

Bringing Net Zero Energy from Design to Operation

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TD Bank, N.A.

Sept 18, 2013



getting to zero national forum
2013 NASEO Annual Meeting at the
Framing the policies, programs and projects that will drive zero net energy buildings





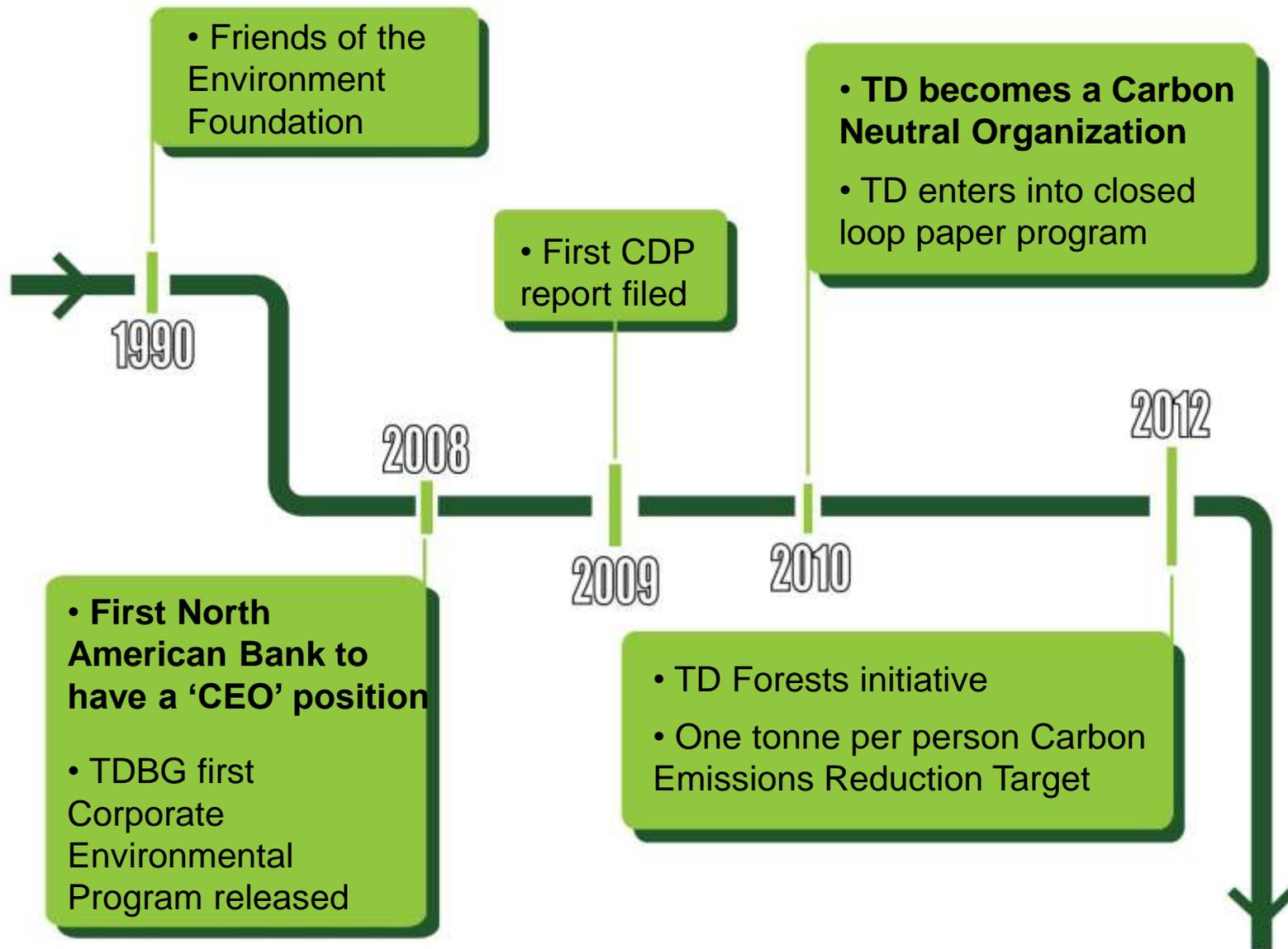
TD Bank Group and the Environment

TD Bank Group

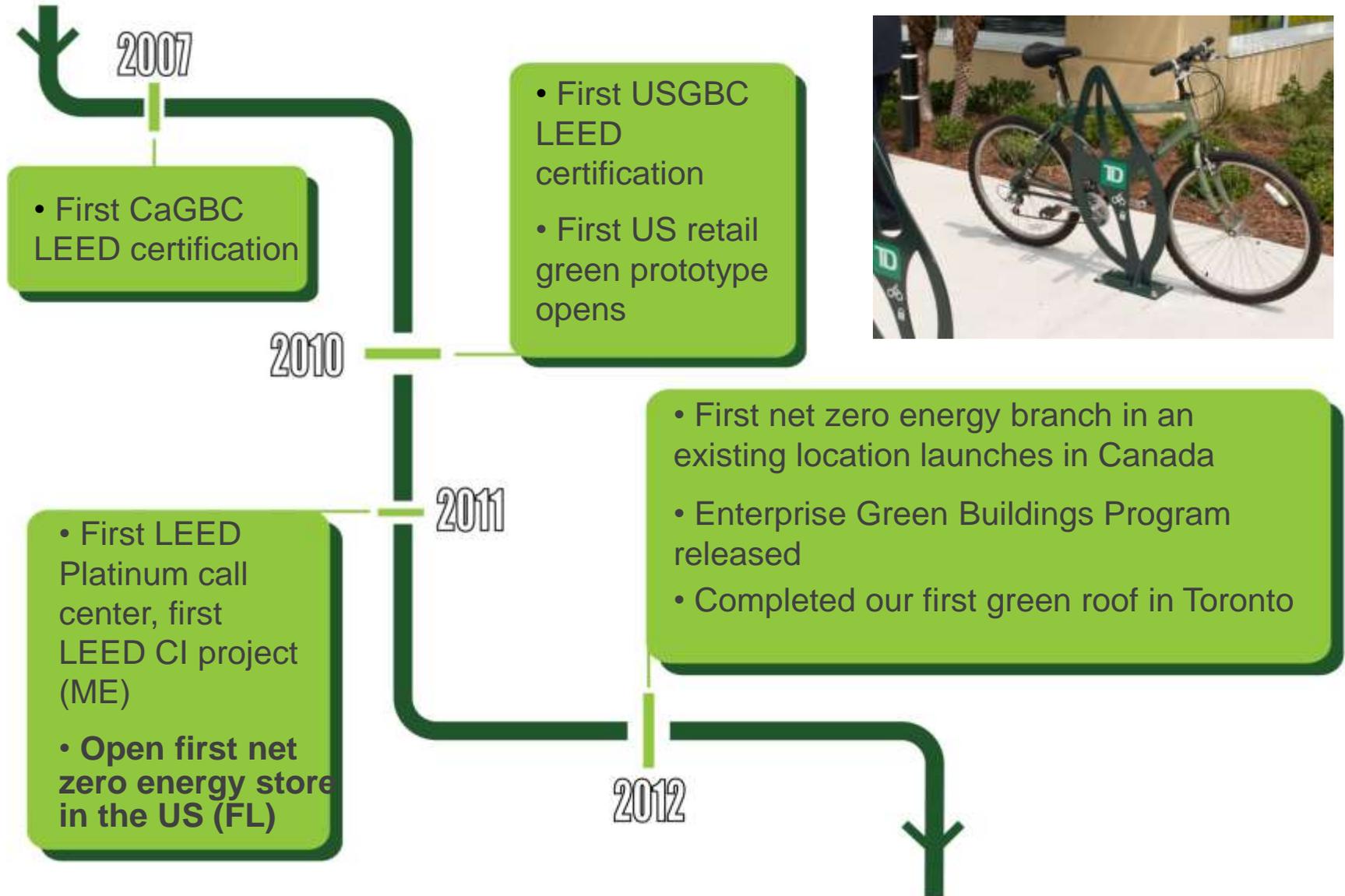
- Toronto Dominion bank formed in **1955** from merger of two banks
- In 2005, TD acquired 51% of Banknorth and the remaining shares in 2007 and announced its intention to acquire Commerce Bancorp.
