such a proffer would be applicants who expect to be very energy efficient and who would want their efforts recognized.” “The FCG may get just a patchwork of reports, but that would be the start of a movement. As occupants see the

energy efficient data and realize that certain buildings are especially energy efficient, they would be likely to ask to see other energy data. This would add to public pressure on builders and owners to reduce energy consumption.” (Linda Burchfiel)

- Staff has also noted that it currently lacks the resources to collect data. “Many utilities are willing to provide data updates.” (Linda Burchfiel)
- “An additional argument in favor of using proffers to encourage public tracking and reporting is that it is the beginning of a process, which will often be successful, of raising awareness among the public. Once the public knows that energy performance data can be made available, there will be public pressure to produce performance data for other buildings, and reporting will gradually become standard. As with the argument encouraging experimental design, it may not always work, but the risk is worth it.” (Linda Burchfiel)

MITRE Recommendation 4d: Third-Party Certifications and Performance Guidelines—Net Zero and Passive House

- No specific comments.

MITRE Recommendation 4e: Innovative Energy Proposals

- No specific comments.

MITRE Recommendation 5: Public Reporting

- “MITRE’s recommendation to encourage landlords to make energy use public in order to drive efficiency is commendable. Staff perspectives present objections without exploring how to overcome them as other jurisdictions have. For office buildings the sampling can be limited to a common period of time, 6 am to 8 pm for example to overcome daily occupancy differences. For apartments and condos, I feel the objections raised by staff do not apply. In making housing more affordable in Tysons and Fairfax, perhaps the County could first pursue this recommendation for apartment buildings.” (Ross Shearer)
- “On the individual level, it is no less important for occupants to have an idea of a building’s energy performance before signing the lease.” (Linda Burchfiel)



County of Fairfax, Virginia

MEMORANDUM

DATE: February 16, 2015

TO: Planning Commission Environment Committee

FROM: Stella Koch, Chairman *Stella M. Koch*
Environmental Quality Advisory Council

SUBJECT: MITRE Building Energy Technology Report

The Environmental Quality Advisory Council (EQAC) has reviewed the report from the MITRE Corporation entitled “Building Energy Technology Recommendations to Fairfax County” and the related county staff perspectives on this report.

We think that the MITRE report provides some insights in developing an energy policy for the county. The staff comments add an important perspective on the practicality of these recommendations. Technological advances are continually evolving, and flexibility is an important factor in the development of county policy. We also note the MITRE report deals primarily with dense high-rise development planned for Tysons Corner, so some of the statements regarding renewable energy may not be applicable to other areas of Fairfax County.

EQAC is supportive of reporting, renewable energy and energy efficiency efforts and we would like to review and contribute to follow up steps.

We thank you for consideration of these comments.

cc: Board of Supervisors
Edward L. Long, Jr., County Executive
David J. Molchany, Deputy County Executive
EQAC file, February 2015

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| Summary of MITRE Corporation Building Energy Technology Recommendations, Staff Perspectives, Stakeholder Comments and Environment Committee Positions to Fairfax County | | |
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| Overarching Recommendation | | |
| 1 | <p>“We strongly recommend the FCG continue its practice of not employing a prescriptive approach to building technologies or components.” (Sec. 6.1)</p> <ul style="list-style-type: none"> • “We . . . recommend that FCG take no action directly on building form, integration, construction, or operations.” (Sec. 3.3.1.2) • “We strongly recommend that FCG continue its practice of not prescribing technologies or designs to developers. . . . This is because a building is a system.” (Sec. 3.3.3.2) | |
| | <p>Staff Perspective: Staff concurs. Staff views the recommendation as being consistent with the current green building policy. Staff continues to support engagement with applicants to explore potential proffers.</p> | <p>Stakeholder Comments: Interest expressed in augmenting LEED with energy-specific performance.</p> |
| | <p>Environment Committee Position: Support for the staff perspective</p> | |
| Recommendations regarding Individual Technologies/Data Collection | | |
| 2a | <p><i>Wind:</i> “We recommend that FCG not encourage installations unless a developer has himself proposed the project. If, however, FCG wishes to explore the option further it could use the proffer process to map the prevailing wind fields over Tysons Corner.” (Sec. 3.1.1.2)</p> | |
| | <p>Staff Perspective: Staff concurs with MITRE’s general recommendation. However, because the Virginia NREL map shows wind generation is impractical in Tysons (and most of Virginia generally), staff does not consider mapping to be a good use of resources.</p> | <p>Stakeholder Comments: No specific comments.</p> |
| | <p>Environment Committee Position: Support for the staff perspective.</p> | |

**Summary of MITRE Corporation Building Energy Technology Recommendations, Staff Perspectives,
Stakeholder Comments and Environment Committee Positions to Fairfax County (continued)**

