Mayor's Power Line Undergrounding Task Force

Betty Ann Kane
Chairman
Public Service Commission of the District of Columbia
1333 H Street, NW
Washington, DC 20005

August 23, 2012

History of the DC Public Service Commission

- Independent Home Rule Charter agency
- Created by Congress in 1913 to regulate gas, electric, telephone, common carriers
- Two Commissioners and Chairman appointed by the Mayor with the advice and consent of the D.C. Council
- Staggered four year terms

DC PSC Commissioners

Betty Ann Kane

Lori Murphy Lee

Vacant

Seat

The Commission functions as a quasi-judicial body

- Issues orders
- Makes rules
- Conducts investigations

Mission

- To promote the availability, reliability, affordability and quality of energy and telecommunication services. We also promote the provision of utility services that are safe, universally available & foster economic development.

This is done by:

- Protecting consumers by ensuring public safety, reliability, and quality services;
- Regulating monopoly services to ensure their rates are just and reasonable;
- Fostering fair and open competition among service providers;
  Resolving disputes among consumers and service providers; and
- Educating consumers and informing the public.

THE SHAW PRESENTATION

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Briefing on the Study of the Feasibility and Reliability of Undergrounding Power Lines in the District of Columbia in

Formal Case No. 1026

Shaw Consultants International, Inc.

September 30, 2010

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Shaw Consultants International Inc.

- Kathy Kelly – Responsible Officer
- Phil DiDomenico – Project Manager
- Dick Yanco – Technical Project Lead

Project Purpose and Objectives

- Purpose
  - Study the economic and technical feasibility, and reliability implications of undergrounding power lines in the District of Columbia
- Objectives
  - Provide a comprehensive review and analysis of previous undergrounding studies and enhance Pepco efforts to date
  - Provide costs and reliability expectations for selected undergrounding alternatives to the existing overhead distribution system
  - Address barriers to undergrounding including costs, reliability, environmental concerns, economic disruption, etc., and how to overcome them
  - Develop and analyze the cost and reliability implications of undergrounding alternatives for the delivery of energy to customers in Washington, D.C.

Project Scope

- Task 1 - Project Initiation
- Task 2 - Review Previous Pepco Studies and Other Undergrounding Studies and Practices
  - Study focus
  - Methodologies
  - Findings
- Task 3 - Analyze Pepco System, Costs, and Reliability
  - Review Pepco outages and reliability methodology
- Task 4 - Feasibility of Undergrounding Existing Lines
  - Offer and evaluate alternative undergrounding strategies
- Task 5 - Potential Impacts and Costs of UG
  - Include environmental, residents and visitors, businesses, infrastructure, transportation, and means of overcoming them

Key Definitions

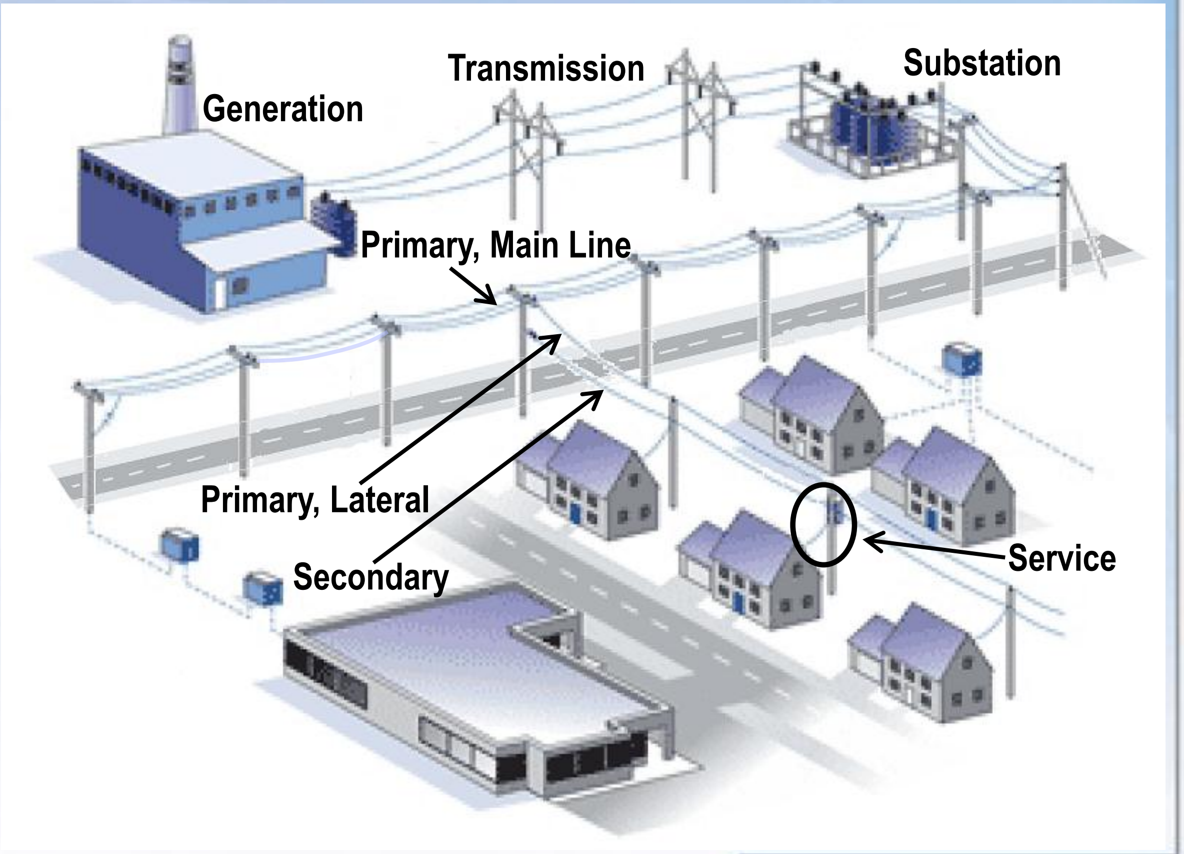
- **Circuit-Mile** is used to represent the geographic distance of a feeder regardless of number of conductors involved, i.e. single versus three phase
- **SAIFI** is the total number of customer interruptions divided by the total number of customers served
- **SAIDI** is the sum of all customer interruption durations divided by the total number of customers served
- **CAIDI** is the sum of all customer interruption durations divided by the total number of customer interruptions
- A **Circuit** or **Feeder** refers to all of the equipment associated with providing electric distribution service from the substation to the customer
- **Typical Feeder** means those with similar SAIFI statistics, tree density, and construction characteristics to the non-zero average SAIFI of all feeders
- The **Composite Performance Index (CPI)** takes into account factors such as number of interruptions on a feeder, outage hours, system average interruption frequency and duration

The Electric System…

- Electricity travels from a power plant over high-voltage transmission lines to substations. At a substation, the electricity voltage is lowered so that it can travel over the distribution system via primary lines. Transformers further reduce the electricity voltage so it can be used by the home or business. Secondary and service lines carry electricity to the home or business

D.C. System

- ✓ 160,000 customers supplied via underground system
- ✓ 80,000 customers supplied via overhead system
- ✓ 660 circuit–miles of overhead
- ✓ Customers impacted by outages during 2008 were related to:
  - Overhead System: 112,345 customers
  - Underground System: 97,650 customers
  - Other: 49,593 customers



Note: Illustration is based on "Pepco, Summer Storms – July, August 2010" presentation, with modifications.