- In 2008, the Commerce acquisition was completed and TDBG became one of the **seven largest banks by branch network North America.**
- Canada Trust has +1,100 branches and growing
- TD Bank has +1,300 stores and growing.



When did our environmental focus start?



Real Estate Notables



LEED Goals & Achievements



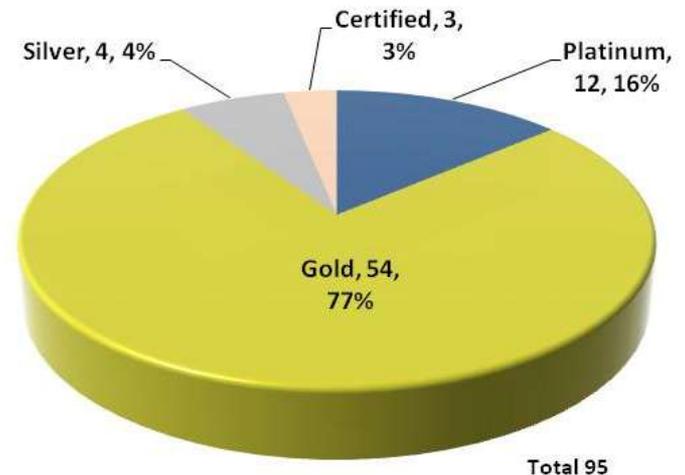
- All new stores are currently seeking certification under **LEEDv3** - Retail rating system NC and CI
- Prototype store design by itself starts at **Gold Level** (60+ points) with potential additional site specific points to get projects to **Platinum Level** (80+ points):
- Currently working directly with GBCI in the Proven Provider program



