Green Energy Incentives Assessment Project Final Report

Prepared for:

Tompkins County Planning Department
Tompkins County Industrial Development Agency (TCIDA)
Tompkins County Area Development (TCAD)

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Background

There is a widely-recognized urgency to reduce energy use in buildings, in order to reduce carbon emissions and slow the devastating effects of climate change. New York State's energy plan sets a long-term goal of an 80% reduction in greenhouse gas emissions by 2050. California plans that new commercial buildings will be zero-energy buildings by 2030. Architecture 2030, a widely-adopted standard, has set an interim goal of 70% reduction in fossil energy use for new buildings through the year 2020, 80% through 2025, 90% through 2030, and 100% reduction after 2030.

The Tompkins County Industrial Development Agency (TCIDA) offers tax abatements to specific new building development projects, for a variety of reasons, including economic development and promotion of higher density development. Given the emerging significant interest in reducing greenhouse gas emissions, consideration is being given to providing incentives for green building design and construction, specifically to promote low-energy and low-carbon buildings. This project is intended to develop criteria and justification for such incentives.

The project began with a series of conversations with developers, using specific projects as examples, to explore issues such as the level of energy efficiency developers typically seek without incentives, what further efficiency is possible, and associated returns on energy investments.

The project then evaluated possible energy efficiency standards which could serve as energy goals for such incentives, and the associated level/range of incentives.

The project concluded by recommending specific rating systems, and a measurement protocol to assess the success of the program.

<u>What Would a Successful Green Tax Incentive Look Like?</u>

A successful green energy incentive would have most or all of the following characteristics:

- Be ***cost-effective***: For a given incentive, significant and measurable changes in energy use would be seen in new building design and construction, preferably meeting substantial goals, at minimum cost to the taxpayer.
- Be ***complementary*** to other incentives; does not double-dip; does not compete; does not render other incentives less effective or obsolete; supports and integrates well with other incentives so that other incentives can be leveraged, and the green energy incentives can be most cost-effective (minimized)
- ***Influences decision-making*** constructively; minimizes incentives to "free riders" (those who would have designed/built efficiently anyway, without incentives)
- Has a ***ripple effect***, in affecting future building design and construction decisions, by both incentives-receiving developers and other developers. This is called ***spillover***. Spillover might occur through lessons learned, best practices developed and shared, and more.
- Supported projects serve as a ***demonstration/example*** for other developers.
- ***Simple to administer***
    - Simple to calculate
    - Simple to explain

    - Simple to manage (for example, to achieve quality control, for reporting, etc.)
    - Simple to evaluate (measurement and verification)
- Has a ***measurable effect***
- Is ***not easily gamed***. In other words, does not allow developers to obtain incentives without substantially delivering the goals of energy efficiency, through “model-tweaking”, gaming of measurement, or other means of either unfair gaming (cheating) or “rules-bending”
- ***Achieves goals***: energy conservation and economic development
- ***Easily changed/calibrated*** to changing market conditions. For example, if energy costs rise (or if a federal or state carbon tax is implemented, essentially raising the effective price of energy), and so the built-in incentive to conserve energy goes up, it might be desirable to reduce the incentives. Conversely, if energy prices drop, there may be a need to raise the incentives.
- Be ***fair***, for example, not conferring preference to one technology (e.g. preferably technology-neutral) or building sector.
- Be ***acceptable to the community***, including stakeholders such as the community at large, the TCIDA, county legislature, TCAD, and others
- Be ***defensible,*** in other words be sufficiently defensible in the face of community or legal challenges
- Accounts for ***differences in energy use*** between different sectors. For example, office and healthcare buildings typically use more energy than hospitality buildings – if an incentive is based “per square foot”, then sector-specific incentives would be more fair and cost-effective than one single sector-agnostic incentive.
- Offer the promise of ***persistence of savings***, for example by encouraging best practices, such as the ongoing use of EPA’s Portfolio Manager to track energy use, which could be a requirement for maintaining the tax abatements
- Possibly “slides” to incentivize not only reaching a minimum/threshold efficiency, but going ***beyond-minimum***

<u>Innovative Aspects</u>

Considering a property tax abatement for energy is a novel approach, and not one we have heard of before. The timing of such an offering to developers, essentially early in the design process, is such that it has a great potential for influencing design and construction. It also comes at a time when the developer is highly engaged in the scope of the proposed project/design, and may be particularly interested in approvals, even for reasons other than the proposed green incentives, such as public relations, the conventional abatement they are seeking, etc. The proposed approach could serve as an example for other new commercial buildings in the county, even ones not seeking or eligible for incentives. It could also serve as a model for other communities in the state and nation.

<u>Precedent</u>

There is growing precedent for state and municipalities encouraging or requiring better-than-code energy performance. For example, the state of California will require all commercial buildings to be zero-energy buildings by the year 2030. Boulder County, Colorado, has set a goal of zero energy in buildings by 2031. Sarasota County, Florida, has set a goal of all new municipal construction being carbon neutral by 2030. Washington DC has set a goal of all new buildings to be net zero by 2032. There are many more such examples.

Task 1- Discussions with Developers

We met in person with two developers, spoke on the phone with a third developer, and met with a manufacturer. All have previously received tax abatements. We also examined drawings for three new commercial buildings that have received abatements: An office building, a hotel, and a multifamily building.

Questions asked during the interviews are provided in Appendix A.

Interesting and unexpected findings included mention of energy improvements that developers are already doing in their new buildings. For example, two of the three case-study buildings are using high-efficiency water heaters. One building has slightly more wall insulation than required by the energy code. Another building has slightly more roof insulation than required by the energy code. The hotel is using low-flow bathroom faucets. Two of the three case-study buildings have air conditioning that is slightly more efficient than the energy code requires. One of the three case-study buildings has a higher-efficiency boiler than required by code. One building is having high-efficiency LED lighting installed. One developer and the manufacturer mentioned having made energy improvements to existing buildings in their portfolio, and the manufacturer has also installed a modest-sized solar photovoltaic system.

However, despite mention of these energy improvements, energy savings relative to code requirements are estimated to be negligible, for two reasons:

1. To substantially save energy in a building, measurable improvements need to be made for many different systems, typically including: Lighting type and layout, lighting controls, heating, cooling, heating and cooling controls, ventilation, infiltration, wall insulation, roof insulation, window efficiency, window size, plug loads, water heating, hot water distribution, hot water fixtures, and more. What we are seeing is 2-3 modest energy improvements per building. We estimate savings from these improvements to only be between 2% and 7% for the three case studies.
2. These savings are largely offset by other sub-optimal design choices. For example, two out of three case study buildings are using a type of heat pump system (boiler/tower water loop heat pump) that have been shown to be inefficient for the type of building in which they are installed (hotel and single-story office building). While the heating systems comply with the energy code, substantial energy savings would have been seen if a simple traditional boiler had been used, or other traditional systems (furnace, air-source heat pump, etc.). Furthermore, all three case-study buildings are using more window area than is recommended for energy-efficient buildings. The new energy code (October 2016) limits window-to-wall ratio to 30%, and energy-efficient design is typically 20% or less. All three buildings have a window-to-wall ratio over 30%, and the average is 36%. Finally, all three buildings could have been designed with slightly more optimal

building shapes, reducing exposed walls and roof area, which would reduce both energy use and construction cost.