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Task 2 - Feasibility of Undergrounding Report – DC PSC

STATE UNDERGROUNDING POLICIES AND PRACTICES

Review UG Studies and State Mandates

- Reviewed:
  - Nationwide Undergrounding (UG) studies
  - State mandates & practices
  - Pepco studies to date
- Review focused on the following key factors:
  - Decision criteria
    - Reliability improvement, storm hardening, aesthetics, cost
  - Scope
    - Primary, secondary, system-wide
  - Level of detail
    - Order of magnitude vs. detailed engineering estimates
  - Degree of implementation to-date
  - Cost recovery mechanisms

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Summary of Findings – UG Studies

- Reviewed 16 reports from 8 states, dating from 2000 through 2009
- Four main issues were addressed
  - Estimating the cost of undergrounding
  - Identifying the benefits of and drawbacks to undergrounding
  - Assessing reliability implications
  - Identifying potential sources of funding

UG Studies Examined

Year	State	Report Title	Estimated Cost per Circuit-Mile	Study Driver	Study Methodology
Ongoing	MO	Project Power On	N/A	UG program	Targeted UG with initial $300 million investment budget; investment is prioritized to complete lowest cost projects first
2009	TX	Cost-Benefit Analysis of the Deployment of Utility Infrastructure Upgrades and Storm Hardening Programs	N/A	Costs & Benefits of Storm Hardening	Reviewed utility cost data, hurricane simulation model
2008	OK	Inquiry into Undergrounding Electric Facilities	$1.5 million for mainline, $0.5 million for lateral	Cost & Reliability	Reviewed previous studies, interviewed utility and government staff, collected utility data
2008	FL	Infrasource Study Phase 3: Modeling	N/A	Model future costs & benefits	Developed model for calculating costs
2007	FL	Infrasource Study Phase 2: Case Studies	$400,000 to $1.6 million	Costs & benefits of completed projects	Review of actual costs and benefits for four UG projects
2007	FL	Infrasource Study Phase 1: Literature Review	N/A	Cost	Review of previous studies
2006	FL	Cost Effectiveness of Undergrounding Electric Distribution Facilities in Florida	$1.1 million	Cost - effectiveness	Includes qualitative benefits in study

UG Studies Examined

Year	State	Report Title	Estimated Cost per Circuit-Mile	Study Driver	Study Methodology
2006	Multiple	Out of Sight, Out of Mind (commissioned by EEI)	$1 million	Costs, benefits, reliability	Review of Previous Studies
2005	NY	Review of Undergrounding Policies and Practices	N/A	Nationwide Policies	Review of Previous studies and LIPA system
2005	FL	Preliminary Analysis of Placing Investor-Owned Electric Utility Transmission and Distribution Facilities	N/A	Cost	Updated undergrounding costs based on a cost estimate from 1991
2005	VA	Virginia Corporation Commission	N/A	Feasibility, Costs, Funding	Developed costs and benefits
2004	MD	Hurricane Isabel Response Assessment	N/A	Reliability	Investigation of storm preparedness and restoration
2003	MD	Maryland Task Force to Study Moving Overhead Utility Lines Underground	N/A	Cost	Evaluated costs and funding alternatives
2003	NC	Statewide Undergrounding Study	N/A	Cost	Developed estimate of undergrounding
2002	NC	A Five-year Survey of Underground and Overhead Reliability Comparisons for North Carolina (1998-2002)	N/A	Reliability	Investigated frequency and duration of outages for both OH and UG
2000	MD	Maryland PSC	$1 million	Reliability	Compared reliability of OH feeders with UG feeders
1998	Australia	Putting Cable Underground Working Group	N/A	Feasibility, Cost, Regulatory	Public finance principles, benefits, assessment of funding options, avoided cost model

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Ongoing UG Efforts

- Anaheim, CA experience
  - Anaheim is 19 years into a 50 year UG project, placing sub-transmission and primary distribution lines underground along existing major transportation corridors
  - Goals of the Anaheim UG
    - Improve aesthetics
    - Reduce outages
    - Reduce tree trimming costs
    - Increase property values
- Florida
  - A few municipalities in Florida are moving ahead with focused undergrounding projects approved to address both aesthetics and perceived storm reliability benefits
  - A tariff has been established that allows customers to pay the incremental cost of undergrounding.

Pepco Undergrounding Studies

- Chronology of Commission-mandated studies
  - 2004 report on the feasibility of removing pre-existing lines and relocating underground
  - 2006 report on the feasibility of undergrounding above ground utility lines
  - 2007 response to Commission Order #14209 – Reliability of Undergrounding

2004 Pepco UG high level cost estimate → 2006 Pepco UG detailed cost estimate → 2007 Pepco Reliability Study

- Each study added more information to the record in FC 1026

UG Studies – Lessons Learned

- Reliability improvement data is limited, but a typical conclusion reached is that the reduction in frequency of overhead outages is counter-balanced by increases in duration of underground outages
- TX and OK studies concluded that targeted UG can be cost-effective
  - A targeted approach would combine aggressive vegetation management, storm hardening of key outage-prone equipment and limited undergrounding of key circuits
- No study concluded that the quantifiable benefits provide justification for the increased costs of undergrounding existing overhead facilities on a system-wide basis
- Methodologies primarily focused on developing initial cost estimates of UG, with limited evaluation of overall benefits and resulting cost-effectiveness

UG Studies – Lessons Learned (cont'd.)

- Undergrounding costs were found to range significantly depending on vintage, construction, topography, and congestion
- Large scale undergrounding of existing overhead facilities is an expensive proposition
- Cost recovery mechanisms studied included:
  - Conventional rate base methodology
  - Rate surcharge for all customers for a fixed number of years
  - Incremental cost to UG new residential developments paid by affected customers and/or developer

State Policies & Practices - Lessons Learned

- Survey of 50 State Public Service Commissions
  - None of the 40 responding commissions presently require undergrounding of <u>existing</u> power lines
  - Six states (including DC) require undergrounding of distribution lines for all <u>new</u> residential subdivisions
    - Arizona, Maryland, DC, Michigan, New Jersey, and New York
  - In addition to these six states, municipal entities in six other states are requiring undergrounding in <u>new</u> residential subdivisions
    - Missouri, New Mexico, Nevada, Utah, Washington State, and West Virginia
    - In most cases, incremental cost of UG is being paid by customer that benefits and/or developer
  - In some locations, such as Florida, Hawaii and other coastal areas, undergrounding is proceeding based on storm related reliability concerns, aesthetics and benefits to tourism
  - Several Commission staff report that undergrounding becomes an issue after a major storm event, but it is less of an issue once the high cost of undergrounding is determined