TD LEED Certifications (Enterprise)



TD LEED Certifications (US)





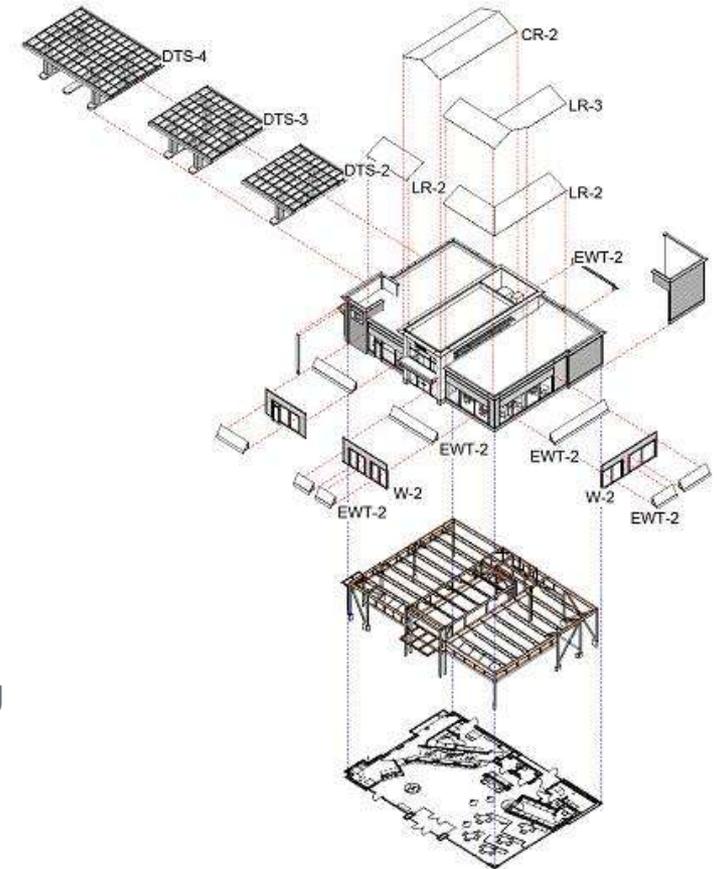
Green Prototype into Net Zero

It all Starts with the Prototype (Green Potato)



■ Key Objectives of the Green Prototype

- Cost effective base building can be contextualized to the local community through a predefined kit of parts, material selections and an historic mural
- All buildings will be LEED certified
- Extensive daylighting and lighting controls yield a **90% reduction** in the electrical lighting load **1.18 watts/sf (.78 watts/sf including daylight harvesting)**
- Low-e glazing, shaded windows and increased insulation help reduce total building energy consumption **40% below code**
- Photovoltaic panels **generate 12-15% of electricity**
- Efficient plumbing fixtures and drought tolerant landscaping **decrease water consumption by 40%**
- Energy efficient mechanical system reducing energy costs and improves indoor air quality **VRV system (10 zones)**
- Interior materials and finishes selected to maximize use of **recycled content**



More than 80% of building components remain consistent

From Green Prototype to Net-Zero



■ TD Bank Business Rationale

- Assist the organization achieve energy reduction initiatives by reducing operational costs
- Education on how to get there, sharing of lessons learned with non NZ projects
- Reduce the amount of Greenhouse Gas we produce
- Goal to be an Environmental Leader

■ Net –Zero Definition

- Offset total building energy use on an annual basis. At times, power will be required from the grid. At the end of the year the amount of energy produced will equal the amount of energy consumed.

