LANDMARK : A ZERO ENERGY DISTRICT VISION

A CITIZEN PLANNING EXPLORATION BY STEPHEN KOENIG + DAVID PEABODY : MAY 17, 2021

OVERVIEW

Alexandria as a community has worked hard to prepare for climate change. As the emergency accelerates, we must amplify our efforts to realize these plans.

The energy utilized to erect and operate buildings is a massive source of the greenhouse gas emissions we are working urgently to reduce. To meet our 50% reduction goal, new development must achieve net zero energy use by 2030.

Approval of the Landmark Plan will entitle 4.2 million square feet of new construction on 50+ acres, creating a dozen new blocks of the city.

Alexandria's residents and leaders should expect the owners, developers, and designers to bring a Zero Energy District Vision to this endeavor.

BENEFITS

Increased wellness and productivity for individuals and the community.

Decreased costs and increased property values through reduced energy use.

Increased resilience for the buildings, the district, the grid, and the city.

Decreased climate impacts through reduced greenhouse gas emissions.

CONCEPT

Power the entire district with renewable energy generated on site and off site.

Optimize energy use through increased efficiency, reduced demand, and grid interactive buildings.

Maximize resilience through on site generation, on site electrical storage, and grid independent operability.

ARCHITECTURE

Buildings with low Energy Use Intensity maximize efficiency and minimize demand.

All-Electric buildings eliminate fossil fuel infrastructure and on site combustion.

Carefully shaped building forms maximize individual and collective solar exposure.

Intelligently interconnected buildings reduce peak loads and enhance resilience.

RENEWABLE ENERGY

On Site Distributed : Solar Roofs + Facades + Parking	± 35%
On Site District : Geothermal ± Heat Exchange Systems	± 10%
Off Site Community : Solar ± Wind ± Geothermal	± 55%
TOTAL **RENEWABLE ENERGY** :	**100%**

*THE **DISTRICT** AND THE **GRID***

Load diversity, demand flexibility, coordinated controls, and battery storage across all buildings optimizes interaction with the grid.

Utilities are beginning to develop community microgrids. This increases grid resilience while adapting to the growth of on site generation and storage, as well as accommodating the enormous impact of electric vehicles.

Innovative technology deployed now to lay the groundwork for a community microgrid contributes to, and benefits from, the evolution of the grid.

PROCESS

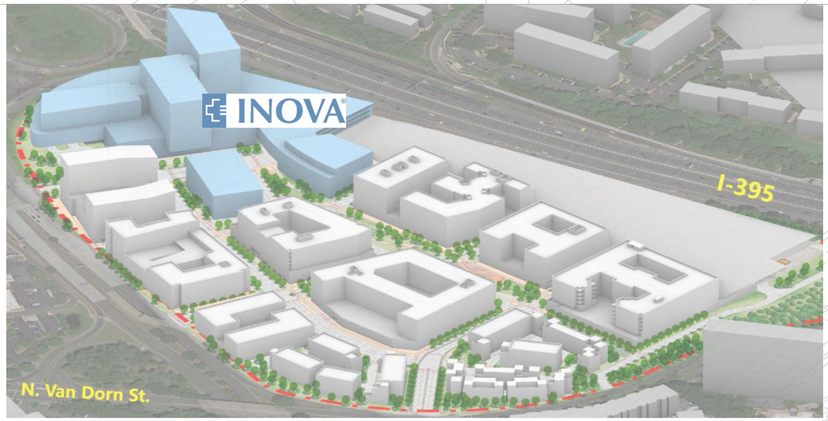
Zero Energy District realization requires a shared vision and mutual commitment.

The development plan can work to a People / Planet / Profit bottom line.

Life cycle analysis can balance initial investment with improved operational efficiency and long term energy cost savings.

Challenges of organization, finance, and governance can be met with steadfast collaboration by Alexandria, Inova, Foulger Pratt and Dominion Energy.

This approach is technically and economically viable. We can choose it.



