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## **Written Statement of Bruce E. Biewald**

U.S. Subcommittee on Energy and Power hearing:  
“Benefits of and Challenges to Energy Access in the 21st Century: Electricity”

Thursday, February 27, 2014

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## **Summary of Major Points**

- Electric utilities make important resource decisions involving a great deal of capital investment. The long lifetimes of these assets—often 50 years or more for conventional power plants—create the need for good planning based on reasonable projections of future prices.
- Environmental regulations—including policies related to carbon dioxide (CO<sub>2</sub>) prices—and fuel prices are two important drivers for electric utility planning.
- It is feasible to estimate future prices for both CO<sub>2</sub> and fuels used in electric generation:
  - Fuel prices are routinely projected and relied on in every utility integrated resource plan (IRP), despite well-known uncertainties and considerable volatility in the recent past.
  - The practice of placing a monetary value on the impacts of CO<sub>2</sub> emissions has become increasingly commonplace in the United States. Utilities can and do project future CO<sub>2</sub> prices, even though they are uncertain.
- My colleagues and I reviewed 88 IRPs released by U.S. utilities in 2012 or later. Of these, 38 IRPs from 33 utilities used non-zero CO<sub>2</sub> prices in the computer modeling used to determine the best generation and transmission investment decisions for the next few decades. The non-zero, public reference case price forecasts for 2025 average \$16.11 per short ton of CO<sub>2</sub> in 2012 dollars.

## **Written Statement**

Good morning members of the U.S. Subcommittee on Energy and Power. My name is Bruce Biewald. I am the President and CEO of Synapse Energy Economics, a research and consulting firm specializing in energy, economic, and environmental topics.<sup>1</sup> The practice of placing a monetary value on the impacts of carbon dioxide (CO<sub>2</sub>) emissions has become increasingly commonplace in the United States. My testimony focuses on the use of a “CO<sub>2</sub> price” in the electricity sector. Written together with several colleagues at Synapse Energy Economics, my November 2013 report, *2013 Carbon Dioxide Price Forecast*, reviews U.S. federal and state policies related to CO<sub>2</sub> pricing, recent modeling efforts used to determine an appropriate price level, and real-world CO<sub>2</sub> price forecasts used in the U.S. electric sector today.<sup>2</sup> I have included this report as a supplement to my written statement.

Electric utilities make important resource decisions involving a great deal of capital investment. The long lifetimes of these assets create a need for good planning based on reasonable projections of future prices. Many utilities must comply with state Integrated Resource Planning (IRP) requirements.<sup>3</sup> Utilities project CO<sub>2</sub> and fossil fuel prices for future years in order to plan for the best resource investment decisions in their IRPs.

The *2013 Carbon Dioxide Price Forecast* reviews CO<sub>2</sub> price forecasts from the most recent IRPs of 28 utilities. For the purposes of this testimony, we have expanded this review. My colleagues and I reviewed 88 IRPs released by U.S. utilities in 2012 or later. Of these, 38 IRPs from 33 utilities used non-