Task 3 - Feasibility of Undergrounding Report – DC PSC

RELIABILITY AND COST IMPLICATIONS

Reliability Impact Methodology

- Shaw Consultants developed a methodology to demonstrate a correlation between the different types of construction characteristics (overhead vs. underground) and outages, to expand upon Pepco's efforts
  - Selected 10 typical performing distribution feeders based on the 2008 SAIFI and CPI performance data supplied by Pepco
    - 5 feeders were selected based on SAIFI & 5 were based on CPI
  - Reviewed 5 years outage event history for each feeder
    - Overhead vs. Underground
    - Primary vs. Secondary
    - Non-Storm vs. Storm
  - Calculated outage frequency on a per circuit mile basis
  - Calculated average outage duration (CAIDI)
- This approach was used to derive the <u>expected</u> overall reliability improvement, on a District-wide basis, from undergrounding the existing overhead feeders

Ten Typical Circuits Selected

- Identified five average feeders in 2008 based on SAIFI
  - Average SAIFI of all feeders with outages, excluded feeders with no outages
  - The average SAIFI for reporting year 2008 for feeders in the District with outages was 1.26 outages per year
  - Five feeders that had a SAIFI nearest to 1.26 were selected, making sure to include a cross section of assets
    - 2 feeders are primarily overhead (approximately 97%)
    - 1 feeder is 100% underground
    - 2 feeders are a combination of overhead and underground.
- Identified five average feeders in 2008 based on CPI
  - Utilized Pepco's CPI sorting and prioritization system to identify candidates for the Worst Performing Feeders (WPF) in the system
  - The median of the CPI scores was calculated and feeders in the vicinity of that median score were selected,
    - 2 underground feeders (one 100% underground and the other 91% underground)
    - 3 mixed feeders, two predominantly overhead and one predominantly underground
- In total, the ten typical circuits included 4,385 overhead customers and 1,262 underground customers – the DC area, in total, includes approximately 80,000 overhead customers and 160,000 underground customers, including the network system

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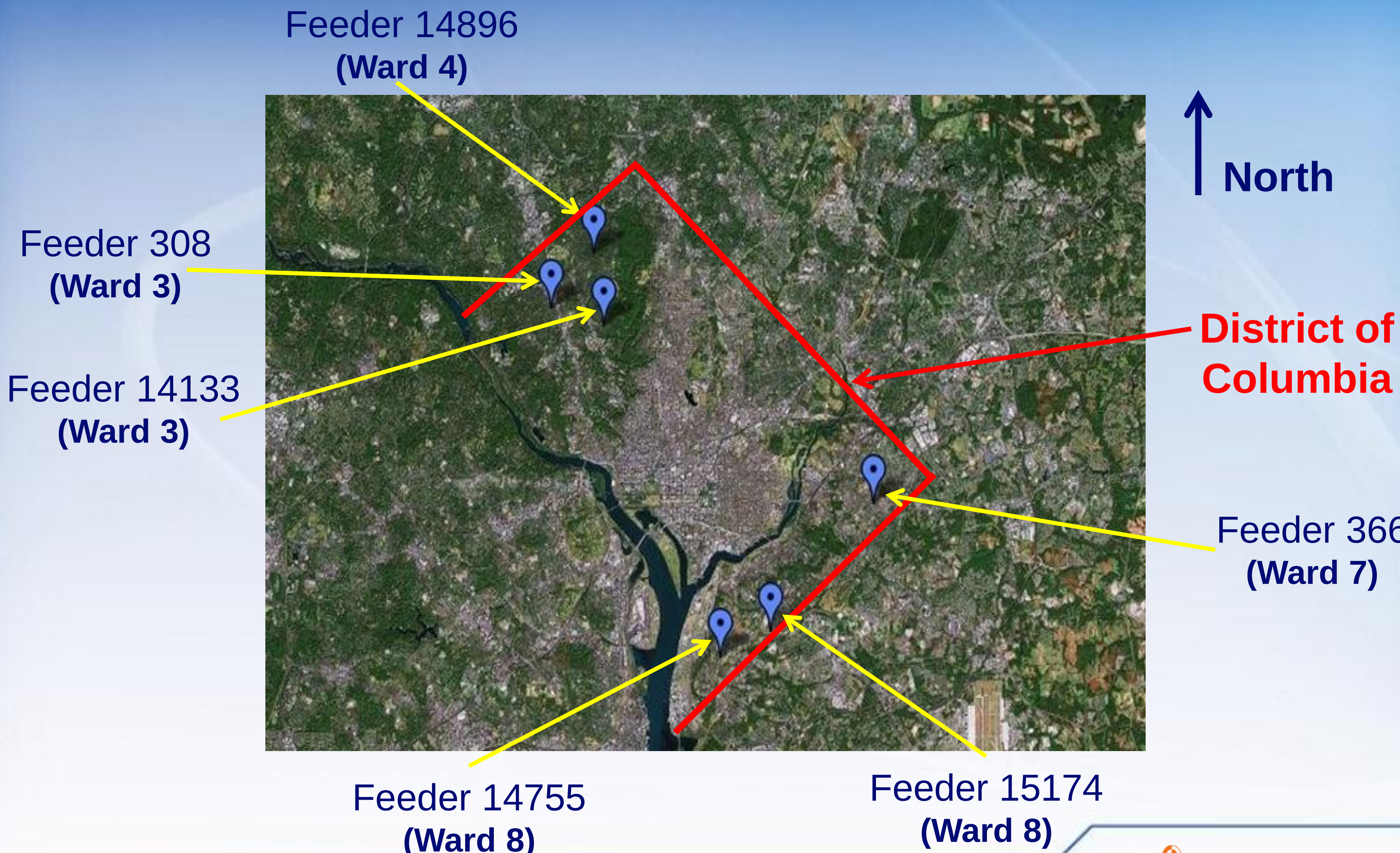
Locations of the Six Primarily OH Typical Circuits

(selected on the basis of outage history and tree density)



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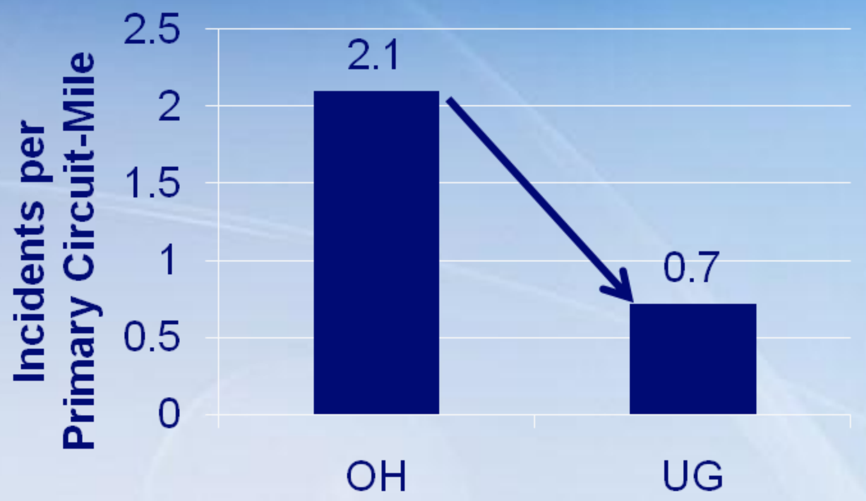
Expected Reduction in Outage Incidents per Circuit-Mile After Converting OH to UG