Other findings from these meetings and drawing reviews included:

- There has been no recent implementation of certified high-performance building design and construction: No use of NYSERDA's New Construction Program, no solar energy systems (except for a small system installed at an existing building), no ENERGY STAR buildings, and no LEED buildings. Interestingly, most high-performance design and construction in larger local projects appears to have been done by mission-driven not-for-profits, such as INHS and EcoVillage.
- Developers do not currently benchmark buildings for energy use, for example by using EPA Portfolio Manager.
- Developers stated that they seek return on investments (ROI) in the 12-20% range, equivalent to a 5-8 year simple payback. The one manufacturer with whom we spoke stated that they seek a higher ROI, in the 20-30% range (3-5 year payback), which in our experience is typical for manufacturers, as they compare energy investments with competing investments in manufacturing/production processes.
- The manufacturer has access to low electricity prices, through a state economic development program. This increases paybacks for energy investment (reduces ROI), and so makes energy investments more difficult to justify.

What Energy Improvements Would a Well-Informed Developer Invest In?

We evaluated several broad group of improvements, to assess which ones a well-informed developer might invest in. By "well-informed developer", we mean a developer who is provided realistic independent, objective assessment of energy improvements, rather than overly-optimistic assessments often provided by equipment vendors.

We found that only one energy improvement provides a return on investment that would meet the stated goals of local developers: High-efficiency water heaters. There are also two groups of not-widely-recognized investments that always make sense: Those that save energy but do not add cost to a building (such as low-flow showerheads and faucets), and those that save energy while reducing cost to a building (such as building shape improvements, reduced window-to-wall ratio, and efficient lighting layouts).

Three of the examined energy improvements almost fall into an attractive range: Heating plant efficiency, solar photovoltaics (assuming continued federal tax credit), and wall insulation. Four energy improvements are clearly unattractive investments: Roof insulation, efficient elevators, infiltration reduction, and cooling plant efficiency. Reasons vary for why some investments are poor. For example, roof insulation improvements are likely more difficult to justify because the energy code already requires well-insulated roofs. Cooling plant efficiency is likely more difficult to justify because our climate is cold (less cooling is required), and also less cooling is used in buildings such as apartments and hotels (shorter runtime of cooling equipment). A summary of our findings is shown in the table below.

	Return on Investment
Roof insulation	1%
Efficient elevators	1%
Reduce infiltration	2%
Cooling plant	4%
Heating plant	6%
Solar PV	7%
Wall insulation	8%
Efficient water heater	12%
+ Items with no added cost (e.g. low-flow showerheads)	
+ Items with energy and cost savings (e.g. building shape)	

It might be noted that although most of these investments are unattractive in and of themselves, it is common for energy projects to include both economically attractive and less attractive improvements in a single project. The attractive improvements essentially help to pay for the less attractive improvements, in order to provide a balanced set of improvements that delivers substantial savings.

Do We Need to Worry About "Free Riders"?

Free riders are participants in incentive programs who receive financial incentives for decisions which they would likely have made anyway. Our assessment is that there will be no free riders in the proposed green energy incentives. Currently, developers simply do not design or build efficient buildings. Our conclusion is that new large buildings in the county do not use less energy than code-compliant buildings. No recent projects receiving tax abatements have participated in any high-performance building programs (NYSERDA, LEED, ENERGY STAR, etc.). Efficient equipment that has been installed in these buildings are generally minor in energy improvement impact, and efficiency gains have been offset (lost) by other sub-optimal decisions, for example in heating equipment selection, window sizing, and building shape.

Task 2 – Determine Incentive Standard and Level/Range of Abatements

Options for an Incentive Standard

There are several widely used energy standards.

The energy code, essentially one section of the building code, represents one such standard. The energy code is the law for new buildings. In New York State, the energy code is changing in October 2016, and will be based on the International Energy Conservation Code (2015), with minor state-specific modifications. The new energy code is not sufficient to meet the county's goals, but represents a baseline against which proposed improvements can be measured.

Architecture 2030 is another widely used standard. It sets as a goal that until 2020, new buildings bill be designed to use 70% less energy than the current stock of buildings of the same type.

LEED is a standard that includes not only energy conservation, but also water conservation and other green features. It is a point-based system. Energy efficiency points vary with the energy efficiency of the building. No specific single energy target is required.

ASHRAE has a new standard called the Building Energy Quotient (BEQ). It is a scoring system, where 0 represents a Zero Energy Building, and 100 represents a building typical of current built stock.

Passivhaus is a high-performance building standard originally developed in Germany. It also has a U.S.-specific version.

ENERGY STAR is a standard that uses actual utility bills to benchmark buildings against the average use of similar existing buildings. If a building uses 25% less energy than similar buildings, it can qualify for the ENERGY STAR label.

The Challenge of Equivalence

One problem with many of the existing standards is that they are not equivalent, and it is not easy to translate one standard to another.

The energy code itself is constantly changing. In New York, standards in recent decades include the 1990 Energy Conservation Code, the 2000 International Code, the 2009 code, revisions that went into effect January 1, 2015, and a new code that will go into effect on October 3, 2016.

The "baseline" of many standards is also different, and each baseline sometimes changes as each standard is revised over time. The baseline of Architecture 2030 is a database of existing buildings. The current baseline of LEED is ASHRAE Standard 90.1-2010. The baseline of NYSERDA's current energy program is also ASHRAE Standard 90.1, but its 2013 version (90.1-2013). Passivhaus uses an absolute standard of energy use per unit of building floor area, and imposes additional requirements around infiltration and ventilation.

We have attempted to estimate a rough equivalence between the standards, for purposes of our recommendations. But any analysis at equivalence is necessarily rough.

There are signs of an attempt to harmonize the standards. A proposal has been made to standardize on a 2004 baseline, with indexed adjustments over time. We do expect some standardization of standards, in coming years, especially among LEED, NYSERDA, and the state energy code, all reportedly seeking to harmonize on a method using ASHRAE Standard 90.1 with a constant baseline.

Review of Other Incentives (Federal, State, etc.)

Most other existing incentives are regarded to be too modest to spur action in most cases, and certainly not to the level of energy savings sought by the county. For example, none of the recent recipients of local tax abatements have sought or received energy incentives for new construction projects (for example, NYSERDA), or has sought certification under any of the common high-performance building standards (ENERGY STAR, LEED, Architecture 203, Passivhaus, etc.).

Federal 179d Tax Deduction

The federal government has had a tax deduction for several years, called the 179d deduction. It has only been available to for-profit organizations, and to government agencies (where the tax deduction is taken by the building design professional), but has not been available to not-for-profits. Available since about 2005, the 179d tax deduction has been repeatedly slated for elimination, but has been repeatedly renewed, currently available till December 31, 2016. The incentive essentially is a $1.80/SF tax deduction if a building is designed to 50% lower energy use, using an older version of ASHRAE Standard 90.1 as a baseline (2007). Measurement and verification is not required. The deduction is based on a computer model. There is anecdotal evidence that the deduction has mainly been obtained by free riders, in other words the deduction has been obtained by owners of high-performance buildings who learned after-the-fact that the deduction is available and that their building qualifies. Buildings qualifying for the proposed property tax abatement will undoubtedly also qualify for the 179d tax deduction. Its value, at a marginal tax rate of 28%, is $0.50/SF. We did not account for the 179d tax deduction, in developing a recommended green energy incentive, because of its anticipated expiration at the end of 2016. However, if the 179d deduction is ultimately extended, it could be accounted for in adjusting the proposed green energy incentive. In other words, if the 179d deduction is extended, the TCIDA could reduce its incentive.