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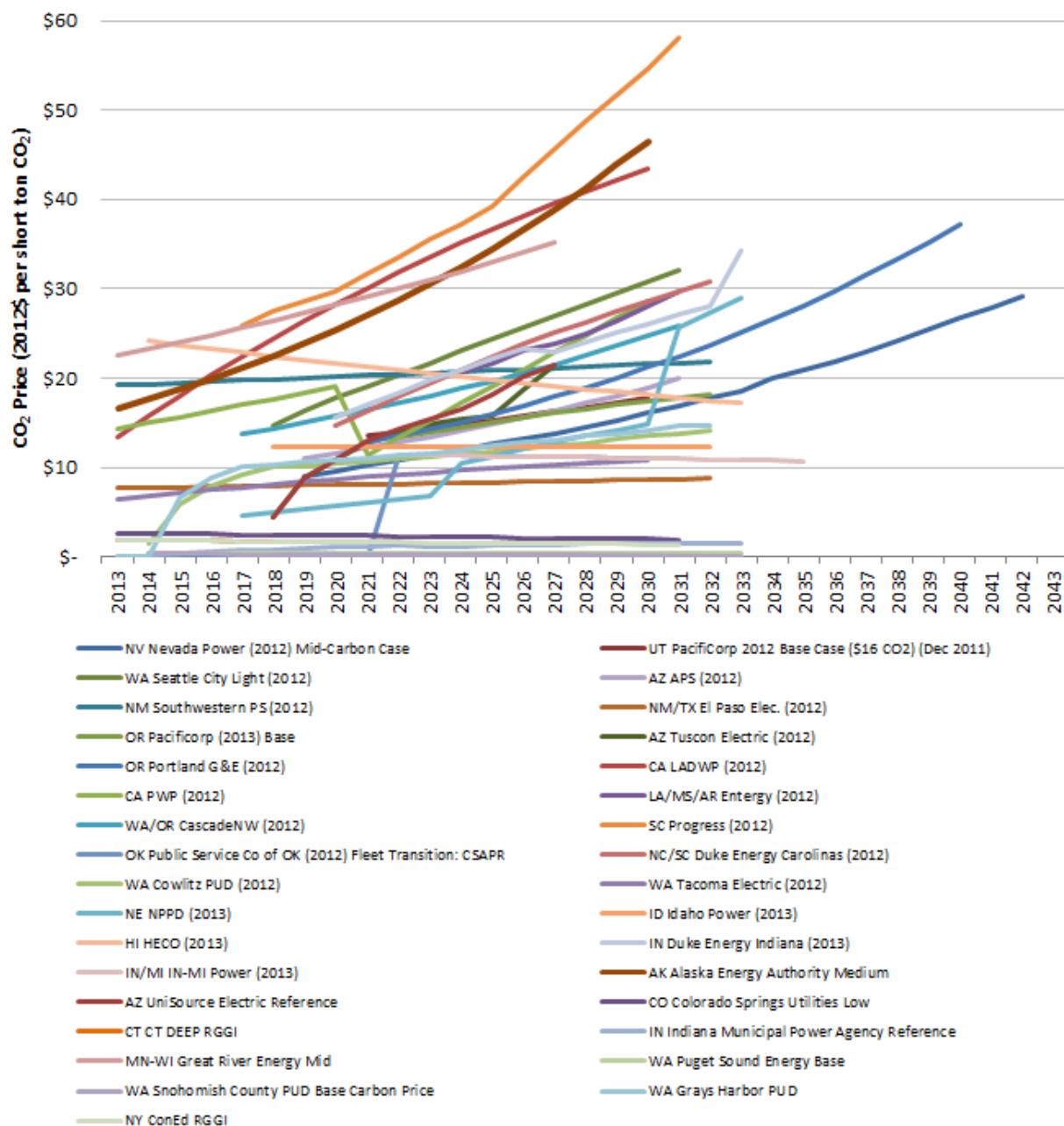
<sup>1</sup> Synapse’s staff of 30 includes experts in energy and environmental economics, resource planning, electricity dispatch and economic modeling, energy efficiency, renewable energy, transmission and distribution, rate design and cost allocation, risk management, cost-benefit analysis, environmental compliance, climate science, and both regulated and competitive electricity and natural gas markets. Our clients include public utility commissions in U.S. states and Canada, offices of consumer advocates, attorneys general, environmental organizations, foundations, governmental associations, public interest groups, and federal clients such as the U.S. Environmental Protection Agency and the Department of Justice. Synapse is located in Cambridge, MA. To be clear, I am not testifying on behalf of any Synapse client.

<sup>2</sup> Luckow, P., E. A. Stanton, B. Biewald, J. Fisher, F. Ackerman, and E. Hausman. November 2013. *2013 Carbon Dioxide Price Forecast*. Synapse Energy Economics.

<sup>3</sup> For more information on state IRP best practices, see: Wilson, R. and B. Biewald. June 2013. *Best Practices in Electric Utility Integrated Resource Planning*. Synapse Energy Economics. Prepared for the Regulatory Assistance Project.

zero CO<sub>2</sub> prices in the computer modeling used to determine the best generation and transmission investment decisions for the next few decades. The “reference case” (also called the central, base case, or business-as-usual case) emissions forecasts used in these utilities’ IRPs are shown in Figure 1.

**Figure 1. 2012 and 2013 electric utility IRP CO<sub>2</sub> price forecasts: reference cases (2012\$ per short ton CO<sub>2</sub>)**