- ✓ Undergrounding the OH Primary alone provides 93% of the benefit associated with undergrounding
- ✓ Undergrounding the OH Secondary provides only an incremental 7% improvement



	OH Customers Affected 2004-2008, Ten Typical Circuits	Outage Incidents per Circuit-Mile			Incremental Improvement
		OH	UG	Change	
Combined (Primary and Secondary)	54,063	2.9	1.4	-1.5	100%
Primary (Mainline and Lateral)	**53,792**	**2.1**	**0.7**	**-1.4**	**93%**
Secondary	271	0.8	0.7	-0.1	7%

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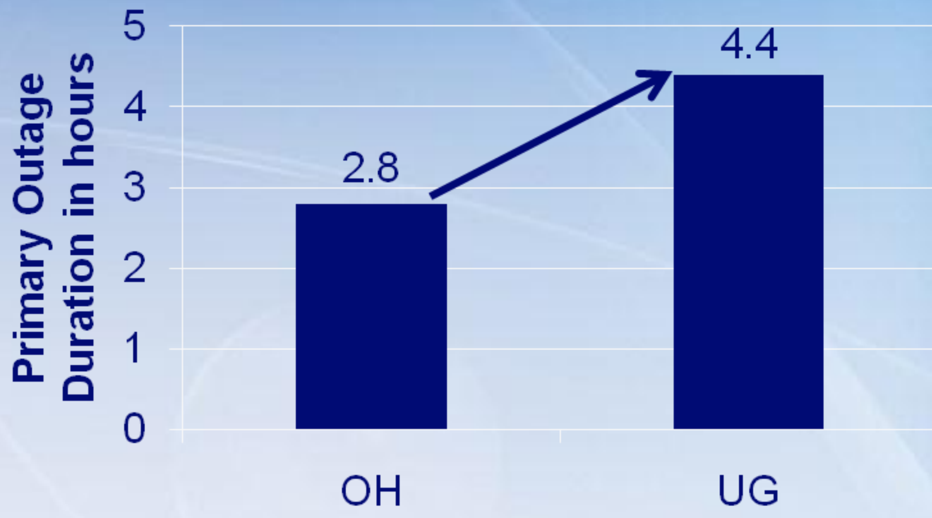
Expected Increase in Outage Duration after Converting OH to UG

- ✓ Consistent with industry experience, this analysis indicates fewer outages with longer durations would be expected
- ✓ Increases the duration of non-storm outages (CAIDI) by 1.6 hours, or 96 minutes, or 58% per incident
- ✓ These CAIDI values do not reflect any potential improvements due to adoption of Smart Grid technologies



	Non-Storm Outage Duration (Hours)			Increase
	OH	UG	Change	
Primary (MainlLine and Lateral)	**2.8**	**4.4**	**+1.6**	**58%**
Secondary	4.9	5.4	+0.6	11%

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Findings - Reliability

- Significant outage incidents that involve large groups of customers and drive the SAIFI index higher are associated with both the OH and UG ***primary*** assets
- Secondary incidents, while recognized as a great inconvenience for those customers involved, are insignificant in the total numbers of customers affected
- Any significant improvement in the performance of the District feeders will depend on making improvements in the overhead primary distribution system
- Replacement of OH primary with UG primary is estimated to result in a decrease of 1.4 primary outage incidents per circuit-mile
- Duration (CAIDI) for non-storm incidents would increase approximately 1.6 hours, with an average UG primary restoration time in the range of 4.4 hours per outage incident

Estimated Cost to Underground

- In order to compare and contrast Pepco's estimated cost to underground, developed as part of Pepco's 2006 report on the feasibility of undergrounding above ground utility lines, Shaw Consultants developed a cost estimate using the RS Means construction cost database, a national cost database for heavy construction
  - Includes common construction components such as trenching, conduit, concrete, cable and manholes
  - The costs are further adjusted by locality to account for local differences in prevailing wage rates and material costs
  - Shaw Consultants used material quantities provided by Pepco, based on the primary schematic plan for Feeder 14007 as utilized by Pepco, to develop the cost to underground in the 2006 report

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Pepco 2006 Cost Estimate Feeder 14007

Item	Cost ($2006)	Cost per Circuit-Mile
Conduit and Cable	$ 29,806,689	$ 3,211,928
Splice and Manhole	$ 2,009,892	$ 216,583
Switch Manholes	$ 459,453	$49,510
Primary Mainline Total	**$ 32,276,034**	**$ 3.5 million**

Note: Feeder 14007 is 9.28 circuit-miles in length.

Shaw Cost Estimate Summary Feeder 14007

Item	Cost ($2006)	Cost per Circuit-Mile
Primary Mainline		
Cable	$ 1,917,980	$ 206,679
Conduit	$ 14,391,023	$ 1,550,757
Manholes	$ 995,325	$ 107,255
Primary Mainline Subtotal	**$ 17,304,328**	**$ 1.9 million**
Labor Productivity Adjustment	$ 1,854,324	$ 199,819
Engineering	$ 1,360,264	$ 146,580
Permits	$ 76,635	$ 8,258
Removal Costs	$ 153,269	$ 16,516
Project Management	$ 747,187	$ 80,516
Overheads	$ 2,873,798	$ 309,677
Contingency	$ 3,831,730	$ 412,902
Primary Mainline Total	**$ 28,201,535**	**$ 3.0 million**

Note: Feeder 14007 is 9.28 circuit-miles in length.

UG Cost Estimate Comparison

- Shaw Consultants estimated the total cost to underground the overhead primary mainline portion of Feeder 14007 at $3.0 million per circuit-mile, which compares favorably with the original 2006 Pepco estimate (excluding transformer and switch costs)

Basis	Cost per Circuit-Mile ($2006)
Pepco 2006 Estimate	$3.5 million
Shaw Consultants Estimate	$3.0 million
Anaheim Experience	$3.2 million

- In today's dollars ($2010), these costs are estimated to be approximately 25% higher to account for increases in both labor and material costs