■ Overview

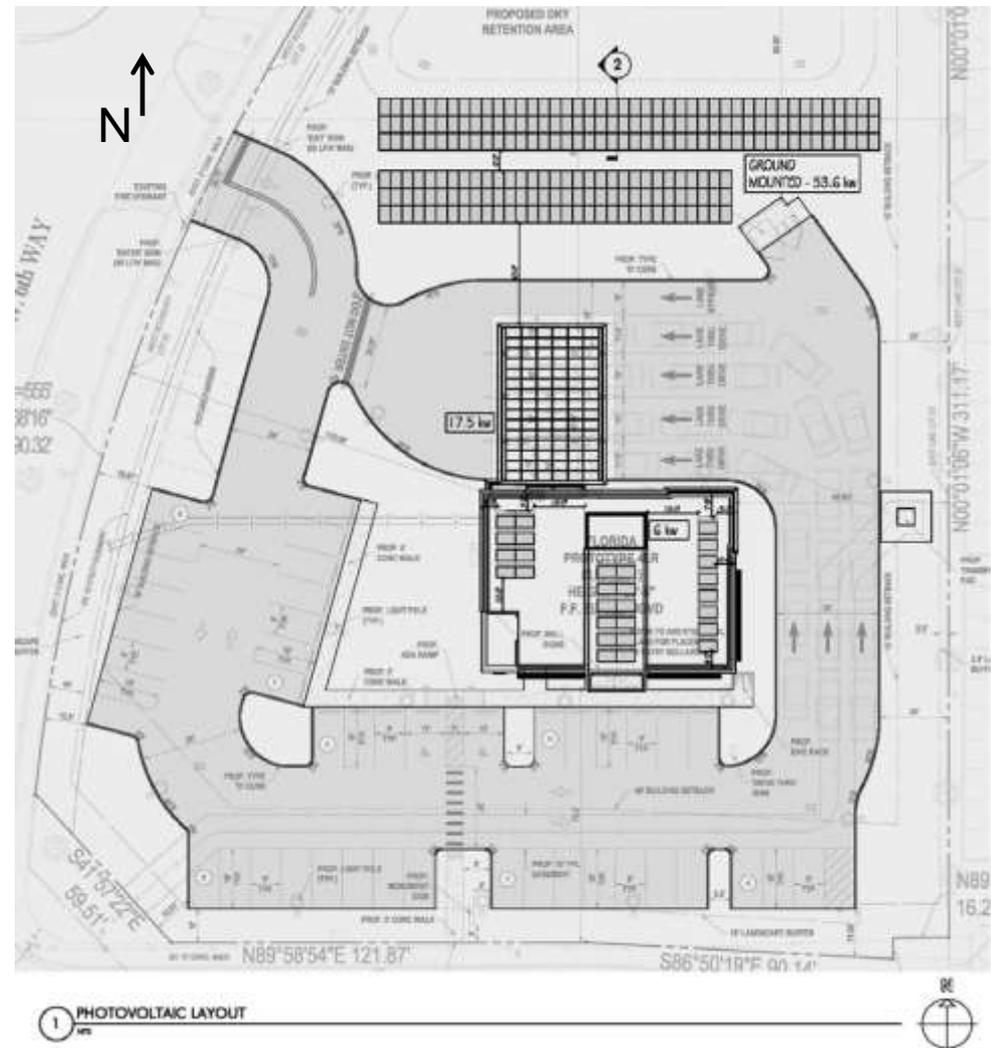
- Location: Ft Lauderdale, FL
- Building type(s): Retail
- 3,970 ft² (369 m²)
- Lot size: 1.68 acres
- Previously developed land



Net-Zero Design



- Achieving Net Zero Energy on an Annual Basis:
 - Modeled Building Consumption = **96,648kwh/yr**
 - Energy generation (4-lane Drive thru PV canopy and roof mounted laminate PV's) = **26,334kwh/yr**
 - Therefore, additional require PV requirement = **70,314kwh/yr**
 - The designed ground mount PV system @ 20° angle facing due south will produce **~80,000kwh/yr**
 - The 80,000kwh PV field requires approximately 6,360sf of open ground area using crystalline PV technology



Net-Zero Business Case



Cypress Creek Net Zero Cost Analysis

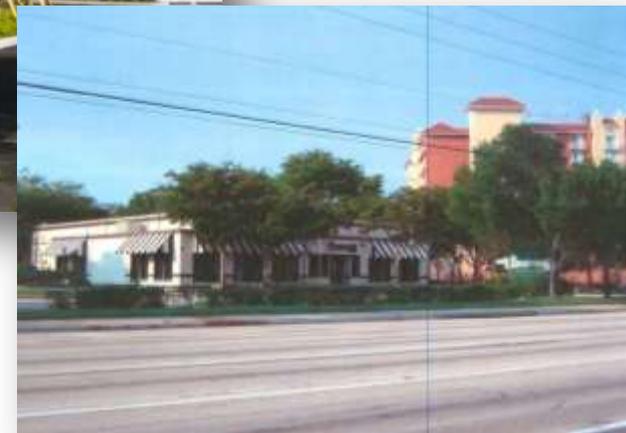
Net Zero Increase above base store cost	19.8%
Federal PV Rebate avg of base store cost	-7.4%
Total Increase above base store cost	12.4%
Cost Reductions per Year related to base store costs	-1.45%
Simple Payback	~8.5 years



Cypress Creek Store, Ft. Lauderdale, FL



Store Opened 5/13/11
Received LEED Platinum Certification on
2/13/11



Fundamental Commissioning



- Building Commissioning continues past store opening, here is a short list of items found
 - **Unable to pull true data from BMS**, both commissioning and connection issue
 - Main PV Field was not accounted for in the total PV generation Calculations, **breaker tripped for 28 days**
 - Air Handlers were not controlled by BMS, running continuous
 - **Dehumidification unit running 24/7**
 - Additional energy meters required to record total building consumption
 - Lighting controls were re-programmed to match specifications
 - Temperature settings were reprogrammed to match specifications



So Far So Good, that's what we thought.....



