High-Performance Buildings

Summary:

Building upon the goals of "The 2030 Challenge," this initiative would establish a voluntarily higher performance building than required by baseline building energy codes, lowering energy and operating costs. These high performance building goals include new and existing buildings in the residential, commercial, institutional and government sectors.

Background and Overview:

Architecture 2030, a non-profit, non-partisan and independent organization, was established in response to the climate change crisis by architect Edward Mazria in 2002. 2030's mission is to rapidly transform the built environment from the major contributor of greenhouse gas (GHG) emissions to a central part of the solution to the climate and energy crises. Architecture 2030 issued The 2030 Challenge asking the global architecture and building community to adopt the following targets:

- All new buildings, developments and major renovations shall be designed to meet a fossil fuel, greenhouse gas (GHG)-emitting, energy consumption performance standard of 60% below the regional average/median for that building type.

These targets may be accomplished by implementing innovative sustainable design strategies, generating on-site renewable power, and/or purchasing (20% maximum) renewable energy.

The main goals for this work plan were generally modified from the Architecture 2030 Challenge building goals. These goals are summarized in Tables 1 and 2. Following the tables are proposed implementation steps to meeting these goals. The GHG emission reductions for Pennsylvania through 2030 were estimated assuming that these goals are met. The key assumptions and results of that analysis are provided later in this work plan initiative.

Goals:

Table 1. New Buildings Goals and Standards

		2015	2030
New Commercial	Overall goal (relative to 2005 building)	60% fossil fuel energy reduction	80% fossil fuel energy reduction
	Performance standard	Average site EUI2005	Average site EUI2005
	Fraction of buildings that meet standard	100% of new	100% of new
New Residential	Overall goal (relative to 2005 building)	60% fossil fuel energy reduction	80% fossil fuel energy reduction
	Performance standard	HERS 30	HERS 20
	Fraction of buildings that meet standard	100% of new	100% of new

Table 2. Existing Buildings Goals and Standards

		2015	2030
Existing Commercial	Overall goal (relative to 2005 building)	60% fossil fuel energy reduction	80% fossil fuel energy reduction
	Performance standard	Average site EUI2005	Average site EUI2005
	Fraction of buildings that meet standard	20% of existing	50% of existing
Existing Residential	Overall goal (relative to 2005 building)	60% fossil fuel energy reduction	80% fossil fuel energy reduction
	Performance standard	HERS 30	HERS 20
	Fraction of buildings that meet standard	20% of existing	50% of existing

Notes: Energy reductions refer to on-site energy consumption.

Potential Implementation Strategies:

Building Energy Conservation Codes

In addition to adopting current building energy codes (see "Adopt Current Building Energy Codes" work plan) as a prerequisite to meeting the goals of this High-Performance Buildings initiative, the following implementation steps are presented for consideration:

High-Performance Commercial Buildings

- Stretch Codes - Recommend adopting the IBC 2015 and allowing use of the **International Green Construction Code (IgCC)** as a voluntary option for municipalities to meet the goals and commercial building performance standards cited above.
- Additional implementation steps could include:
  - Require IgCC compliance for all publicly-funded commercial building projects in PA.
  - Provide incentives to encourage municipalities, school districts and others to voluntarily adopt and implement the IgCC.
  - Consider a phased-in approach to adopting the IgCC beginning with Energy Star standards, and expanding to cover high-performance standards for energy sources, water, stormwater, materials, etc. Ultimately the goal will be zero-carbon buildings throughout the Commonwealth – a goal that is aligned with the 2030 Challenge.
  - Improve administration and enforcement of both the existing UCC and the IgCC with a statewide emphasis on training.
- **Benchmarking** - Require benchmarking (such as EPA Energy Star Portfolio Manager) for all publicly-owned and leased commercial facilities and all commercial buildings in PA over 50,000 SF by 2020. Other implementation steps could revise public-sector facility manager job descriptions and train staff to incorporate benchmarking into their standard operating procedures.
- **Energy Savings Performance Contracting (ESPC)-** Re-establish a robust Guaranteed Energy Savings Act (GESA)/energy service company (ESCO) program to promote energy savings performance contracting for buildings in the municipal, university, school district and institutional sectors Hire and train staff to run public-sector GESA/ESCO/ESPM

programs. Leverage the efforts of the PA Treasury's new program that aims to facilitate ESPC contracts.

- **Green Strings** – Require all Commonwealth funded Buildings, whether grants, loans, tax credits, tax incentives, etc., to have minimum performance expectation of energy/resource conservation results.
  - The intent of this initiative is to educate involved parties, inform the Commonwealth, and potentially reduce the GHG impacts of building projects. If projects with similar costs and benefits are proposed, give preference to the project with the lowest GHG life-cycle-cost impact.
  - Commonwealth agencies and commonwealth-funded construction projects should include in their decision-making processes appropriate and careful consideration of life-cycle-cost GHG emission effects from proposed actions, and their alternatives. This will be done to understand, minimize, and/or avoid potential adverse effects from GHG emissions as much as possible. Commonwealth agencies will integrate GHG emission impacts as early in their planning processes as possible.
- Leadership PA - Establish a minimum Energy Star rating goal of 75 for all Commonwealth-owned and leased buildings by 2020

High-Performance Homes (Residential)

- **Stretch Codes** - Recommend adopting the **National Green Building Standard (ICC 700)** as a voluntary option for municipalities to meet the goals and commercial building performance standards cited above. Support educational and training sessions about ICC 700 provided by professional associations and providers.
  - Additional implementation steps could include:
    - Require ICC 700 compliance for all publicly-funded residential building projects in PA.
    - Provide incentives to encourage home-builders, developers and others to voluntarily adopt and implement ICC 700.
    - Improve administration and enforcement of both the existing UCC and ICC 700 with a statewide emphasis on training.
- Offer the Commonwealth's residential sector incentives for implementing whole-house energy performance improvements.