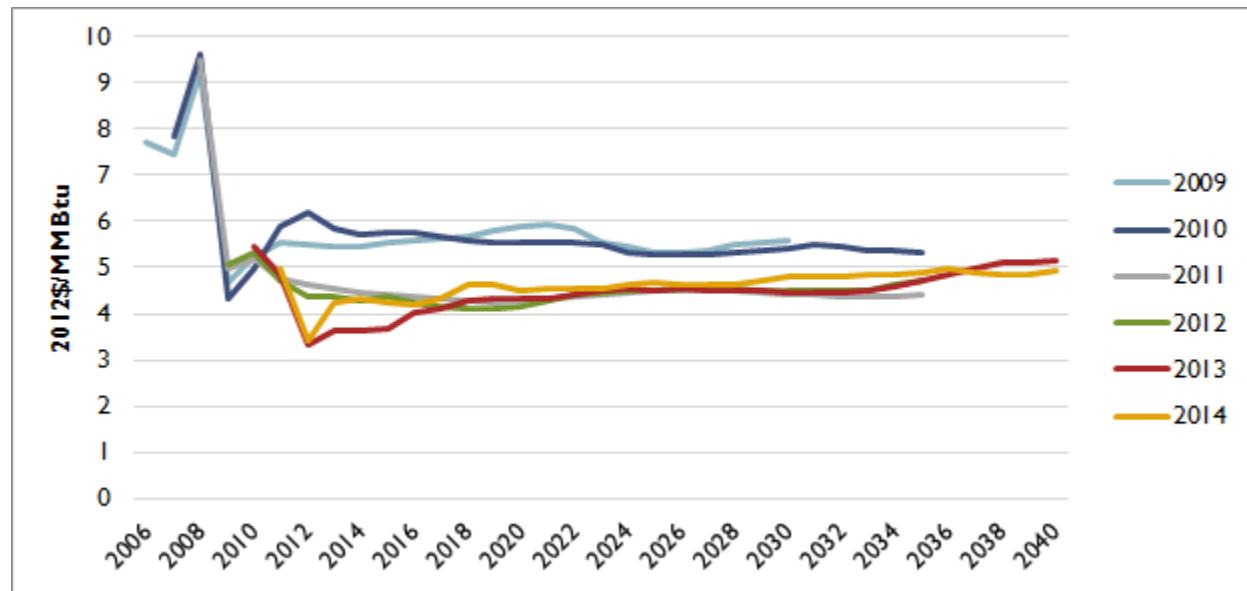
Source: See list of references below

The non-zero, public reference cases that provide a price forecast for 2025 range average \$16.11 per short ton of CO<sub>2</sub> in 2012 dollars.

Utilities can and do project future CO<sub>2</sub> prices, even though they are uncertain. Similarly, utilities project future fuel prices even though they are uncertain. The Energy Information Administration's (EIA's) *Annual Energy Outlook* projects natural gas and other fuel prices approximately 30 years into the future, despite well-known uncertainties and considerable volatility in the recent past. All utilities that develop IRPs use EIA or other fuel price projections in their modeling and planning.

As depicted in Figure 2, there has been a substantial drop (approximately 20 percent) in EIA's natural gas price projections from the 2009 and 2010 forecast vintages to the projections published in 2011 through 2014.

**Figure 2. EIA natural gas price projections in 2012 dollars per million Btu**



Source: Energy Information Administration, *Annual Energy Outlook* (2009, 2010, 2011, 2012, 2013, and Early Release 2014)

Since 2011, EIA has projected that natural gas prices will remain relatively stable through 2040 at roughly \$4.50 per million Btu (in 2012 dollars). At this price, natural gas is expected to be the marginal (price-setting) electric resource for much of the time in most U.S. regions, and stable electricity prices are expected.

Environmental regulations—including policies related to CO<sub>2</sub> prices—and fuel prices are two important drivers for electric utility planning. It is feasible to estimate future prices for both CO<sub>2</sub> and fuels used in electric generation. Fuel prices are routinely projected and relied on in every utility IRP.