June Utility Bill

Bill Statement

Customer Name: TD BANK, NA **Service Dates:** 05/31/2011 to 06/30/2011
Service Address: 665 NW 62ND ST **Statement Date:** 07/01/2011
FPL Account Number: 0756628491 **Next Scheduled Read Date:** 07/29/2011
E-Mail Address: TDUTILITY@BLJC.COM

Amount of your last bill	Payments (-)	Additional Activity (+ or -)	Balance before new charges (=)	New charges (+)	Total amount you owe (=)	New charges due by
317.65	317.65CR	0.00	0.00	255.84	\$255.84	Jul 22 2011

Amount of your last bill 317.65
Payment received - Thank you 317.65CR
Balance before new charges \$0.00

New charges (Rate: GSD-1 GENERAL SERVICE DEMAND)
Electric service amount 201.12**
Gross receipts tax 5.16
Franchise charge 12.38
Utility tax 21.87
Florida sales tax 15.31
Total new charges \$255.84

Total amount you owe \$255.84

-Payment received after July 22, 2011 is considered LATE; a late payment charge of 1.50 will apply and your account may be subject to an adjusted deposit billing.

-Your kWh usage reflects 6,296 of renewable energy you delivered. You have 1,890 kWh remaining that may be applied on your next bill.

Meter reading - meter 6LL378N
Current reading 17535
Previous reading -12258

Your kWh usage reflects 6,296 (21,482 kbtu) of renewable energy you delivered. **You have 1,890 kWh (6,449 kbtu) remaining that may be applied on your next bill.**

What happened.....



TD Bank											
665 NW 62nd St, Fort Lauderdale, FL 33309											
Service Date	# days in cycle	KW	Electric Reading	Electric KWH	Netmeter Reading	Netmeter KWH	Net KWH	Bank Add	Bank Sub	Bld KWH	Total in Bank
4/8/2011	0	0	0	0	0	0	0	0	0	0	0
4/29/2011	21	21	5521	5521	3971	3971	1550	0	0	1550	0
5/31/2011	32	24	12258	6737	11579	7608	0	871	0	0	871
6/30/2011	30	19	17535	5277	17875	6296	0	1019	0	0	1890
7/29/2011	29	25	25447	7912	19913	2038	5874	0	1890	3984	0

(13,593 kbtu)

July 2011 energy bill

Net-Zero-Commissioning

Fundamental Commissioning was just not enough



■ We hired an independent Commissioning agent to perform retro-commissioning

- Loose fan belts
- Humidity sensor in direct sunlight – faulty readings
- Dehumidification unit still running 24/7 supposed to shut down when RH is below 72%
- CT meters not installed on the energy recovery unit and 2 fan coil units
- **Exterior light circuit wiring was hot to the touch, final connection was loose and drawing close to 45% more power than required**
- **CT meter from main PV field was installed in the wrong direction**
- BMS system is not collected true building data due to incorrect metering