Investment Tax Credit and Depreciation of Renewable Energy Systems

The federal investment tax credit (ITC) of 30% has been available for several years, and was recently renewed, although it is planned to be eliminated over the next few years, by decreasing each year. It is available for renewable energy systems (photovoltaic, solar thermal, etc.), and geothermal heat pump systems. This tax credit has been successful in that many “early adopters” have had solar systems installed. However, none of the interviewed developers have installed solar energy or other qualifying systems (e.g. geothermal heat pumps).

Renewable systems on commercial buildings are also eligible for accelerated depreciation.

NYSERDA Incentives

NYSERDA has had an incentive for solar energy that over the years has been steadily reduced, from as high as over $3/watt, to its current rate of $0.40/watt, which will continue to drop through 2016. It is believed that this incentive will at some point be eliminated, although it was recently increased for certain sectors (e.g. low-income).

NYSERDA has energy efficiency incentives for high-performance new commercial building projects. The current program (through December 31, 2017) offers $0.16 per annual kWh saved, plus $280 per annual peak summer kW saved, for projects that are more than 30% more efficient than a baseline design. The baseline design is defined in ASHRAE Standard 90.1-2013 (Appendix G).

Additional support is available for soft costs, such as engineering work to identify energy improvements, energy modeling, commissioning of energy systems, and support for the design team (e.g. architect's team) to incorporate the energy improvements in the project design. Significantly, if the project is over 40% more efficient than the baseline (a level that should be met by the abatement program we are considering), NYSERDA covers 80% of the soft costs of energy improvements, in addition to providing an incentive to the design team, a separate incentive for commissioning, and additional incentives if a building is LEED-certified. Incentives are subject to caps.

The NYSERDA New Construction incentive has significance for several reasons:

- It would reduce the required incentive for the TCIDA.
- It provides funding to cover much of the soft costs for compliance with the proposed tax abatement, including the selection of energy improvements, energy modeling, support for the design team (architect's team), commissioning (testing), and more.
- It provides an independent third party verification, in terms of NYSERDA's review of the consultant's submittal. It also typically provides a site inspection to ensure that proposed improvements were actually installed.

The incentive is mainly directed to building energy efficiency (insulation, windows, heating and cooling, ventilation, lighting, motors), but does not apply fully to a variety of "uncontrolled" loads according to ASHRAE Standard 90.1, such as plug loads (computers, appliances, plug lighting), or renewables. There may be some support for providing control of receptacles, for example, but not for the purchase of high-efficiency appliances such as ENERGY STAR devices. Renewables such as solar photovoltaics are not covered by the program, as assistance is provided by a separate NYSERDA program, however some soft costs of evaluating solar as part of substantially reducing building energy usage might be covered.

The NYSERDA New Construction Program incentives are estimated to represent $1.00-$2.00/SF for hard project costs, and depend on the projected (modeled) energy savings. The value of NYSERDA's contribution to soft costs likely represents an additional $0.50-$1.50/SF. A rough overall estimate of NYSERDA's contribution is $2.50, if a building meets the 40%-better-than-baseline threshold.

The NYSERDA New Construction program does not cover multifamily buildings, which are addressed by a separate NYSERDA program. The NYSERDA multifamily new construction program is currently being redesigned. Early indications are that incentives are roughly in the same ballpark as for the non-multifamily commercial program, specifically for buildings which reach a very high level of energy efficiency, but this can only be confirmed when the program is introduced. The multifamily program will have three tiers. The highest tier (Tier 3) is intended to encourage zero energy buildings, and allows for "near zero energy" buildings, but may require energy performance better than the range we are seeking. The middle tier (Tier 2) is anticipated to target 15% better than the energy code, and so will likely not be strong enough to reach our goals. Tier 2 may come with modest incentives, in other words the incentives at this efficiency level are not big.

The NYSERDA new construction incentives are relatively successful, although, again, have mainly been used by "early adopters". For example, none of the interviewed developers has sought or received NYSERDA new construction incentives.

The Question of Operational Energy Use

A building uses energy in many ways. For example, a building requires energy for heating and cooling. The energy use of these components is defined by the building design and construction – how much insulation is in the walls, the types and size of windows, the type and efficiency of the heating and cooling systems, infiltration, ventilation, and other intrinsic components of the building's essential fabric. We refer to these as the "asset-related" components of energy use in a building.

However, a major component of a building's energy use is dependent on the behavior of its occupants: When lights are turned on and off, what appliances are used, and more. We refer to these components of energy use as "operational" energy use.

As buildings become more efficient, the operational component of energy use becomes a larger fraction of overall energy use. And, while we cannot control detailed aspects of how occupants use energy in a building, we can provide tools with which energy use can be more efficient. Emerging approaches include control of receptacles, for example, allowing receptacles to be controlled (such as being shut off) from a central computer system. Another approach is to use more energy-efficient appliances, such as ENERGY STAR appliances.

To reach the deep levels of energy savings required to meet county, state, and federal goals, we likely need to move beyond asset-related energy use, and we need to also encourage operational energy savings. Initial efforts in this direction include receptacle control, as mentioned. In addition, we believe that the use of energy-efficient appliances is essential to meeting energy goals. So, we propose to require the use of ENERGY STAR appliances, when new permanent appliances are installed in a building, such as refrigerators, laundry equipment, etc. We further will recommend (but not require) that developer-tenant lease agreements encourage (but not require) the use of ENERGY STAR appliances.

Recognition-Based Approaches

A variety of *recognition-based* or *certification* approaches to high-performance building design and construction have been developed in recent years. These include LEED, Architecture 2030, Living Building Challenge, and Passivhaus. While these approaches do not come with financial incentives, they are of interest for two reasons:

a. As possible qualification criteria for abatements.
b. As achievable energy targets that we may consider.

Recognition-based approaches have value, for public relations. The TCIDA could even consider providing public recognition of its own, for projects achieving efficiency under the proposed green energy incentives program.

Level of Incentives

In order to develop recommendations for incentives, we need to ask several questions:

1. Are energy improvements readily possible to reach the county's goals?
2. How much do such energy improvements cost?
3. What level of incentives will be sufficient to entice developers to make substantial energy improvements? What level of incentives might be "too much", in other words would be unnecessarily high, and so a waste of taxpayer money.
4. How should the incentive be structured? In other words, what formula should be used, preferably complementing the existing abatement structure?

Attainable Savings

Are energy improvements readily possible to reach the county's goals? Is unusual architecture or technology required to reach these goals?