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| 2b | <p><i>Geothermal:</i> “An engineering study is necessary to determine the general suitability of [ground source heat pumps (GSHPs)] in Tysons Corner. We are aware of no such general study, and so we recommend against FCG encouraging the installation of GSHPs if the developer does not support the idea. If FCG wishes to pursue this avenue for the future, however, a comprehensive engineering study of the issue may be of interest.” (Sec. 3.1.2.2)</p> | | |
| | <p>Staff Perspective: Staff concurs. Staff recognizes geothermal as a proven technology but one that needs to be evaluated by a developer on a case-by-case basis.</p> | <p>Stakeholder Comments: No specific comments.</p> | <p>Environment Committee Position: Support for the staff perspective</p> |
| 2c | <p><i>Solar:</i> [Given that, in Tysons,] “urban density and vertical development will be the rule . . . we recommend that FCG encourage the adoption of solar systems only if the developer originally proposes and supports the installation. . . . Insolation is well-known and easily available from NREL; there is nothing to be gained from a proffer of data collection on this subject.” “Passive systems are generally functions of design, rather than technology implementations, so while insolation management will be a core concern for energy efficiency design, FCG will likely find it difficult, at best, to negotiate proffers on the subject.” (Sec. 3.1.3.2)</p> | | |
| | <p>Staff Perspective: Staff concurs. Staff supports MITRE’s perspectives on solar generation but notes that it remains a relatively expensive way to generate electricity (or reduce greenhouse gas emissions) when compared to Virginia electric rates.</p> | <p>Stakeholder Comments: No issues raised with MITRE’s recommendation; comments focused on the cost of solar systems and environmental and societal benefits of solar-generated electricity.</p> | <p>Environment Committee Position: Support for MITRE’s recommendation on solar systems subject to continued tracking and possible reconsideration in the future; support for passive solar design within broader contexts, and flexibility to support such design; support for consideration of innovative technologies and solar fields if/when proposed.</p> |

**Summary of MITRE Corporation Building Energy Technology Recommendations, Staff Perspectives,
Stakeholder Comments and Environment Committee Positions to Fairfax County (continued)**

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| 2d | <i>Storage for Load-Shifting:</i> “We recommend that Fairfax remain neutral on the implementation of load-shifting in an individual building. . . . [and] we recommend that FCG only pursue energy storage systems only if they are originally proposed and supported by the developer.” (Sec. 3.2.3) | | |
| | Staff Perspective: Staff concurs. | Stakeholder Comments: No specific comments. | Environment Committee Position: Support for the staff and MITRE perspectives |
| Recommendation regarding District Energy | | | |
| 3 | “We . . . recommend that . . . unless an applicant is proactively pursuing a district energy approach (or similar effort), the county not seek proffers on the subject of district energy in favor of seeking proffers with more certain benefit. If FCG wishes to proceed towards district energy, we recommend that it first seek help from federal resources” (Sec. 3.4.2) | | |
| | Staff Perspective: Staff concurs. | Stakeholder Comments: No specific comments. | Environment Committee Position: The committee supports the concept but does not recommend proactive pursuit at this time in light of impediments. There may be future application as this technology evolves. |
| Recommendations regarding 3rd Party Certifications and Performance Guidelines | | | |
| 4a | <i>LEED:</i> “FCG already pursues certification-based approach with its use of LEED. We recommend that it continue this course rather than looking for more direct influence over the technology particulars of a building. . . . We recommend continued use of LEED.” (Sec. 5.4) | | |
| | Staff Perspective: Staff concurs. Staff views the recently-revised green building policy as consistent with this recommendation. | Stakeholder Comments: No specific comments. | Environment Committee Position: Support for the staff perspective |

**Summary of MITRE Corporation Building Energy Technology Recommendations, Staff Perspectives,
Stakeholder Comments and Environment Committee Positions to Fairfax County (continued)**

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| 4b | <p><i>Designed to Earn ENERGY STAR:</i> “To complement LEED, we recommend that the county encourage Designed to Earn the ENERGY STAR [DEES] certification We recommend DEES certification, rather than ENERGY STAR certification” (Sec. 5.4) “. . . because LEED only considers design, FCG should also encourage at least Design to Earn ENERGY STAR certification . . . (Sec. 6.4)</p> | | |
| | <p>Staff Perspective: If is determined that the previous decision to not emphasize any particular green building aspects should be revised such that energy efficiency should be emphasized, staff concurs with the consideration of the use of DEES to the extent DEES is recognized as complementary, rather than as an alternative, to other green building commitments. Policy Plan guidance appears to support DEES aspirational efforts.</p> | <p>Stakeholder Comments: Supportive. LEED requires only a minimal increase in energy efficiency; other options in addition to DEES may be available (e.g., ASHRAE guides; LEED energy optimization points).</p> | <p>Environment Committee Position: Provide a general emphasis on energy efforts within the green building policy but do not establish a preference for any particular approach or certification system relating to energy efficiency/conservation. Encourage such efforts but don’t establish any prescriptions or expectations on specific levels of energy performance.</p> |

**Summary of MITRE Corporation Building Energy Technology Recommendations, Staff Perspectives,
Stakeholder Comments and Environment Committee Positions to Fairfax County (continued)**