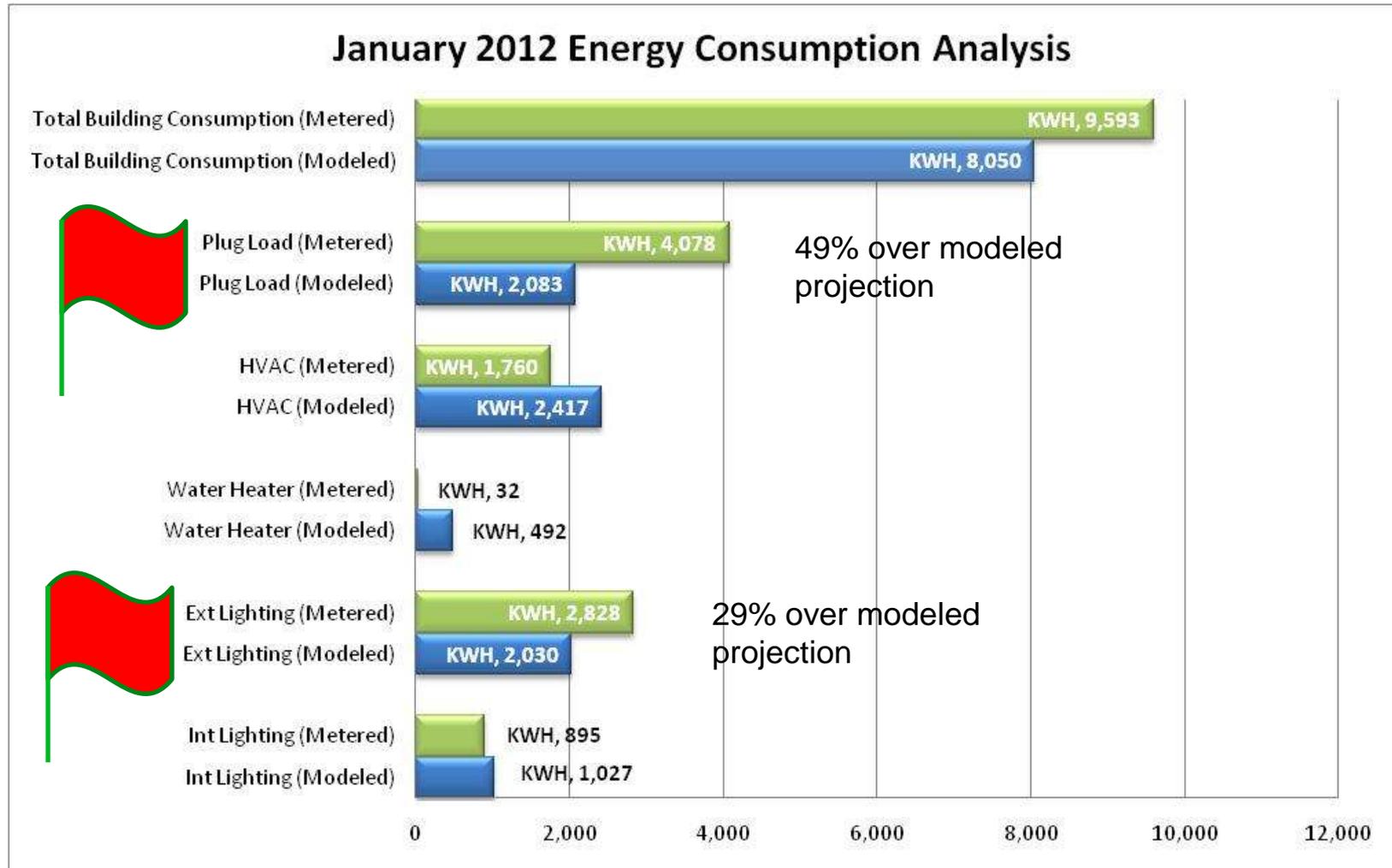
■ Measurement and Verification – How to verify the building systems performance

- We had to gear the M&V plan specifically for the net-zero location



And now we wait...and monitor!

Reporting Sample



Recovery Strategy



- Switched out 400 watt metal halide site lights with 210 watt LED equipped with a step down dimming control

- Reduced energy consumption by 64%

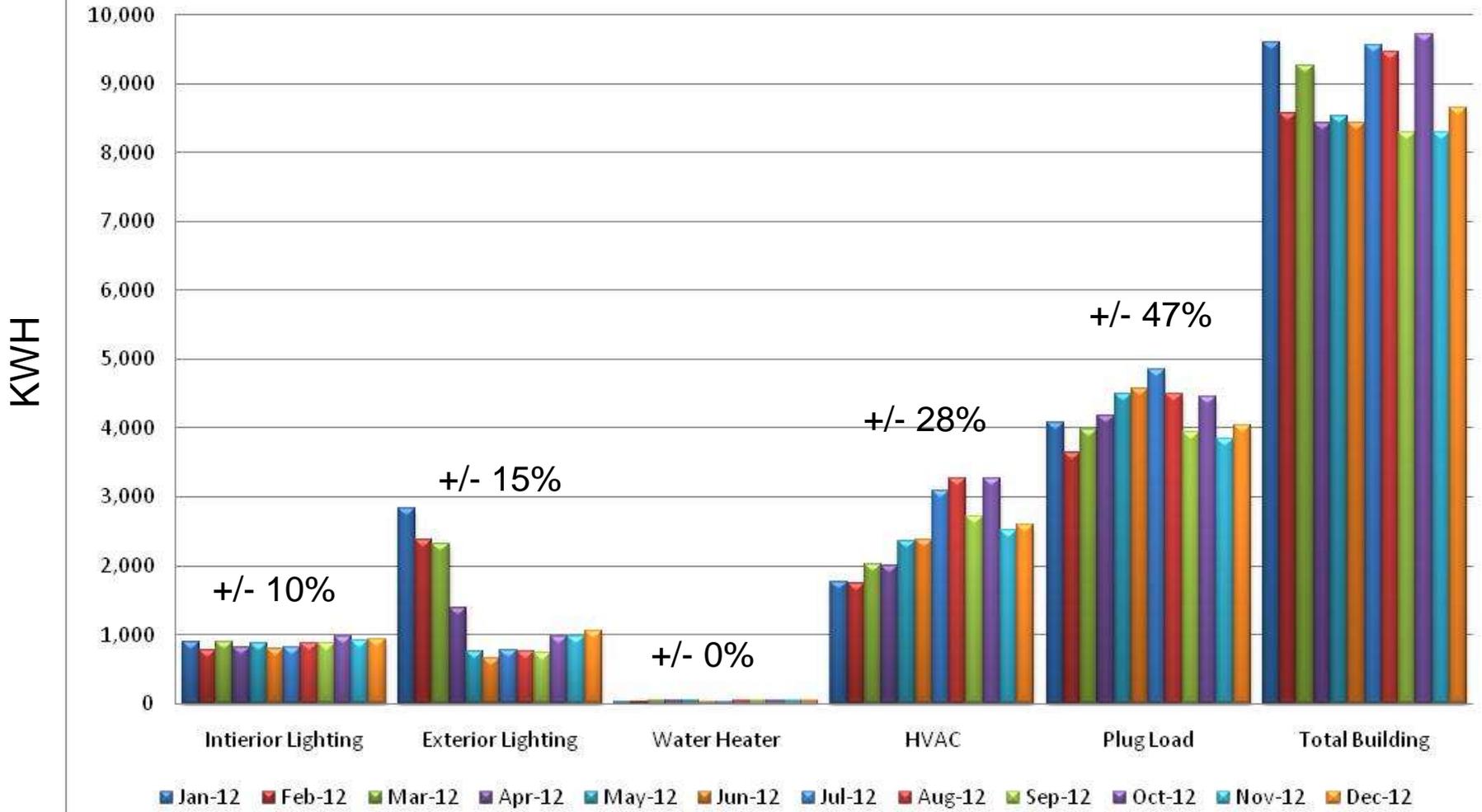
- Switched out the standard 3 hot plate coffee maker with Eco version insta hot
 - Reduced energy consumption by 91%