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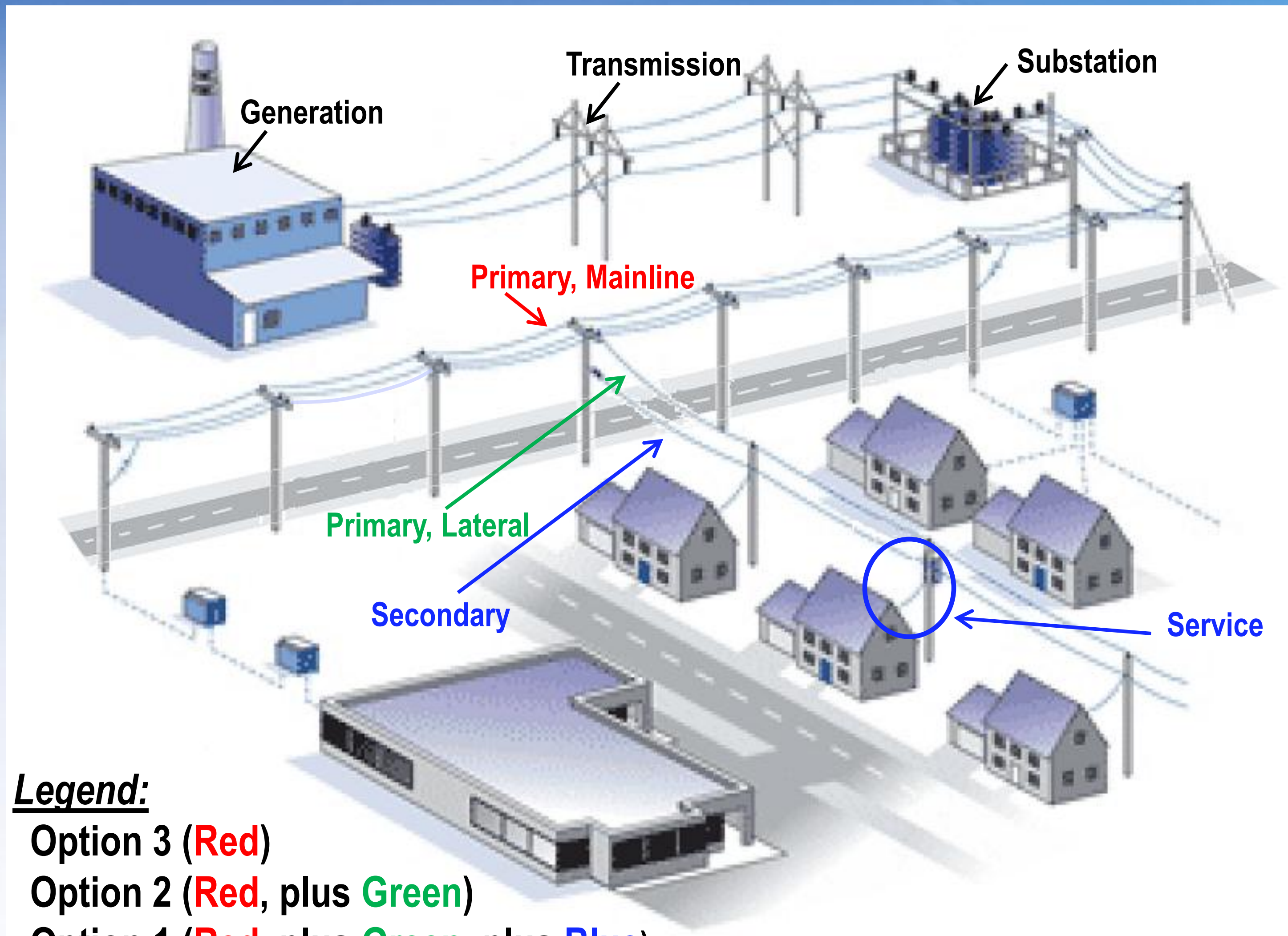
Findings – Cost of UG

- Shaw Consultants' undergrounding cost estimate compares favorably with the original 2006 Pepco estimate of $3.5 million per circuit-mile
- The difference in these cost estimates is not significant given the scope of the project and the typical variations expected when comparing regional averages to specific local experience
- Actual costs of the Anaheim project provides further substantiation to the reasonableness of both the Pepco and the Shaw Consultants estimates

Task 4 - Feasibility of Undergrounding Report – DC PSC

UNDERGROUNDING FEASIBILITY ANALYSIS

District-wide Undergrounding Options Considered



Legend:

Option 3 (Red)

Option 2 (Red, plus Green)

Option 1 (Red, plus Green, plus Blue)

Note: Illustration is based on "Pepco, Summer Storms – July, August 2010" presentation, with modifications.

District-wide Undergrounding Option Implications

Option	Estimated Cost to UG ($2006)	Customers Affected (2008 data)	OH Customer Outages Avoided	Incremental Cost per Customer Affected	Relative Benefits
Undergrounding Mainline Primary (Option 3)	$ 1.1 Billion	73,384	65%	$14,990	Significant reliability improvement; least road-work needed to implement
Undergrounding Mainline Primary and Laterals (Option 2)	$ 2.3 Billion	97,650	87%	$49,452	Additional reliability benefits, almost equal to those of Option 1; addresses 87% of customer outages
Undergrounding All Existing Overhead Assets (Option 1)	$ 5.8 Billion	112,345	100%	$238,176	Slightly increased reliability over Option 2; maximum aesthetic benefits

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Findings – Undergrounding Options

- Undergrounding the Mainline Primary (Option 3) represents the most cost-effective solution if reliability is the number one concern
  - Lowest cost option at $1.1 Billion ($2006) impacting the majority (65%) of customers affected by outages
- If aesthetics are a major driver, UG all overhead assets (Option 1) is the only approach that will eliminate electric distribution related overhead construction and its visual impacts
  - Highest cost option at $5.8 Billion ($2006) incrementally impacting 35% of customers affected by outages
- One way to mitigate the costs but retain a significant portion of the reliability and aesthetic benefits is a targeted approach where overhead assets are replaced on a limited basis based on frequency and duration of outage events
  - Pepco or the Commission could identify “opportunities” for undergrounding, such as infrastructure improvements for other utilities, transportation systems, and road repair

Task 5 - Feasibility of Undergrounding Report – DC PSC

OTHER CONSIDERATIONS OF UNDERGROUNDING

Other Considerations Investigated

Most natural and human impacts from UG are aesthetic and biological, and not directly related to reliability, but may impact cost

- Environmental Impacts
  - Noise
  - Storm water run-off
  - Wildlife
  - Vegetation
- Human & Natural Environment Benefits
  - Impacts on residents and visitors
  - Business and commercial impacts
  - Impacts on road transportation

Environmental Impacts

- Noise
  - Noise impacts are construction related
  - These are short-term in nature and are manageable
- Storm Water Run-off
  - Short-term in nature
  - Limited to transport of sediments
- Wildlife
  - The health of a wildlife population is directly related to the health, diversity, and physical structure of its vegetation
  - UG can lead to an improved natural environment, through an improved tree canopy, which can support a much more diverse wildlife population
- Vegetation
  - Excavation in close proximity can remove 40% of the roots of a tree
  - Street trees develop roots under sidewalks and lawns, not under streets, due to lack of air, compaction of earth
  - Excavation of utility trench in street has little impact, while in sidewalk can have a devastating impact on health of trees
  - UG reduces or eliminates tree trimming, allows for healthier trees

Human & Natural Environment Benefits

- Impacts on Residents and Visitors
  - Improvement in air quality and consequent improvement of health of residents and visitors
  - Construction impacts: noise, traffic and access issues
  - Aesthetic benefit of UG difficult to quantify
  - Increased property values due to improved tree canopy
  - Energy savings through increased shading and wind reduction
- Business and Commercial impacts
  - Construction can result in reduced business for retail establishments due to limited parking and more difficult access
  - Primary benefit is aesthetic, but research has demonstrated that this can improve sales
  - Energy savings through increased shading and wind reduction
- Impacts on Road transportation
  - Reduced motor vehicle accidents

Findings – Other UG Considerations

- Other benefits and costs associated with undergrounding remain difficult to quantify, they include:
  - Environmental Impacts
  - Business impacts of construction
  - Tourist implications of long-term construction in the nation's capital
  - Inconvenience for residents and safety issues
- Adding these costs to the analysis would require significant additional research to put a value on the issues

Feasibility of Undergrounding Report – DC PSC

CONCLUSIONS AND RECOMMENDATIONS

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Summary Recommendations/Observations

- Reliability improvement data is limited, typical conclusion reached is that the reduction in frequency of overhead outages is counter-balanced by increases in duration of underground outages
- TX and OK studies concluded that targeted UG can be cost-effective
  - A targeted approach would combine aggressive vegetation management, storm hardening of key outage-prone equipment and limited undergrounding of key circuits
- No study concluded that the quantifiable benefits provide justification for the increased costs of undergrounding existing overhead facilities on a system-wide basis
- Six states (including DC) require undergrounding of distribution lines for all new residential subdivisions
- In addition to these six states, municipal entities in six other states are requiring undergrounding in new residential subdivisions

Summary Recommendations/Observations (cont'd.)