PROPOSED MASSING ON SITE SOURCE : COMMUNITY PRESENTATION JANUARY 4, 2021

SOURCE : COORDINATED DEVELOPMENT DISTRICT PROPOSAL APRIL 9, 2021 PROPOSED BLOCKS + FOOTPRINTS

RENEWABLE ENERGY ON SITE
CONCEPT PLAN

HORIZONTAL SURFACES WITH SOLAR ACCESS
PARKING ROOFS

FACADES WITH SOLAR ACCESS

ENERGY HUB

GEOTHERMAL

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LANDMARK : A ZERO ENERGY DISTRICT VISION

ARCHITECTURE *Minimizing energy use maximizes both emissions reduction and cost savings.*

ENERGY USE INTENSITY (EUI) TARGETS FOR THE BUILDINGS

BUILDING TYPE	BLOCK	EUI : kBTU / SF / YR	EUI : kWh / SF / YR
MULTIFAMILY	E G H I J K L	**15.**	4.4
TOWNHOUSE	L M	**20.**	5.9
RETAIL	E G H I J K L	**25.**	7.3
HOTEL	D	**20.**	5.9
FIRE STATION	J	**30.**	8.8
MEDICAL OFFICE	C D E	**30.**	8.8
HOSPITAL	A B	**100.**	29.3

ENERGY REQUIRED TO OPERATE THE BUILDINGS

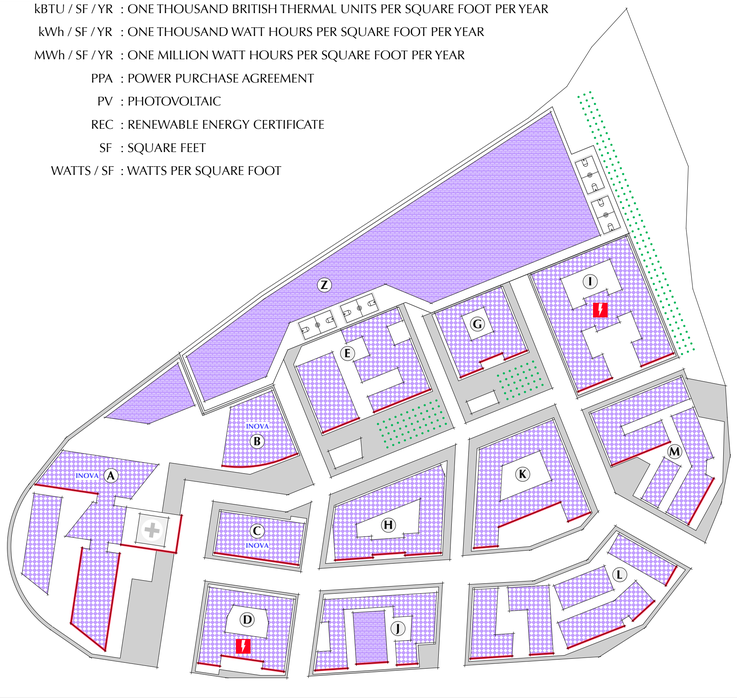
BUILDING TYPE	AREA / SF	x EUI	= kWH / YR
MULTIFAMILY	2,100,000.	4.4	9,232,122.
TOWNHOUSE	250,000.	5.9	1,465,416.
RETAIL	300,000.	7.3	2,198,124.
HOTEL	100,000.	5.9	586,166.
FIRE STATION	50,000.	8.8	439,625.
MEDICAL OFFICE	400,000.	8.8	3,516,999.
HOSPITAL	1,000,000.	29.3	29,308,324.
TOTAL BUILDING AREA / SF :	**4,200,000.**		46,746,776. kWh / YR

DISTRICT TARGET FOR ENERGY USE : **47,000.** MWh / YR

DEMAND

TERMS

- kBTU / SF / YR : ONE THOUSAND BRITISH THERMAL UNITS PER SQUARE FOOT PER YEAR
- kWh / SF / YR : ONE THOUSAND WATT HOURS PER SQUARE FOOT PER YEAR
- MWh / SF / YR : ONE MILLION WATT HOURS PER SQUARE FOOT PER YEAR
- PPA : POWER PURCHASE AGREEMENT
- PV : PHOTOVOLTAIC
- REC : RENEWABLE ENERGY CERTIFICATE
- SF : SQUARE FEET
- WATTS / SF : WATTS PER SQUARE FOOT



KEY PLAN WITH BLOCKS + FOOTPRINTS

RENEWABLE ENERGY *A mix to be optimized in coordination with evolution of the grid.*