We evaluated the three case study buildings, all real buildings either already-built or under construction. We began with a baseline energy utilization index (EUI) that roughly matches the forthcoming new commercial energy code (October 2016), for each building type. We then allocated energy use to cooling, heating, lighting and other, hot water, and kitchen uses, according to published estimates for these three types of buildings. We then estimated energy savings for a variety of improvements, including:

- Heating system efficiency
- Heating distribution efficiency
- Heating system *type*. For example, some types of heating systems use more energy than other types of heating systems, in specific types of buildings. Geothermal heat pumps are regarded as the most efficient type of heating system, also provide efficient cooling, and work well with solar photovoltaic systems because they use electricity and not a fossil fuel. Air source heat pumps are another option with similar benefits. A common heat pump system that is not always efficient is the "boiler/tower water loop heat pump", and the use of this type of heat pump system should be discouraged in buildings that do not have large interior cores. Through wall heating systems, such as PTACs, have been found to introduce air leakage, and should be discouraged. These are just a few examples of options and issues in selection of the heating system *type*.
- Cooling system efficiency
- Heating and cooling controls
- Lighting type
- Lighting design/layout. Lighting energy depends not only on the type of fixture, but if the layout is efficient
- Lighting controls
- Window-to-wall ratio. We assumed reducing the window area from 36% window-to-wall ratio to an efficient 20%, sufficient to meet accepted green standards for acceptable views.
- Efficient building shape

- Solar photovoltaic
- Insulation
- Reduced Infiltration
- Efficient elevators.
- Hot water heating
- Hot water distribution
- Plug loads

The improvements evaluated were not intended to be exhaustive. For example, we did not evaluate commercial kitchen improvements (cooking and refrigeration) for the hotel, and a variety of other standard improvements, such as energy recovery ventilation, demand-controlled ventilation, efficient motors and drives, and laundry, among others.

With these sixteen improvements, we are able to get into the range of the target energy use of 70% less than the average existing building of the same type, per the goals of the Architecture 2030 standard, for the three case studies. For the multifamily building, we exceeded the energy goal, for the hotel and the office building, we fell slightly short.

Conclusions from the exercise include:

- A wide variety of energy improvements are needed to reach the goal. One or two large improvements (for example, solar energy system alone, or high-efficiency boiler alone, or thick wall insulation alone, etc.) will not allow a building to reach the goal.
- Most energy improvements are highly standard, do not impact the building architecture or aesthetics, and will not present any challenges to designers or contractors. These include high-efficiency heating, heating distribution system efficiency improvements, high-efficiency cooling, added insulation, high-efficiency hot water heating, and lighting improvements, among others.
- Some energy improvements may be new to architects, developers, contractors, building occupants, building inspectors, and other stake-holders. These include reduced window-to-wall ratio, more efficient building shape (although we recognize that optimal buildings shapes are often limited by the site size and building functionality), solar energy systems, and reduced infiltration. In particular, reduced infiltration requires attention to air-sealing details (floor-to-wall interface, wall details, shaft details, infiltration testing) that might be new to most builders and building inspectors, even though they are well-proven best practices in high-performance buildings.

What Energy Savings Do Different Rating Systems Deliver?

We evaluated potential energy savings for different rating systems. Our scoping analysis found:

	Energy Utilization Index (EUI)		
Building type	Hotel	Multifamily	Office
Baseline - current building stock	104	78	110
Architecture 2030 target	31	24	33
2016 Energy Code	88	44	72
EPA ENERGY STAR	81	66	81
LEED (16 energy points)	50	24	44
40% Less Than 2016 Energy Code	53	26	43
40% Less Than 2016 Energy Code plus ENERGY STAR appliances, restaurant equipment, commercial laundry	31	23	33
Passivhaus (approximate)	23	23	23
Zero Energy Building	0	0	0

The 2016 Energy Code and EPA Energy Star clearly do not deliver savings anywhere close to the Architecture 2030 target. At the other end of the scale, Passivhaus, a very high-performance standard, likely will deliver the required energy savings, as obviously does a building designed to zero energy building standards.

A highly efficient LEED building (minimum of 16 LEED energy points, on a scale from 1-18), does meet the goal for multifamily buildings, comes close for office buildings, and falls farther short for hotels, likely due to the commercial cooking equipment in a typical hotel restaurant.

A building designed to NYSERDA's "Deep Energy Savings" standard for commercial buildings (PON 1601Rev, 40% better than ASHRAE 90.1-2013) is fairly similar to a very efficient LEED building.

By adding requirements that appliances be ENERGY STAR rated, we are able to reach the goals of Architecture 2030.

Incremental Cost

How much more will an efficient building cost? We roughly estimate the added (incremental) cost at between $7 and $21/SF, averaging $15/SF, or a 9% premium on a building that costs $160/SF. This estimate is in line with other estimates for the added cost of high-performance buildings. And, again, $160/SF for construction cost and $15/SF for the added incremental cost to deliver a highly-efficient building are "scoping estimates", necessarily rough and likely to vary with building type, location, and economic conditions over time.

It should be noted that we did not subtract construction cost for improvements that save both energy and construction cost, such as lower window-to-wall ratio, smaller heating systems, and simpler buildings shapes. However, evidence is strong that high-performance buildings that use these strategies can meet energy efficiency goals while offsetting some of the added costs of energy improvements that do add to construction cost.

Return on Investment

We estimate annual energy cost savings of $0.60/SF, on average. Energy cost savings are lower than they have been in years, due to the low cost of natural gas. Our own prior study showed savings over $1.50/SF for a building in NY City, where energy costs are higher.

At $15/SF construction cost premium, for savings of $0.60/SF, the simple payback is 25 years, and the return on investment is 4%.

For developers participating in NYSERDA's New Construction program, we anticipate incentives of approximately $2.50/SF, reducing the incremental cost to $12.50/SF. To bring the cost to the developer into a range where we believe the rewards to the developer are worthwhile, we believe the payback needs to be 5 years. To meet this criterion, the value of the tax abatement would need to be $9.50/SF, and the developer's contribution would be $3/SF. We must recognize the risks the developer is taking on: Added cost up front, no guarantee of the magnitude of the energy savings, no guarantee of the magnitude of the added hard and soft costs, and added work for the developer to coordinate and manage the added work/investment required.

By way of comparison, the current tax abatements on a 7-year schedule are estimated to represent approximately $19/SF, in current dollars, for an average property tax rate of $33 per $1000 of assessed property value, and $160/SF increased assessment. Comparing a proposed $9.50/SF proposed tax abatement to the current $19/SF, in other words, the abatement would be increased by about 50%. It should be emphasized that, whereas $9.50/SF was used for developing the abatement schedule, the actual delivered abatement will vary, depending on the assessment and the local property tax rate.

Incentive Structure

The current 7-year abatement schedule is:

Year	Abatement
1	90%
2	77%
3	64%
4	51%
5	39%
6	26%
7	13%

We first examined an incentive structure that follows the current tax abatement structure, simply raising the slope of the declining line by adding a fixed percentage to each year, cumulatively increasing this each year. We were able to deliver the sought added abatement by adding 6.5% to the year 1 abatement, making it 96.5%, then adding 13% to year 2, adding 19.5% to year 3, and so forth. However, this ended up with 58.5% in the final year (Year 7), and feedback from developers was that the drop-off from Year 7 to post-abatements (Year 8) was too steep.

So, instead, we propose a schedule that begins at 100% for the first three years, and then drops off to end up lower at Year 7:

Year	Abatement
1	100.0%
2	100.0%
3	100.0%
4	90.0%
5	70.0%
6	50.0%
7	30.0%

For an example 70,000 SF building, with a tax rate of $33 per $1000 of assessment, assuming an assessed value of $160 per SF, the added abatement amounts to approximately $9.50/SF, in constant dollars. The base abatements would be approximately $1.33 million, the enhanced abatement would be approximately $2 million, and the difference (added abatement) is approximately $670,000. In areas of the county with higher tax rates, such as the City of Ithaca, this approach would generate a higher tax abatement, which seems appropriate, due to the likely higher cost of construction in this area.