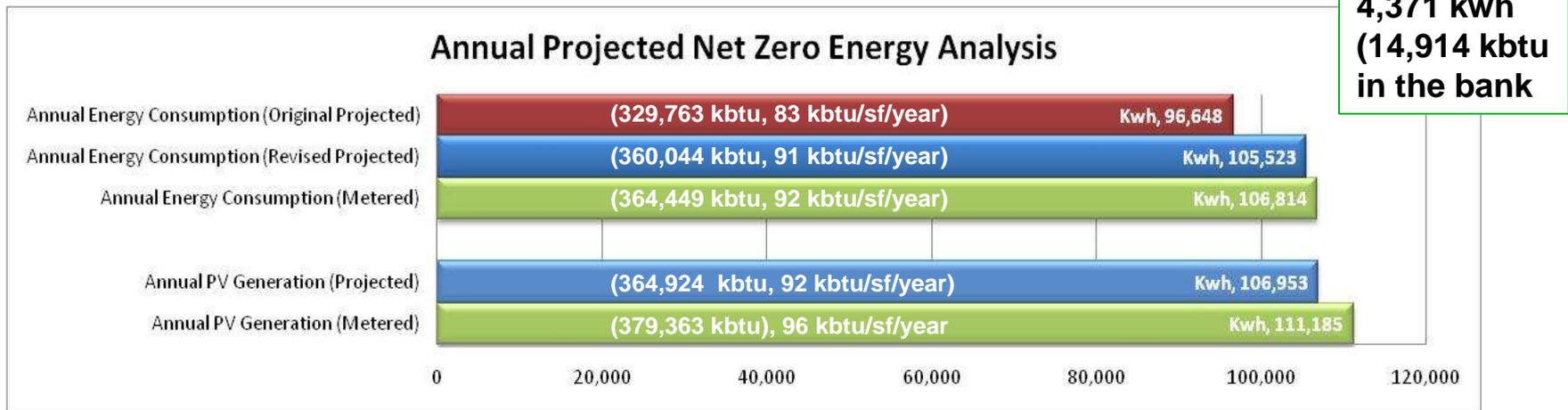
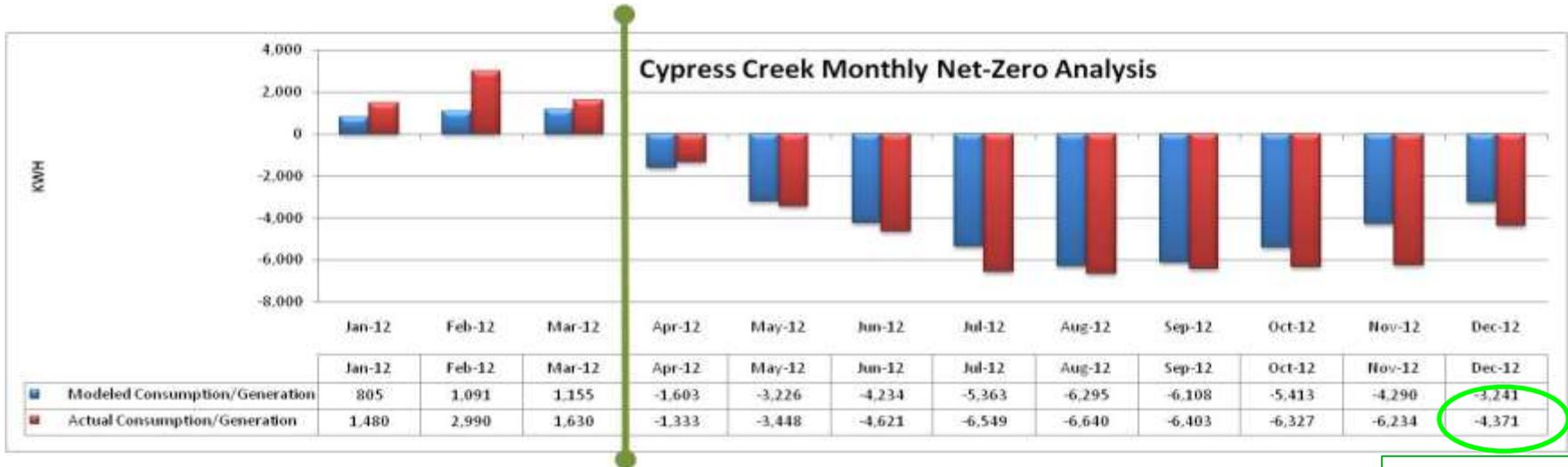
Monthly Data Tracking