- None of the 40 responding Commissions presently requires undergrounding of existing power lines
- Several Commission staff report that undergrounding becomes an issue after a major storm event, but is less of an issue once the high cost of undergrounding is evaluated
- Secondary assets have a relatively small effect on the total outage events and duration of the outages that the majority of customers experience
  - Any significant improvement in the performance of the District feeders will depend on making improvements in the overhead primary distribution system
- Shaw Consultants' UG cost estimate compares favorably with the original 2006 Pepco estimate of $3.5 million per mile
  - The difference in these estimates is not significant, given the scope of the project and the typical variations expected when comparing regional averages to specific local experience

Summary Recommendations/Observations (cont'd.)

- Undergrounding the Mainline Primary (Option 3) represents the most cost-effective solution if the number one concern is reliability – this option impacts the majority (65%) of customers affected by outages at the lowest cost of $1.1 billion
  - However, if aesthetics are a major driver, undergrounding all overhead electric distribution related assets (Option 1) is the only approach that has the potential to eliminate all overhead construction and its associated visual impacts, at an estimated cost of $5.8 billion – over five times the cost of Option 3 with an incremental reduction in customers affected of only 35%
- One way to mitigate the costs but retain a significant portion of the reliability and aesthetic benefits is a targeted approach where all overhead assets are replaced on a limited basis based on selection criteria related to frequency and duration of outage events, customers' willingness to pay, and other demographics
- Other benefits and costs associated with undergrounding remain difficult to quantify
  - Adding other environmental costs to the analysis would require significant additional research to put a value on the issues

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UG Studies – Cost Recovery

- A few studies identified potential cost recovery approaches for investment in undergrounding existing facilities
  - The conventional rate base approach
  - Collecting a surcharge from all customers for a specified time frame to fund the increased investment
  - Requiring customers to contribute the incremental cost of undergrounding facilities

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2004 Pepco Feasibility Study

- Summary
  - Methodology focused on developing a high level cost estimate to UG existing OH assets
    - District wide cost to UG was extrapolated from per circuit mile cost estimates based on groups of OH assets by voltage class (e.g. 4kV, 13kV, 34 kV)
  - Study also identified a number of areas of concern related to UG
    - Tree damage, customer property damage, economic losses
  - Estimated $4 billion to UG the existing OH system in the District
- Shaw Consultants' Findings
  - Study was very preliminary in nature
  - High level cost estimate not actionable
  - Could have incorporated more discussion on the benefits of undergrounding

2006 Pepco Feasibility Study

- Summary
  - Methodology focused on developing a more detailed cost estimate
    - Detailed estimate was developed for a single feeder that was then extrapolated to include a total of 15 selected feeders
    - Estimated $1.0 billion to UG 15 selected feeders
      - Selected feeders were based on susceptibility to power outages
      - Utilized actual cost data from the work management information system
      - Obtained actual cost estimates for residential and commercial services from electricians
- Shaw Consultants' Findings
  - Shaw estimates this would extrapolate to $6.2 billion to UG entire existing District OH system
  - Represents a 55% increase over the previous 2004 estimate
  - Could have incorporated more discussion on the benefits of undergrounding

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2007 Pepco Reliability Study

- Summary
  - Pepco prepared a comparison of 5 of the 15 worst performing OH feeders vs. 5 UG feeders of similar construction
  - 5 UG feeders were chosen based on construction characteristics (e.g. numbers of customers, feeder mileage, radial design), not on performance
  - Overall results indicated improvement in reliability
    - 70% improvement in outage frequency (SAIFI)
    - 35% improvement in outage duration (SAIDI)
- Shaw Consultants Findings
  - A greater emphasis on the <u>typical</u> feeder performance would serve to represent the reliability improvement that may be expected District-wide by undergrounding, however, this study can be regarded as a best case scenario

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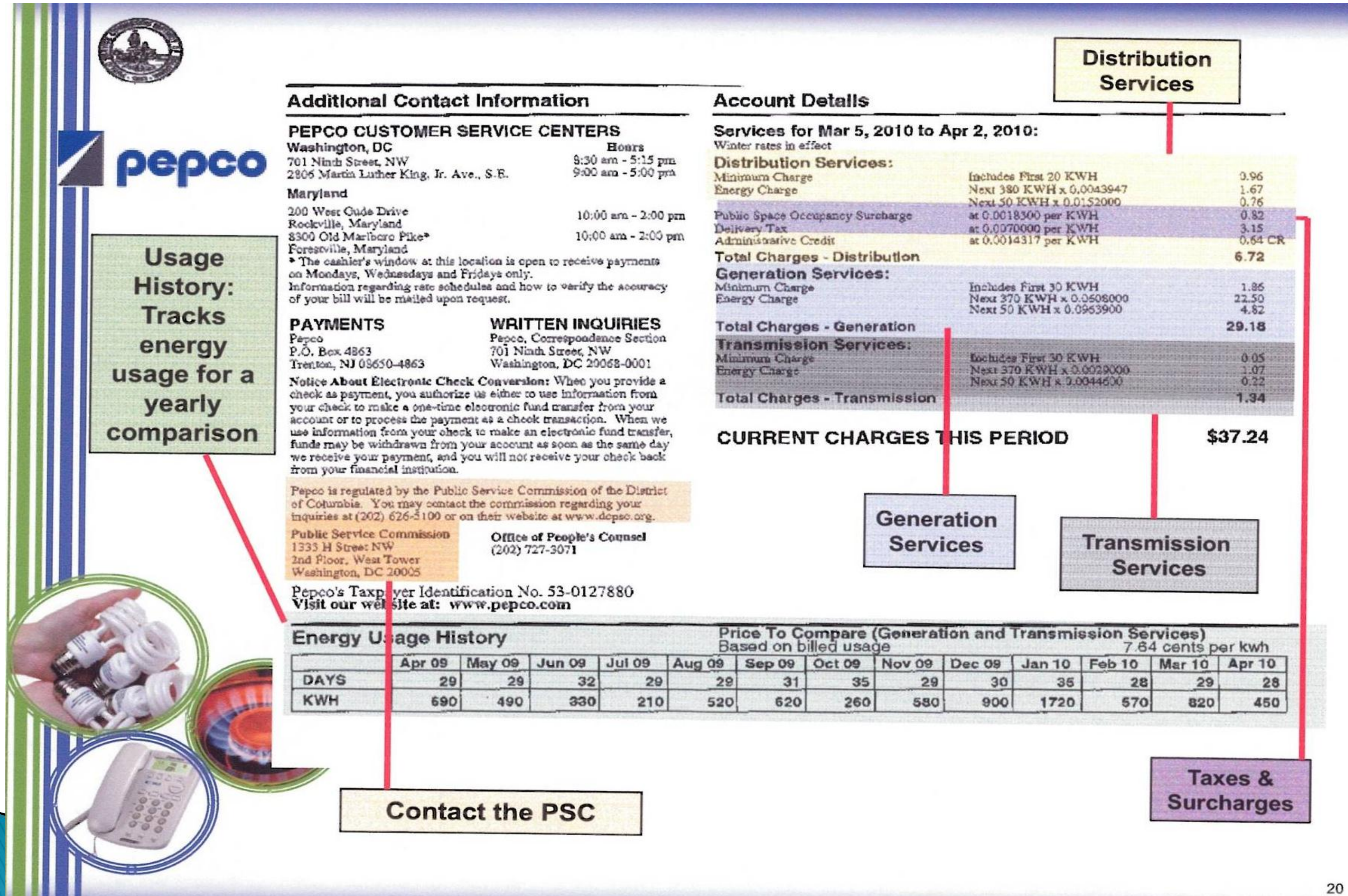
Electric Bill for Residential Customer