For a 10-year abatement, the current schedule is:

Year	Abatement
1	100%
2	90%
3	80%
4	70%
5	60%
6	50%
7	40%
8	30%
9	20%
10	10%

In order to generate an added abatement equal to $9.50/SF, we propose the following schedule:

Year	Abatement
1	100.0%
2	100.0%
3	100.0%
4	90.0%
5	90.0%
6	90.0%
7	70.0%
8	50.0%
9	30.0%
10	10.0%

Reality Check: Two New Local Buildings

Two new local buildings with low energy designs were examined, to evaluate their energy performance and construction cost.

EcoVillage TREE Common House

The 20,000 square foot EcoVillage TREE common house is a four-story apartment and community building, with 15 apartments, and common areas mostly on the first floor. The apartments are typical in size: There are 2 studio apartments (450 sq.feet each), 6 one BR (690 sq. ft each), and 7 two-three BR (1150 sq. ft. each). Despite being located in the ecologically-minded EcoVillage community, the building is traditional in many ways: It has an attractive exterior including amenities such as balconies, has a full sprinkler system, has both elevator and stairways, and, in addition to the apartments, has a kitchen and dining room on the first floor, a children's play area, a multi-purpose room, a laundry room, three bathrooms (in addition to one in each apartment), a sitting room, and two guest rooms. It is fully accessible on all floors. Significantly, the building serves as a community building not only for the residents of the 15 apartments located in the building, but also for 25 additional houses in the neighborhood. So, for example, laundry energy use is not just for 15 apartments but rather for 40, use of the kitchen and dining room are not just for 15 apartments but rather for 40, etc.

The common house has wall cavities filled with dense packed cellulose (R=20). Exterior walls are sheathed with the Zip System (waterproof OSB panels with seams taped). It also has two inches of solid Polyisocyanurate panels (R=14) on top of the sheathing, with metal/fiber-cement siding on top of purlins. Overall insulation in exterior walls is rated at R=34. Thick insulation is placed entirely under the foundation slab. The heating system is electric baseboard. Lighting is 72% LED and 28% compact fluorescent lamps (CFL). Ventilation is provided separate from heating, with a heat recovery ventilation system running continuously. Attention was directed to air-sealing during construction. All appliances are ENERGY STAR rated. Domestic hot water is provided by a solar thermal system, backed up by electric resistance heat. A 50 kW solar photovoltaic system provides electricity. The building was originally going to seek the Passivhaus certification, but EcoVillage decided against Passivhaus due to the added cost of air sealing.

The EcoVillage building has been occupied since late 2015. Although we do not have a full year of energy bills, we do have bills (and solar PV production) spanning both winter and spring months, which allow us to extrapolate to a year's energy use. We estimate the annual energy use, taking credit for the solar PV production, to be 9 kBtu/SF/year. This is far lower than the current average of 78 kBtu/SF/year for the existing stock of multifamily buildings in our climate, and also far lower than the Architecture 2030 goal of 24 kBtu/SF/year for a multistory multifamily building.

The building takes advantage of several common approaches to deliver low energy use at affordable construction cost: There is no basement (slab-on-grade), it has a modest window-to-wall ratio (approximately 16%), complex shapes are avoided (such as cantilevers, exposed lower roofs, un-needed corners, etc.), and low-cost electric resistance heat is used.

The final sale price for the apartments, inclusive of everything (except carports or special added amenities) is an affordable $102,000 to $257,000.

The final construction cost of the TREE common house building was $2,475,000 (rounded to the closest thousand dollars). This cost includes the entire building (foundation, structural, interior finishes, siding, mechanical, electrical including the service/distribution/lighting, plumbing, stairs, elevator, insulation and soundproofing, the common kitchen, doors and windows, sprinkler system, and permits). This construction cost represents $123.75/SF.

This cost is unusually low, and indicates that a high-quality building with extremely low energy use can be built affordably. The construction cost is even lower than an authoritative estimate (RS Means) for the average cost of multifamily buildings, of $130.78/SF.

Both of these square-foot costs (the EcoVillage actual costs and the RS Means estimate) do not include the following:

- soft costs (including architectural drawings and corrections, energy and legal consultants, etc.)
- construction management
- site prep
- infrastructure (such as water delivery/pump house)
- inspections
- insurance and taxes during construction
- options that people added to their particular apartments

Assuming 30% for the above costs (a rough estimate), we estimate a total cost of $3,217,500, for a total construction cost of $161/SF for the EcoVillage building.

HOLT Office

The 7225 square foot HOLT office is a recent single-story downtown gut rehab. HOLT set a goal for the building to be net-zero energy. Net-zero energy means that it intends to produce as much energy on-site (using a solar photovoltaic system) as it uses, on an annual basis.

The building re-used an existing structure. The walls have a fairly typical R-value of 14, and the roof has a better-than-code R-value of 40. The heating and cooling is provided by a high-efficiency air-source heat pump system. Lighting is a mix of high-efficiency LED and fluorescent (T5 and T8). Ventilation is provided separate from heating and cooling, with an energy recovery ventilation system, further controlled for energy-efficiency to only run when needed ("demand control"). Domestic hot water is provided by an electric resistance storage water heater. A 60.5 kW solar photovoltaic system provides electricity.

The HOLT office has only been occupied since the spring of 2016. Sufficient utility bills for meaningful analysis are not yet available.

The building takes advantage of several common approaches to deliver low energy use at affordable construction cost: It re-uses an existing structure, it has a modest window-to-wall ratio (approximately 18%), and a low-cost electric water heater is used.

The final construction cost of the HOLT building was reported to be $990,000, or approximately $137/SF, with detail regarding infrastructure and soft costs not available.

The estimated added costs and energy savings of the energy conservation improvements was reported as part of the planning for the improvements.

Improvement	Energy Savings (kBtu/SF/year)	Added Construction Cost ($)
Insulation	0.49	6387
Energy Recovery Ventilation	0.61	3275
Demand Controlled Ventilation	1.53	2000
High-efficiency air-source heat pump	9.29	22542
Lighting	2.56	2200
Total	14.5	36404
Per SF	14.5	4.85

In addition, the solar system reportedly cost $99,250, or $13.74/SF, presumably before the 30% investment tax credit. Soft costs (energy modeling, added design costs) are estimated to bring the total added project cost to $21.87/SF. NYSERDA incentives are estimated to reduce this by $2.26, to end up with a net added cost of $19.61/SF, again, presumably before the 30% tax credit for the solar installation.

HOLT's approach was different than that of the EcoVillage building. It takes advantage of its large roof area to install a large solar photovoltaic system, to complement a smaller set of energy conservation improvements. By contrast, EcoVillage chose a larger set of energy conservation improvements, and a smaller solar photovoltaic system, relative to the building size. However, it is also interesting to note that both buildings use added insulation, high-efficiency ventilation, high-efficiency lighting, a modest window-to-wall ratio, an efficient building shape, and a solar photovoltaic system among their core energy improvements.