Monthly Measurement & Verification data



Net-Zero We made it!!!!



- The current KBTU/SF average of legacy stores is **127.17 KBTU/SF**. This is above the normal baselines because our stores hours and IT requirements

Net-Zero Lessons Learned



- **PV Design -- Without sun we have no power!**
 - **Shading Study** - - A shading study is a critical part of the final design. The study we prepared for Cypress defined a section of the PV field that would be in shade during the winter when the sun is at it's lowest point. Any portion of a PV field connected to one single inverter that is subjected to shade can disrupt power generation for the whole specific field. We resolved the issue by isolating the specific PV panels and installing micro-invertors, separate invertors for each panel.

- **Interconnection Agreement – Buy in by the utility**
 - **Utility** – In order for the utility to account for any on-site power generation an agreement must be completed. Most utility companies will install a net-meter (Bi-directional meter).

- **PV Disconnect – Don't back-feed the system**
 - Most utilities require a separate PV disconnect located on the exterior of the building. The utility is concerned with a possible back-feed onto the grid when the power is off.

- **PV Circuit Alarm - - Need to keep the system running**
 - Need to alarm the PV electrical circuit, if the breaker trips, no one will notice. A tripped PV circuit will not impact the building operations, but the renewable energy will be shut down.

- **Customer Facing Renewable Energy LCD – It's all in the inverter**
 - SMA inverters come with a built in software package



Net-Zero Lessons Learned



- **Plug Loads** - Understand your true plug load, do not rely on rule of thumb calculations

- **Measurement & Verification** – Detailed measurement and verification plan for a net-zero building must to be defined along with the design documents. General goal is to read total building KWH consumption compared to Total building generation.
 - **Installation of bi-directional power meter** - - Monitor point needs to be able to read both consumed and generated KWH. Monitor must capture any generated KWH that is fed directly into the stores panel, this power bi-passes the net meter and is not accounted for by the utility.
 - **Installation of 3 additional meters to measure the Daikin system (Air handlers) kWh consumption** - - Must capture all consumed KWH in the building.

- **Commissioning** – With new technology comes a learning curve. Critical part of a net-zero building is to eliminate all unnecessary KWH consumption.
 - **AAON airflow station** - - As part of the final control set up we found that a built in controller from a dehumidification unit was not connected to the BMS system.
 - **Daikin Fan Coil Units** – The system is running the FCUs 24/7, as opposed to running per our BMS schedule. Resolution required coordination from the Engineer, the manufacturer and the contractor.
 - **Lighting** - - During commissioning it was discovered that the "pole lights" circuit has a 25 amp breaker, but it is drawing 27 amps. Breaker was changed to 35 amp breaker

Customer Impact



I am delighted to report that in three short weeks we can proudly say we have had the best results for a Denovo pre and post GO.

The Net-Zero initiative has supported us in this success. We see an average of 75 fans a day and hold an engaged conversation about our Net-Zero initiative with 25.

On my business calls two out of five clients have prior knowledge of our Net-Zero initiative.

We also had fans share that they have been inspired to engage in a green initiative at home whether it be installing rain capture/filtration system or using native species for landscaping.



Questions



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