ON SITE SOLAR UTILIZING SURFACES WITH APPROPRIATE EXPOSURE

BLK	ROOF SF	PARKING SF	FACADE SF	x % USED	= PV COLLECTOR SF
A	89,000.	19,500.	90,000.		
B	30,000.		15,000.		
C	27,000.		15,000.		
D	38,000.		20,000.		
E	52,000.		20,000.		
G	32,000.		15,000.		
H	46,000.		30,000.		
I	70,000.		15,000.		
J	32,000.	13,000.	20,000.		
K	54,000.		25,000.		
L	72,000.		20,000.		
M	58,000.		15,000.		
Z		267,500.			
	600,000.			x **50%**	= 300,000. SF
		300,000.		x **80%**	= 240,000. SF
			300,000.	x **20%**	= 60,000. SF
	TOTAL SURFACE AREA	1,200,000.			SF
	TOTAL PV COLLECTOR				**600,000.** SF
	EFFICIENCY OF PV COLLECTOR			x	24. WATTS / SF
	TOTAL CAPACITY OF PV COLLECTOR				14,400. kW
	ANNUAL HOURS OF PRODUCTION			x	1,277. HRS
	ANNUAL PRODUCTION OF PV COLLECTOR				18,388,800. kWh / YR
	EFFICIENCY FACTOR (DC TO AC) CONVERSION			x	.87 FACTOR
	TOTAL DELIVERED SOLAR ENERGY				15,998,256. kWh / YR

34% : **16,000.** MWh / YR

ON SITE DISTRICT

FEASIBILITY AND EXTENT TO BE DETERMINED :

- GEOTHERMAL ENERGY
- WASTE HEAT EXCHANGE
- THERMAL ENERGY UTILITY

10% : **4,500.** MWh / YR

OFF SITE RENEWABLE

AVAILABILITY AND PHASING TO BE DETERMINED :

- COMMUNITY SOLAR
- LOCAL POWER PURCHASE AGREEMENTS

56% : **26,500.** MWh / YR

DISTRICT TARGET FOR ENERGY PRODUCTION : **47,000.** MWh / YR

SUPPLY

REFERENCES

IPCC : CLIMATE CHANGE 2014 / U.N. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE
https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf

ZERO CODE 2.0 / ARCHITECTURE 2030
http://zero-code.org/

EXAMPLES *of performance at the required level, and a new tool for planning at the district scale.*

MEDICAL

GUNDERSEN HEALTH SYSTEM — WI / MN / IA

To contain rising energy costs, increase affordability of its healthcare services, and improve the quality of its community's environment, in 2008 GHS made a strategic institutional commitment to operational independence based on clean energy.

Integrating performance and efficiency improvements across its facilities with on-site and off-site renewable energy projects, GHS has produced more energy than it consumes since 2014. Its 3,000,000 sf portfolio operates at a cumulative energy use intensity of 85 EUI.

Lutheran Medical Center in La Crosse, WI is the GHS flagship. This 325 bed, 430,000 sf facility with a Level 2 trauma center opened in 2014 with a geothermal system and operates at an energy use intensity of 130 EUI.

http://buildourfuture.org/

SWEDISH MEDICAL CENTER — ISSAQUAH, WA

An acute care hospital with 175 beds, this 575,000 square foot facility includes a medical office building and a central heat recovery facility.

Opened in 2011, the complex operates at an energy use intensity of 115 EUI.

https://tc0608.ashraetcs.org/documents/research/TA_2013_Hospital.pdf

RESIDENTIAL

SECOND + DELAWARE — KANSAS CITY, MO

A walkable urban multifamily community, this Arnold Development Group project is an engaging place to live, contributes to the environment, and makes a profit.

It is Passive House Certified, all electric architecture of 6 stories and 290,000 sf with on site solar power generation and an Energy Use Intensity of 16 EUI. Highly insulated walls and windows envelop a concrete frame to create a durable and adaptable building with a 100+ year life span.

The apartments are quiet, comfortable and desirable at competitive market rents. Of 276 units at least 20% are available at Area Median Income values from 30-80% AMI.

Rather than focus on minimum initial cost and maximum short term return, in this approach:

- **Lower energy costs generate higher Net Operating Income from day one.**
- Higher net operating income supports initial financing of higher construction cost.
- Higher net operating income increases sales value in the marketplace.

This architecture can productively contribute to achieving a zero energy district.

This profitable private sector development model for quality housing is available now. It is ready to be scaled up to help solve our housing and climate challenges.

http://www.arnolddevelopmentgroup.com

DISTRICT

A GUIDE TO ENERGY MASTER PLANNING OF HIGH PERFORMANCE DISTRICTS — 2020

A comprehensive district approach to integrating building efficiency, interconnectedness, and renewable energy achieves improved environmental performance and resilience.

The National Renewable Energy Laboratory led this effort to synthesize proven best practices, current research, and climate change driven innovations.

This is an eminently practical guide for citizens, elected leaders, planners, developers, designers and everyone engaged in the critical work of evolving our built environment.

15 case studies across a range of project types and scales are profiled.

https://www.nrel.gov/docs/fy21osti/78495.pdf