Additional Contact Information

PEPCO CUSTOMER SERVICE CENTERS

Washington, DC	Hours
701 Ninth Street, NW	8:30 am - 5:15 pm
2806 Martin Luther King, Jr. Ave., S.E.	9:00 am - 5:00 pm
Maryland	
200 West Gude Drive, Rockville, Maryland	10:00 am - 2:00 pm
8300 Old Marlboro Pike*, Forestville, Maryland	10:00 am - 2:00 pm

* The cashier's window at this location is open to receive payments on Mondays, Wednesdays and Fridays only.

Information regarding rate schedules and how to verify the accuracy of your bill will be mailed upon request.

PAYMENTS
Pepco
P.O. Box 4863
Trenton, NJ 08650-4863

WRITTEN INQUIRIES
Pepco, Correspondence Section
701 Ninth Street, NW
Washington, DC 20068-0001

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Pepco is regulated by the Public Service Commission of the District of Columbia. You may contact the commission regarding your inquiries at (202) 626-5100 or on their website at www.dcpsc.org.

Public Service Commission
1333 H Street NW
2nd Floor, West Tower
Washington, DC 20005

Office of People's Counsel
(202) 727-3071

Pepco's Taxpayer Identification No. 53-0127880
Visit our website at: www.pepco.com

Account Details

Services for Mar 5, 2010 to Apr 2, 2010:
Winter rates in effect

Distribution Services:		
Minimum Charge	Includes First 20 KWH	0.96
Energy Charge	Next 380 KWH x 0.0043947	1.67
	Next 50 KWH x 0.0152000	0.76
Public Space Occupancy Surcharge	at 0.0018300 per KWH	0.82
Delivery Tax	at 0.0070000 per KWH	3.15
Administrative Credit	at 0.0014317 per KWH	0.64 CR
Total Charges - Distribution		**6.72**
Generation Services:		
Minimum Charge	Includes First 30 KWH	1.86
Energy Charge	Next 370 KWH x 0.0608000	22.50
	Next 50 KWH x 0.0963900	4.82
Total Charges - Generation		**29.18**
Transmission Services:		
Minimum Charge	Includes First 30 KWH	0.05
Energy Charge	Next 370 KWH x 0.0029000	1.07
	Next 50 KWH x 0.0044600	0.22
Total Charges - Transmission		**1.34**