Task 3 – Develop Method/Rating System and Measurement System

Possible Rating Systems

A variety of possible rating system approaches were evaluated, for the proposed green energy incentives:

1. ***A specific target for a building's actual use*** (measured), in an Energy Utilization Index (EUI, in units of kBtu/SF/year). The benefits to this approach are that actual energy reductions are promised, and so compliance with the Architecture 2030 program and county goals are assured and, if not, then tax incentives are withheld. Disadvantages to this approach include high risks for developers, and so a likelihood that they will choose not to participate.
2. ***Per cent reduction from a baseline***, usually a baseline established by one of the versions of ASHRAE Standard 90.1. This is a widely-used approach, and is the one taken by LEED, by the energy code (whole-building compliance path), and by NYSERDA's New Construction program. Disadvantages are that actual energy usage is not guaranteed. Also, the baseline sometimes changes, as codes and standards change.
3. ***Simpler modeling approaches***: A newer approach is another modeling method, called the ASHRAE Building Energy Quotient (BEQ), which does not require a baseline model (and so is not subject to a changing baseline). It is reportedly simpler than the ASHRAE Standard 90.1 model approach. However, it is newer, and so is less tested. It also is a different approach than the one used by NYSERDA, and so if a developer wishes to seek both proposed green energy incentives *and* NYSERDA incentives, it means creating two different energy models. In some ways, Passivhaus is similar. Passivhaus requires a simpler model, and no baseline model, but requires some on-site testing (to guarantee low infiltration), and has other special requirements, such as the use of heat recovery ventilation.

We decided to eliminate actual energy use (option #1 above) from consideration for this program, because actual energy use can only be measured in the year following occupancy of a building, and developers need the certainty of knowing what incentives are being offered, up front.

A broad comparison of the remaining approaches is shown below.

Standard	Pros	Cons	Cost
ASHRAE 90.1	Also use for energy code, NYSERDA, LEED, etc.	Model cost, complexity	$$
LEED	Recognized	Cost, non-energy aspects may not be needed	$$$
Passivhaus	Recognized	More than needed? Not very standard	$$
ASHRAE BEQ	Simplicity, affordability	New, not used for much else	$
All above	Flexibility		$-$$$

Recommended Rating System

We decided to recommend allowing developers the flexibility of using any of the above methods, any/all of which we believe will meet the county's energy conservation goals.

Our detailed recommendations are provided in Appendix B, in contract-ready language.

It should be noted that among the recommended options, only ASHRAE BEQ comes close to modeling usage that is similar to the Architecture 2030 target, in units of the Energy Utilitization Index (EUI, kBtu/SF/year, relative to an existing-stock baseline). For the other methods, and specifically for the ASHRAE 90.1 method which we believe is most likely to be used, the model leaves behind discussions of EUI, and EUI will only then again come into play in the measurement of actual building energy use, as provided by the benchmarking (reporting of actual energy use) to be required of the developer over the duration of the incentives. However, most of these methods do account for sector-specific characteristics, such as differing energy characteristics among hotels, apartments, offices, and other building types. The one exception is Passivhaus, which takes as a goal an absolute energy-per-unit-area approach, regardless of building type.

It should also be noted that all four compliance paths involve independent third party verification. The TCIDA will not need to review detailed energy calculations or reports. The TCIDA will simply need to receive the independent third party certification. We do provide an option for a developer to propose their own compliance path, and presume this might be an energy model, but in this case the developer might need to pay for independent third party review of the submission.

Measurement and Verification

Measurement and verification is widely performed according to the International Performance Measurement and Verification Protocol (IPMVP). The IPMVP allows for several methods, including on-site measurement, whole-building energy data, and simulation if energy bills are missing. The most applicable method for this program is IPMVP Option C – Whole Building. We recommend implementing it by requiring developers to enter their utility bills in an online energy database developed and maintained by the U.S. EPA, called Portfolio Manager, or any one of the commercial interfaces to this database. This database is widely used, and will likely end up being a useful tool for the developer, to track and monitor energy use, for purposes such as identifying changes in energy use, spikes in energy use, and tracking savings from building improvements over time.

Timing

The proposed timing of the program is as follows:

1. To qualify for the energy incentive, a developer needs to commit in writing to the goals of the program and needs to choose which rating system they plan to use. Developers are encouraged to consult with a qualified energy professional as early as possible in design, because early decisions are typically found to minimize construction costs and optimize cost effectiveness.
2. Within 12 months of the issuance of the certificate of occupancy, the developer will have set up the building in EPA Portfolio Manager and entered the first year's energy usage, and provided online access to the TCIDA. Energy usage will be entered at a maximum quarterly thereafter, for the duration of the energy incentives. Each year, within one month of the anniversary of the certificate of occupancy, the developer shall submit a hard copy printout of energy use, from EPA Portfolio Manager, for the duration of the energy incentives. This reporting is for informational purposes only, and shall not affect the energy incentives.
3. Within 18 months of the issuance of the certificate of occupancy, the developer must submit relevant third-party certification at the target level of building energy efficiency, and results of on-site inspections, if required for the certification.

Does the Proposed Method Meet Our Stated Programmatic Goals?

At the beginning of this report, we outlined characteristics of a successful program. Does the proposed method have these characteristics?

We believe that the proposed approach is cost-effective, by allowing leveraging of state (NYSERDA) incentives, and allowing leveraging of the associated state-defined compliance/standards program, along with its substantial subsidies of soft costs, use of widely-accepted existing standards, and use of existing review and quality control. Incentives to "free riders" (those who would have designed/built efficiently anyway, without incentives) are estimated to be zero. We believe the proposed approach will have a ripple effect, in affecting future building design and construction decisions, by both incentives-receiving developers and other developers. This "spillover" might occur through lessons learned, best practices developed and shared, and more.

Projects supported by the proposed incentives should furthermore serve as a demonstrations/examples for other developers. The proposed approach is simple to administer – all compliance is verified by independent third parties. Measurement and verification is performed by the developer themselves, using the simple and widely-used online utility bill database, EPA Portfolio Manager. The proposed approach should have a measurable effect. The proposed energy savings are so substantial that they should be measurable in energy bills, without any special on-site measurement. The proposed approach is not easily gamed. Developers should not be able to obtain incentives without substantially delivering the goals of energy efficiency, through "model-tweaking", gaming of measurement, or other means of either unfair gaming (cheating) or "rules-bending". All compliance methods use industry-standard protocols and third-party quality control. We believe the proposed approach will achieve the county's goals of substantial energy conservation and economic development.

The proposed approach is easily changed/calibrated to changing market conditions. For example, if energy costs rise (or if a federal or state carbon tax is implemented, essentially raising the effective price of energy), and so the built-in incentive to conserve energy goes up, it might be desirable to reduce the incentives. Conversely, if energy prices drop, there may be a need to raise the incentives. The proposed approach is fair in that it does not confer a preference to one technology (e.g. it is technology-neutral) or building sector.

We believe the proposed approach will be acceptable to the community, including stakeholders such as the community at large, the TCIDA, county legislature, TCAD, and others, because it is based on generally-accepted energy practices, widely in use across the country. And, because it is based on generally-accepted energy practices, we believe it is defensible, in other words it will be justifiable in the face of possible community or legal challenges. The proposed approach accounts for differences in energy use between different building sectors. And the proposed approach offers the promise of persistence of savings, for example by encouraging best practices, such as the ongoing use of EPA's Portfolio Manager to track energy use. The one characteristic that we opted to not include was increasing incentives for buildings that go beyond the requirements of the program and so propose to save more energy. For simplicity, we are recommending a single threshold and associated incentive.