<u>Supporting Steps to Meet Targeted Goals:</u>

- **Energy Mortgages:** Consultation with Pennsylvania Department of Banking to investigate the legal and regulatory barriers to creating a Pennsylvania policy of requiring energy mortgages.
  - Energy audits coupled with energy mortgages could increase the number of families qualified for mortgages. Energy mortgages credit a home's efficiency rating into the loan by proportionately increasing the value of the home. To have a Pennsylvania policy of requiring lenders to provide energy mortgages, it is necessary to adopt a standardized home rating system, like the one adopted by the Residential Energy Services Network (RESNET). Home energy ratings provide a standard measurement of a home's energy efficiency. Ratings can be used for both new and existing homes. An effective rating system will include all information necessary for a lender to judge the worthiness of a home to meet the criteria for an energy mortgage. In October 1998, the mortgage

industry, RESNET and National Association of State Energy Officials adopted the Mortgage Industry National Home Energy Rating System Accreditation Standard. Fannie Mae and Freddie Mac adopted the national accreditation standard.
  - Basing a mortgage on the home efficiency rating allows the buyer to borrow more on the basis that monthly utility bills will be proportionally less. In cases where the home is in need of energy-efficient upgrades, an Energy Improvement Mortgage could help finance the upgrades in an existing home by allowing the owner to use a portion of the mortgage payment to pay for the cost of the upgrades.
  - If appropriate, based on the feasibility of the program, educate the real estate and mortgage industry on the benefits of recognizing a standardized home rating system and adjust the current mortgage profile to include value realized as a result of increased energy efficiency.
- **Reduce Administrative Costs -** Continue working with the U.S. Green Building Council (USGBC) and EPA to streamline work processes and minimize the costs associated with implementing LEED and Energy Star principles and performance requirements into building operational procedures.
- Implement a *Pennsylvania Home Climate Champion Collaborative* to provide vision, clarity, and access to human and physical resources to encourage substantial (greater than 70 percent) energy reductions, while maintaining or improving indoor air quality, resilience to storms and power outages, adaptability, comfort, and affordability between now and 2020. A percentage of these projects should achieve Passive House goals of 90 percent energy consumption reductions, with 10 percent met through renewable energy sources.
- Building Energy Usage Disclosure
  - Require disclosure of energy usage at Time of Listing of residential and commercial buildings.
  - An overarching step is the performance of a rigorous Precautionary Principle analysis which identifies harms and mitigation actions for those harms concurrent with this implementation step.
  - Provides price signals to prospective buyers about the economic value or cost of efficient or inefficient building design and operation.

Key Assumptions:

- MWh consumption estimates from EIA AEO 2014
- Projected cost of electricity and NG from EIA AEO 2014
- 30% reduction in electricity and NG use for energy efficient buildings
- 20% of buildings are energy efficient the first year, additional 2% each year until 2030
- Cost of adopting new code = $199 million (commercial) and $278 million (residential) based on 33% additional payback period (residential = 4.5 years, commercial = 5.6 years) estimated using Department of Energy analysis to adopt 2012 EICC.
- Projected GHG Emissions in Electricity assume .5% annual reduction from 2013 Pennsylvania value (1112 lb/MWh)
- Costs include the added cost of administration, design and construction related to high performance buildings.

Commercial	2015	2030
Projected Electricity Consumtion (MWh)	42,915,282	43,459,194
Projected Cost of Electricity ($/MMBtu)	$36.32	$40.16
Projected NG Consumption (Billion btu)	149,558	152,298
Projected Cost of NG ($/MMBtu)	$8.38	$11.65
Energy Savings in energy efficient building	27.00%	27.00%
% of energy efficient buildings	20.00%	50.00%
Projected GHG Emissions Electricity (lb CO2e/MWh)	1,101	1,021
Projected GHG Emissions NG (Lb CO2e/MMBtu)	117	117
Emission Savings in MMtCO2e	1.586	3.808
Cost of adopting energy efficiency in million $ (5.6 year payback)	1990.0	199.0
Energy Savings in Million $	354.85	1043.51
Net Cost of adopting energy efficiency in million $	1635.15	-844.51

Residential	2015	2030
Projected Electricity Consumtion (MWh)	51,632,590	51,085,560
Projected Cost of Electricity ($/MMBtu)	$50.26	$53.34
Projected NG Consumption (Billion btu)	225,235	209,685
Projected Cost of NG ($/MMBtu)	$11.55	$15.21
Energy Savings in energy efficient building	27.00%	27.00%
% of energy efficient buildings	20.00%	50.00%
Projected GHG Emissions Electricity (lb CO2e/MWh)	1,101	1,021
Projected GHG Emissions NG (Lb CO2e/MMBtu)	117	117
Emission Savings in MMtCO2e	2.037	4.696
Cost of adopting energy efficiency in million $ (4.5 year payback)	2780.0	278.0
Energy Savings in Million $	$618.61	$1,685.70
Net Cost of adopting energy efficiency in million $	2161.39	-1407.70

	2030 Annual			2030 Cumulative		
	Reductions (MMtCO2e)	**Cost ($MM)**	**Cost-Effectiveness ($/tCO2e)**	**Reductions (MmtCO2e)**	**Total NPV ($MM)**	**Cost-Effectiveness ($/tCO2e)**
Energy Efficient Buildings	8.50	-2,252	- 265	97.9	-8,791	-89.8