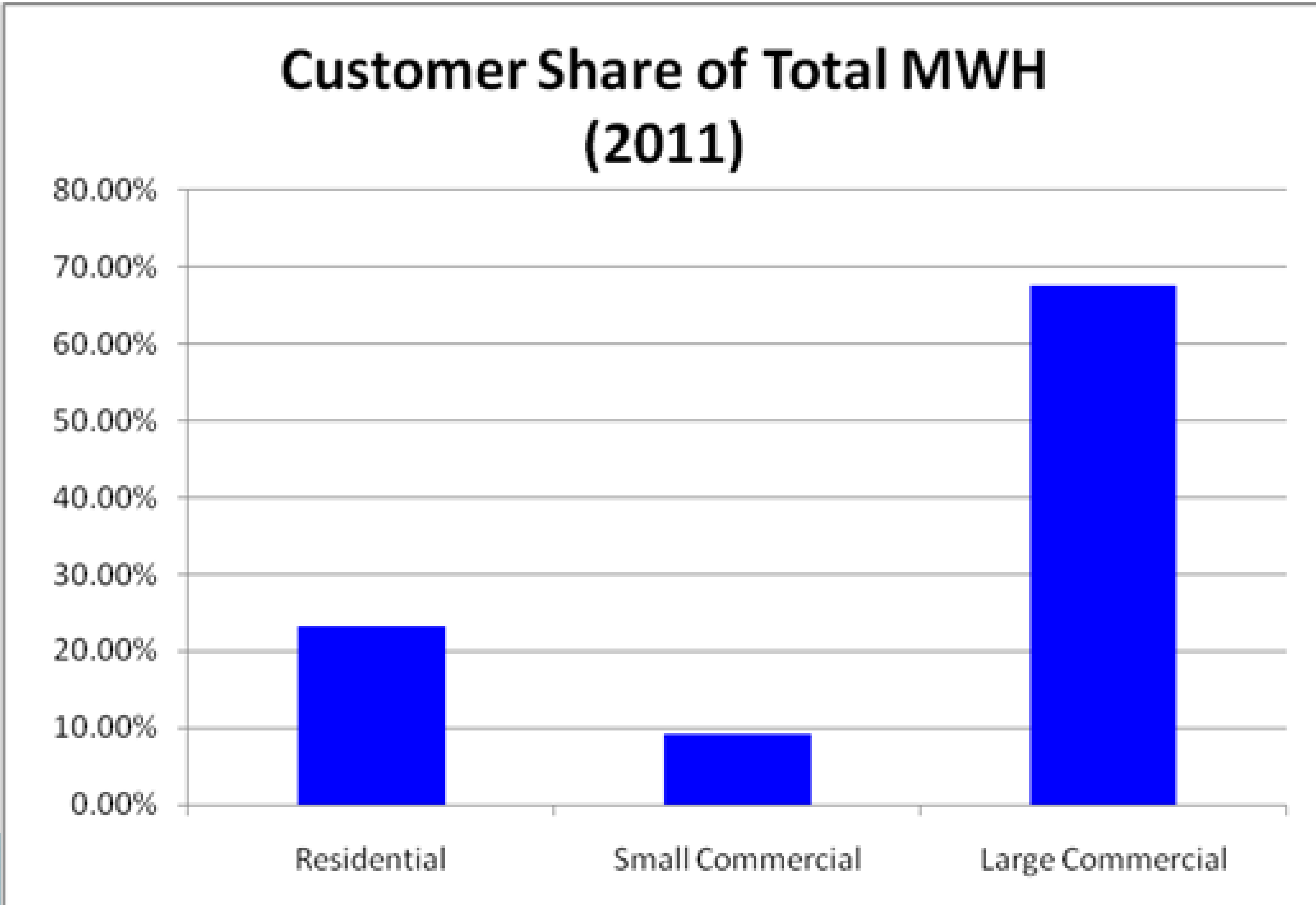
CURRENT CHARGES THIS PERIOD **$37.24**

Energy Usage History

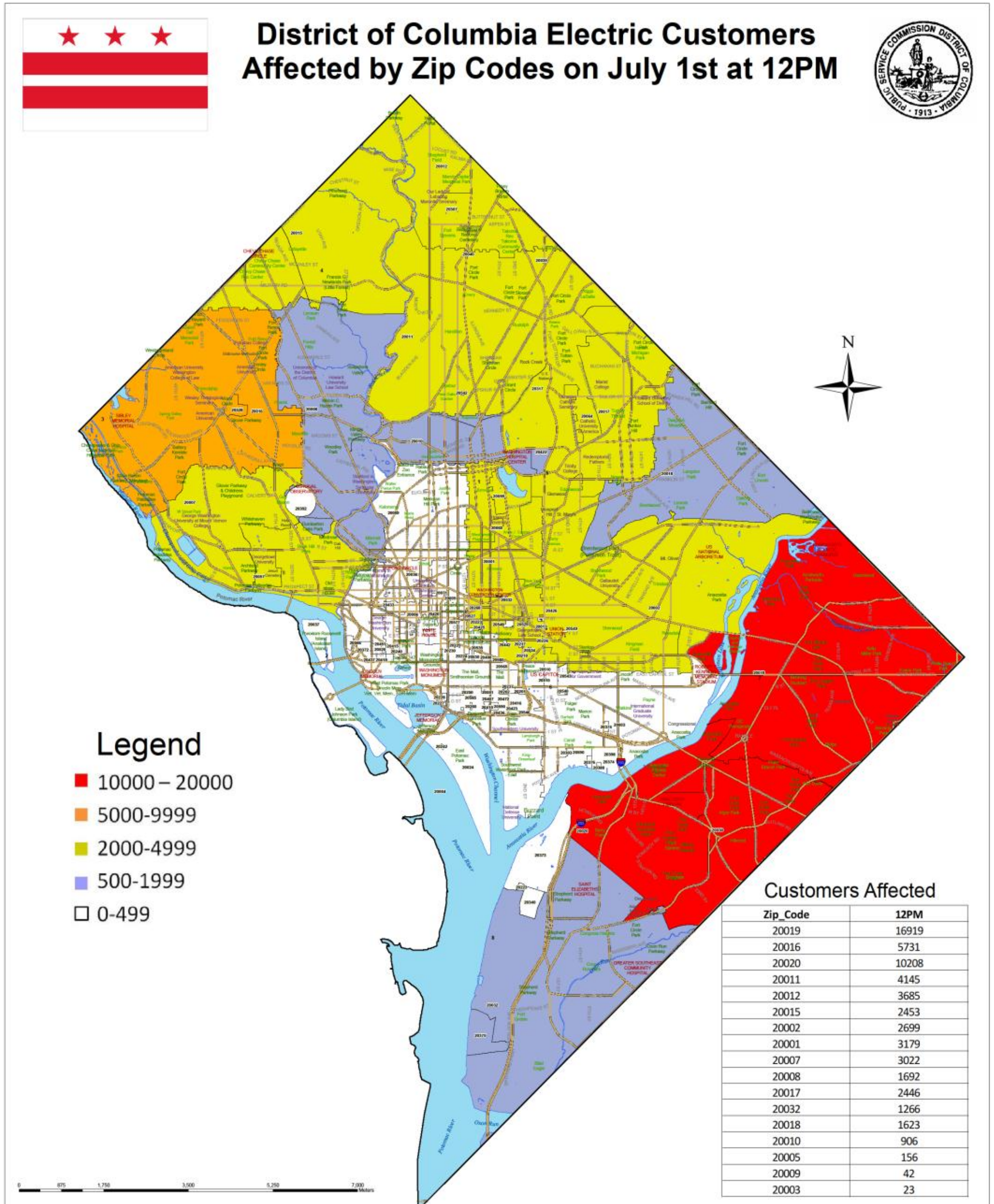
Price To Compare (Generation and Transmission Services)
Based on billed usage 7.64 cents per kwh

	Apr 09	May 09	Jun 09	Jul 09	Aug 09	Sep 09	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10	Apr 10
DAYS	29	29	32	29	29	31	35	29	30	35	28	29	28
KWH	690	490	330	210	520	620	260	580	900	1720	570	820	450

Load Share


Customer Share of Total MWH
(2011)
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Residential
Small Commercial
Large Commercial

District Derecho Storm Map



Customers Affected

Zip_Code	12PM
20019	16919
20016	5731
20020	10208
20011	4145
20012	3685
20015	2453
20002	2699
20001	3179
20007	3022
20008	1692
20017	2446
20032	1266
20018	1623
20010	906
20005	156
20009	42
20003	23

Undergrounding in the Original City

§ 34-1901.01. Additional telegraph and telephone wires prohibited on streets; extensions.

The Mayor of the District of Columbia shall not permit or authorize any additional telegraph, telephone, electric lighting or other wires to be erected or maintained on or over any of the streets or avenues of the City of Washington; provided, that the Mayor of the District may, under such reasonable conditions as he may prescribe, authorize the wires of any electric light company existing on July 18, 1888, and then operating in the District of Columbia, to be laid under any street, alley, highway, footway or sidewalk in the District, whenever in his judgment the public interest may require the exercise of such authority, such privileges as may be granted hereunder to be revocable at the will of Congress without compensation and no such authority to be exercised after the termination of the 50th Congress.

PSC Links

Shaw Report - http://www.dcpsc.org/pdf_files/hottopics/Study_Feasibility_Reliability_Undergrounding_Electric_Distribution_Lines.pdf

Derecho Storm Outage Report - http://www.dcpsc.org/edocket/docketsheets_pdf_FS.asp?caseno=SO02-2012&docketno=2&flag=D&show_result=Y

Service Outage Reports - http://www.dcpsc.org/edocket/docketsheets_pdf_FS.asp?caseno=SO01-2012-E&docketno=8&flag=D&show_result=Y

Undergrounding Programs of Interest

Pennsylvania Public Utility Commission:

http://www.pacode.com/secure/data/052/chapter57/subchapHtoc.html

California Public Utility Commission Rule 20:

http://www.gualalamac.org/Documents/PDF/Underground/Summary%20of%20Undergrounding%20Program%20Process-%20Rev%20%204-27-07.pdf

http://www.pge.com/myhome/customerservice/energystatus/streetconstruction/rule20/index.shtml

San Diego, CA:

http://www.sandiego.gov/undergrounding/documents/ordinance.shtml

The End