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| 4c | <p><i>Benchmarking with Portfolio Manager:</i> “To complement LEED, we recommend that the county . . . encourage annual benchmarking with Portfolio Manager.” (Sec. 5.4)</p> <p>“ . . . because LEED only considers design, FCG should also encourage at least Design to Earn ENERGY STAR and then annual reporting in ENERGY STAR Portfolio Manager to ensure energy-efficiency in practice. FCG should also strongly encourage building owners to help improve LEED by using Portfolio Manager to report energy performance back to the U.S. Green Building Council.” (Sec. 6.4)</p> | | |
| | <p>Staff Perspective:</p> <p>Staff supports tracking and evaluation of energy use in general but has concerns about seeking related proffer commitments. Supportive stakeholder comments caused staff to reconsider its concerns. There may be promise in pursuing commitments, and in particular the idea of gaining county government access to Portfolio Manager (or equivalent) data to support future evaluations if/when resources would be available. However, data consistency, enforcement and staff resource concerns remain. Reporting to USGBC is not an issue—LEED certification includes a reporting requirement.</p> | <p>Stakeholder Comments:</p> <p>Comments express considerable support for energy benchmarking and the use of Portfolio Manager. Commenters describe access to energy use data as a consumer information need and not difficult to collect, state that required submissions will spur tracking by others and note that other localities impose benchmarking requirements.</p> | <p>Environment Committee Position:</p> <p>The committee shares many of staff’s concerns—in particular, the committee is concerned with the amount of staff resources that would be needed to enforce commitments and proactively collect and evaluate energy tracking data. The committee does not support, at this time, the pursuit, either directly or through access to on-line data, of commitments from applicants to the provision of energy tracking information to the county. The committee wishes, though, to leave the door open to reconsideration of this idea in the future (however, not for single family detached or attached residential projects). The Committee supports broader education and outreach efforts to encourage all building owners and operators to track and benchmark their energy use.</p> |

**Summary of MITRE Corporation Building Energy Technology Recommendations, Staff Perspectives,
Stakeholder Comments and Environment Committee Positions to Fairfax County (continued)**

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| 4d | <p><i>Net Zero and Passive House:</i> “We recommend that Fairfax closely monitor developments pertaining to net-zero . . .” (Sec. 5.4) “We also recommend that FCG pay close attention to the evolution of Passive House and net-zero methodologies, and as these practices mature, we recommend FCG use them to specify building performance targets.” (Sec. 6.4)</p> | | |
| | <p>Staff Perspective: Staff concurs in the recommendation to keep aware of related developments; it has done so to date.</p> | <p>Stakeholder Comments: No specific comments.</p> | <p>Environment Committee Position: Support for the staff and MITRE perspectives; revisit when the concept blossoms.</p> |
| 4e | <p><i>Innovative Energy Proposals:</i> “. . . we recommend that FCG allow risk to trump certification. If a developer acting in good faith proposes a project with new, risky technologies that may offer a chance at breakthrough energy performance, and if that riskiness is enough to jeopardize FCG’s usual preferred form of certification, then we suggest that the county accept a commitment to proceed with the risky process in lieu of a commitment to the certification (though maintaining a reporting component to the commitment) and proceed with the risky project (Sec. 5.4) “. . . certification guidelines (though not Portfolio Manager reporting) should not be applied rigidly if a developer wishes to be a test case for unproven energy-efficiency techniques or technologies. . . . FCG should coordinate with DOE programs to recruit suitable experimentation developments, and it should apply flexibility to its guidelines so that policies meant to encourage a minimum level of environmental stewardship do not hamper attempts to exceed it.” (Sec. 6.4)</p> | | |
| | <p>Staff Perspective: Staff concurs with the general approach outlined above. The Comprehensive Plan is a guide—it can therefore support the approach recommended by MITRE should such an opportunity arise. The county has a long history of implementing cutting-edge concepts and its innovative and successful efforts consistently attract national recognition.</p> | <p>Stakeholder Comments: No specific comments.</p> | <p>Environment Committee Position: Support for the staff and MITRE perspectives, with clarification of the use of the term “risky” to reference unproven or emerging technologies.</p> |

**Summary of MITRE Corporation Building Energy Technology Recommendations, Staff Perspectives,
Stakeholder Comments and Environment Committee Positions to Fairfax County (continued)**

Recommendation regarding Public Reporting

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| 5 | <p>“[W]e . . . recommend that FCG encourage building owners to make public their energy consumption performance. From developers, FCG should negotiate access to the consumption data through Portfolio Manager, and the County should post the annual benchmarking results publicly online. . . . Additionally, each facility should have posted its ENERGY STAR scores from each benchmarking along with its LEED Certification.” (Sec. 5.4; see also Sec. 6.5)</p> |
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Staff Perspective:

Staff supports the tracking and evaluation of energy use but has concerns about public reporting of private building energy use. Concerns include uncertain legal authority to require public disclosure of private data, the extent to which applicants would be willing to commit to disclosure, uncertain means to enforce voluntary commitments, and lack of staff resources to maintain and publicize energy use data.

Stakeholder Comments:

Considerable support for energy benchmarking and tracking and the use of Portfolio Manager in particular.

Environment Committee Position:

Concurrence with the concerns identified by staff; committee does not support the publication of energy tracking data from privately-operated buildings through the zoning process.