Other

The Split Incentive

The *split incentive* refers to the challenge of saving energy when one party owns a building and its energy infrastructure and another party uses the building and pays some or all of the energy bills. In commercial buildings, the split incentive is recognized as a major impediment to energy savings. In the three buildings we examined in our case studies, two of three are master-metered: The building owner will pay all energy costs. In the last of the three, the building tenants will be individually-metered. As we consider green energy incentives, we need to recognize that the developer will not always see a direct correlation between investment in energy improvements and their own operating costs. An energy-efficient building can obviously be presented as an asset to tenants or potential tenants but, again, there is not always a direct correlation between investment and recoupment from energy cost savings. A solution to the split incentives problem may be necessary for an abatement incentive to be fully effective.

Methodology

Calculations for this project assumed energy prices of 10 cents/kWh for electricity and $0.66/therm for natural gas. The natural gas rate is NYSERDA's most recently reported statewide average rate. The electricity rate is more typical of commercial rates in Tompkins County, and is lower than NYSERDA's most recently reported statewide average of 13.1 cents/kWh, because the statewide average is skewed by higher rates in New York City.

It should be noted that industrial customers are frequently eligible for lower electricity rates.   Lower electricity rates means that energy improvements take longer to justify themselves, and so there is less motivation for the building owner to make energy conservation investments.

It should also be noted that energy costs have been coming down in recent years. For example, average electricity costs were 2% lower in 2015 than they were in 2007. The decrease in natural gas costs are even more dramatic, with a reduction of 44% since 2007. These low energy costs are a major obstacle to energy conservation, with a far reduced financial incentive to conserve energy.

The accuracy of the estimates in this report are dependent on many factors. As mentioned, energy costs change over time, and can even go down, reducing energy cost savings. Construction costs vary widely, by building type, depending on economic conditions, and depending on where in the county a building is being built. Energy savings can depend on many factors, including behavioral factors, quality of construction, quality of materials, and more.

Energy savings estimates were done on a rule-of-thumb basis. For example, estimated heating use for each of three sample building types (hotel, medium-rise apartment building, large office building) was estimated on an EUI basis (kBtu/SF/year), and the savings were further estimated by applying a typical high-efficiency heating system relative to a heating system that meets the state energy conservation code (the version that goes into effect in October 2016).   For the proposed new equipment, we did not assume the absolute maximum possible energy efficiency, but rather widely commercially available high-efficiency equipment. For example, for the heating system, we assumed a 90% efficient system, even though equipment is available as high as 95% efficient. Energy savings estimates were not done on the basis of detailed energy models, but rather as simple spreadsheet calculations.

Many of the energy savings represented in these estimates are highly predictable and will reliably deliver savings. For example, a high-efficiency heating system should reliably deliver energy savings relative to a standard-efficiency system. There are low risks of savings not being delivered for these improvements, risks that arise if engineering design is not done well, or if deficiencies arise during installation or commissioning of equipment. Furthermore, for other energy improvements, energy savings depend more strongly on broad assumptions about how equipment is used, and so can more easily vary from the predicted energy use. For example, for lighting, we need to make assumptions about how many hours per year the lighting is used, and these assumptions can differ strongly from what actually happens in a building.

It is important to note that the estimates of energy savings of a variety of possible energy improvements were primarily done in order to see if the goals of Architecture 2030 can be met, and not to require specific energy improvements. We then evaluated different rating systems to see if they could roughly deliver the sought energy savings. Because equivalence between different ratings systems is difficult to know definitively, and because it is impossible to control behavior in specific buildings, we will not know definitively if the energy savings will be delivered. This is the purpose of the energy reporting, to allow the TCIDA to assess the success of the program.

In summary, the number of variables affecting the results in this study are necessarily many, the assumptions are many, and the accuracy is necessarily extremely rough. It would be possible for the energy improvements to cost as much as 50% more than what we estimated, or even higher. It would be possible for the energy cost savings to be half what we estimated, or even lower, especially if energy costs continue to go down. The return on investment could easily be significantly lower than projected. Conversely, if energy costs go up, or economic conditions reduce construction costs, the return on investment could be higher. These uncertainties support beginning this program with stronger incentives, to assure participation. If participation is found to be solid, the incentives can be adjusted downward over time. One or two pilot projects might be considered, to test and refine the approach.

Conclusion

The proposed TCIDA program has the potential to achieve several goals:

1. Substantially reduce carbon emissions in large new buildings.
2. Assess a method to substantially reduce carbon emissions.
3. Serve as a role model for other new buildings.
4. Allow developers to gain experience with high-efficiency construction, which will increasingly be expected through increasingly-stringent buildings codes.
5. Over the long run, reduce operating costs for developers and potentially reduce rents for tenants.

Appendix A: Interview Questions Posed to Developers

Current Thinking and Practices

Purpose:

1. Understand how they think now, and organize their portfolio and new projects now, around energy consumption and energy efficiency.
2. Learn if they currently design for better than the Code/Generally Accepted Practice of the time.
3. Discuss both their portfolio in general, and one or more buildings in more depth.
4. Identify any energy goals they aspire to with current and/or new projects.

   Perhaps one or more certifications, maybe utility cost $/SF annually, maybe an EUI target.

5. Do you know what EUI is? Do you estimate that for a project? Do you use Portfolio Manager (which calculates EUI) today with your current buildings?

Financials

1. Let's consider specific projects (name the buildings with permission):
   - A recently completed building in Tompkins County _________________
   - A future building you are planning ________________________________

   For each, ask **Yes/No questions –**

   Did or will you:

a. Get the federal "179d" tax deduction for being a building that uses 50% less energy?
b. Install solar?
c. Participate in the NYSERDA "New Construction Program" and obtain high-performance incentives through that program?
d. Participate in any other programs to obtain incentives for energy efficiency?
e. Obtain an Energy Star Score, through Portfolio Manager?
f. Obtain LEED certification? (If yes, at what level: Basic, Silver, Gold, Platinum)
g. Participate in Architecture 2030?
h. Obtain any other high-performance building certifications (Passivhaus, etc.)?
i. Aim for NetZero?
j. Simply meet current Energy Code?

1. When in the design process do you decide what energy target you're aiming for?

2. How does this compare to the timing on approval of TCIDA tax abatements?

3. What do you think of the idea of property tax abatements for energy efficiency?

4. What key metric do you use to evaluate the project's overall financials?

b. Return on Investment
c. Internal Rate of Return (comparison to discount rate; "competing investment" dynamic)
d. Capitalization Rate (relates to Build-to-Sell developments and what the local market will bear)
e. Other ____________________________

5. What is your target ROI (or IRR, or other metric) in general for your projects?

6. Is the target ROI very similar for each project? Or is there a wide variation?

7. In your proforma (business plan); what did/do you budget for utility costs, ex $/SF?
   Who will pay them (landlord or tenant or combination)?

8. What key metrics do you use to decide which energy efficiency/measures to adopt?
   a. Payback period
   b. $/SF for utility cost
   c. $/SF investment target
   d. Other ________________________________
   e. None – I do not invest in energy efficiency beyond the energy code.

9. When/if considering energy efficiency, do you look at ROI on each potential measure?

   For example do you evaluate separately from each other:

   - Added insulation
   - LED lighting
   - Solar PV
   - High efficient HVAC

   OR Do you mostly roll-up measures into the overall project ROI?

10. Are you aware that certain energy efficiency improvements actually lower the cost of construction?

    If yes, can you give an example.

    If no, just note that . . .

    Are there any other questions we should be asking, or points you would like to make to help us understand your viewpoints on energy, in your role as a developer?

Appendix B: Proposed Requirements

Proposed Requirements for Tompkins County IDA Green Energy Incentives

Minimum Program Requirements

In order to receive base-level tax abatements, developers shall:

- Enter all building energy bills into an online database for the duration of the tax abatements, using EPA Portfolio Manager or approved equivalent, and provide annual reports of Energy Utilization Index (EUI), as well as online access for the TCIDA to the EPA Portfolio Manager data.
- Achieve design at the minimum 10% better-than-baseline level. Compliance shall be achieved in any one of the following ways:
    - Design major project components to be at a minimum 10% more energy-efficient than the current energy code, including: all insulation (wall, roof, foundation), window U-factors, heating plant efficiency, cooling plant efficiency, domestic hot water plant efficiency and lighting power density. For example, if the code requirement for wall insulation is R-20, the proposed design shall be at a minimum R-22. Lighting power density shall be done on a space-by-space basis (not whole-building method). The design drawings shall show each component's energy code requirement, and the proposed better-than-code energy requirement. In addition, the ratio of window to wall area shall not exceed 25%. In addition, all major plug equipment (for example, refrigerators in apartment buildings, cooking equipment in restaurants, etc.) shall be ENERGY STAR rated. In addition, all water fixtures shall meet the requirements of EPA's Water Sense program (faucets, shower heads); OR,
    - Participate in NYSERDA's New Construction program, and obtain a written statement from the NYSERDA consultant that the project design is 10% better than the program's baseline (currently ASHRAE 90.1-2013); OR,
    - Demonstrate a minimum 10% better-than-code in another way, subject to approval. For example, participate in NYSERDA's "stretch energy code" program (still under development as of the writing of this report).

Enhanced Incentive Requirements

In addition to entering energy bills in EPA Portfolio Manager and providing an annual EUI report (see above), developers shall choose and commit to one of the following certifications:

- Achieve design at the 40% better-than-baseline level (ASHRAE 90.1-2013). Developers are encouraged to participate in the NYSERDA New Construction program, which has similar requirements, and which provides additional incentives; OR,
- Participate in the NYSERDA Multifamily New Construction program, and achieve design at the Tier 3 level; OR,
- LEED 4.0 certification, including a minimum of 17 points for Energy Optimization (46% less source energy than ASHRAE 90.1-2010). Onsite renewable energy may be substituted for energy conservation; OR,
- Passivhaus certification.

The TCIDA may accept other proposed approaches that meets the county's intended goal of Architecture 2030 (70% savings for projects before 2020), and that includes independent third-party verification. The TCIDA reserves the right to refuse considering any such non-standard proposals.

Standards which might be considered in the future, but are considered not yet ready, include ASHRAE BEQ and the DOE Asset Tool.

Developers shall determine their target Energy Utilization Index (EUI) according to Architecture 2030, using EPA Target Finder, or approved equivalent. For mixed use buildings, the target shall be weighted by the different building uses, by floor area. The target EUI will only be used for purposes of comparison to subsequent actual EUI, from EPA Portfolio Manager, for purposes of measuring success of the program. The target and actual EUI will not be used for purposes of energy incentive calculation.

Within 18 months of the issuance of the certificate of occupancy, the developer shall submit relevant third-party certification at the target level, and results of on-site inspections. Third party certification shall be NYSERDA, USGBC/GBI, Passivhaus, ASHRAE, or otherwise approved organizations.

In addition, all major appliances, such as refrigerators, laundry equipment, and commercial cooking and refrigeration equipment, shall be ENERGY STAR rated. Developers shall put in their leases that: 1. Tenant appliances are recommended (but are not required) to be ENERGY STAR rated, such as computers, computer peripherals, and smaller consumer appliances. 2. Build-out spaces will comply with the energy goals of the program.

For industrial and lab energy-using equipment not covered by building energy efficiency requirements, all motors over 1 HP in size shall be NEMA Premium Efficiency, and shall be controlled by variable speed drives. In addition, the developer shall procure an independent evaluation of additional energy improvements, and implement those improvements that have a payback of less than 5 years. The independent evaluation shall be through NYSERDA's Industrial/Process program or approved equivalent.

The TCIDA green energy incentive offer will be made as a tax abatement schedule. The actual dollar amount of the abatement will depend on the property assessment and local property tax rate. TCIDA reserves the right to change the tax abatement schedule for future projects, depending on energy prices, changing government and utility energy incentives, changes to the energy code, developer participation rates, changing county energy goals, measured energy efficiency success rates, and other market forces.

Appendix C: Schematic Design Guidelines

For schematic design, the following guidelines may help for planning purposes. These guidelines are not intended to guarantee compliance with the proposed green energy incentives.

- Select high-efficiency heating and cooling plants, with rated efficiencies at least 15-20% higher than required by the energy code.
- Select high-efficiency domestic hot water (DHW) plants, with rated efficiencies at least 15-20% higher than required by the energy code.
- Avoid placing heating and cooling distribution systems in unheated spaces, such as attics, basements, etc. Give preference to systems that have efficient distribution systems and low distribution losses (for example, room-by-room fan coils).
- Use energy recovery ventilation systems in air conditioned buildings, and heat recovery ventilation systems in buildings that do not have air conditioning. Design ventilation systems separate from heating and cooling systems.
- Select heating/cooling systems that allow thermal zoning on a space-by-space basis.
- Perform lighting design on a space-by-space basis, using the space-by-space lighting power density method (not the whole-building method). Use LED lighting where possible. Design to lighting power density of 15-20% less than required by the energy code.
- Require occupancy sensors where possible, for both indoor and outdoor lighting. Require short off-delay (1 minute or less), and commissioning of lighting controls.
- Design to window-to-wall ratio less than 20-25% (the new energy code requires 30% or less). Keep large windows on south-facing surfaces and important facades, minimize windows on north-facing surfaces and in spaces which see low occupancy (stairwells, corridors, utility rooms, etc.).
- Avoid unusually complex building shapes.
- Use 20-30% more insulation R-value than required by the energy code.
- Use best practices for minimizing infiltration and stack effect, and require inspection/commissioning of these elements: Vestibules at entrance doors, air sealing around window and door frames, aerosol duct sealing and sealing of chases/shafts, sealing at exterior wall/floor junctions, and guarded blower door testing of individual spaces or entire building floors.
- Require that water fixtures meet EPA's Water Sense requirements.
- Require that permanent appliances (apartment refrigerators, restaurant cooking equipment, etc.) be ENERGY STAR rated.
- Consider heat pump systems (geothermal or air source heat pumps), avoid boiler-assisted heat pump systems, avoid systems using fossil fuels.
- Design roofs to be "solar receptive": Maximize area available for solar collection systems. For pitched roofs, place roof-mounted components (plumbing vents, exhaust fans, etc.) on north-facing roof surfaces, to keep south-facing surfaces available for solar collection systems.   Orient one roof surface to the south, plus/minus 30 degrees, to maximize potential for solar energy. Maximize solar collection systems on available roof areas, and consider using high-production solar panels to maximize solar production for a given roof area, especially for medium-rise and high-rise buildings.