### List of References for Figure 1

IRP Label in Figure 1	Utility/Entity	Year of IRP	Source materials available at:
AK Alaska Energy Authority Medium	Alaska Energy Authority	2012	<a href="http://www.akenergyauthority.org/southeastIRP.html">http://www.akenergyauthority.org/southeastIRP.html</a>
AZ APS (2012)	APS	2012	<a href="http://www.aps.com/library/resource%20alt/2012ResourcePlan.pdf">http://www.aps.com/library/resource%20alt/2012ResourcePlan.pdf</a>
WA/OR CascadeNW (2012)	CascadeNW	2012	<a href="http://www.wutc.wa.gov/rms2.nsf/177d98baa5918c7388256a550064a61e/bf967822d7e1b4b688257ad7005e339b!OpenDocument">http://www.wutc.wa.gov/rms2.nsf/177d98baa5918c7388256a550064a61e/bf967822d7e1b4b688257ad7005e339b!OpenDocument</a>
CO Colorado Springs Utilities Low	Colorado Springs Utilities	2012	<a href="https://www.csu.org/CSUDocuments/eirp.pdf">https://www.csu.org/CSUDocuments/eirp.pdf</a>
NY ConEd RGGI	Consolidated Edison	2012	<a href="http://www.coned.com/publicissues/PDF/Integrated%20Long-range%20Plan.pdf">http://www.coned.com/publicissues/PDF/Integrated%20Long-range%20Plan.pdf</a>
WA Cowlitz PUD (2012)	Cowlitz PUD	2012	<a href="http://www.cowlitzpud.org/pdf/2012%20Cowlitz%20PUD%20IR_P%20FINAL%20SUBMITTED.PDF">http://www.cowlitzpud.org/pdf/2012%20Cowlitz%20PUD%20IR_P%20FINAL%20SUBMITTED.PDF</a>
CT CT DEEP RGGI	CT DEEP	2012	<a href="http://www.dpuc.state.ct.us/DEEPEnergy.nsf/c6c6d525f7cdd1168525797d0047c5bf/cb827b1ffa58b2fd85257a1d0060c374?OpenDocument">http://www.dpuc.state.ct.us/DEEPEnergy.nsf/c6c6d525f7cdd1168525797d0047c5bf/cb827b1ffa58b2fd85257a1d0060c374?OpenDocument</a>
CONFIDENTIAL	Dominion	2013	<a href="https://www.dom.com/about/pdf/irp/va-irp-2013.pdf">https://www.dom.com/about/pdf/irp/va-irp-2013.pdf</a>
NC/SC Duke Energy Carolinas (2012)	Duke	2013	<a href="http://www.energy.sc.gov/files/view/Duke_IRP2012.pdf">http://www.energy.sc.gov/files/view/Duke_IRP2012.pdf</a>
NM/TX El Paso Elec. (2012)	El Paso Elec	2012	<a href="https://www.google.com/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=1&amp;cad=rja&amp;ved=0CCkQFjAA&amp;url=http%3A%2F%2Fwww.epelectric.com%2Fdocument%2Fintegrated-resource-plan-2012-2031-7-16-12&amp;ei=h5MCU4KdKKPf0QH48IDoAg&amp;usg=AFQjCNGrWSXGNfgHMuM2knj8JKM3az4_LA&amp;sig2=k7GImNw8CpsloIAMNGvCFA&amp;bv">https://www.google.com/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=1&amp;cad=rja&amp;ved=0CCkQFjAA&amp;url=http%3A%2F%2Fwww.epelectric.com%2Fdocument%2Fintegrated-resource-plan-2012-2031-7-16-12&amp;ei=h5MCU4KdKKPf0QH48IDoAg&amp;usg=AFQjCNGrWSXGNfgHMuM2knj8JKM3az4_LA&amp;sig2=k7GImNw8CpsloIAMNGvCFA&amp;bv</a>

			<a href="#">m=bv.61535280,d.dmQ</a>
LA/MS/AR Entergy (2012)	Entergy	2012	<a href="http://entergy-arkansas.com/content/transition_plan/2012_IRP_Filing_103112.pdf">http://entergy-arkansas.com/content/transition_plan/2012_IRP_Filing_103112.pdf</a>
WA Grays Harbor PUD	Grays Harbor PUD	2012	<a href="https://ghpud.org/index.php?option=com_docman&amp;task=doc_download&amp;gid=175&amp;Itemid=179">https://ghpud.org/index.php?option=com_docman&amp;task=doc_download&amp;gid=175&amp;Itemid=179</a>
MN-WI Great River Energy Mid	Great River Energy	2012	<a href="http://www.greatriverenergy.com/makingelectricity/resourceplan/pdoc295631.pdf">http://www.greatriverenergy.com/makingelectricity/resourceplan/pdoc295631.pdf</a>
HI HE CO (2013)	HECO	2013	<a href="http://www.hawaiianelectric.com/vcmcontent/IntegratedResource/IRP/PDF/IRP-2013-Report-Filed.pdf">http://www.hawaiianelectric.com/vcmcontent/IntegratedResource/IRP/PDF/IRP-2013-Report-Filed.pdf</a>
ID Idaho Power (2013)	Idaho Power	2013	<a href="https://www.idahopower.com/pdfs/AboutUs/PlanningForFuture/irp/2013/2013IRP.pdf">https://www.idahopower.com/pdfs/AboutUs/PlanningForFuture/irp/2013/2013IRP.pdf</a>
IN Indiana Municipal Power Agency Reference	IN Municipal Power Agency	2013	<a href="http://www.in.gov/iurc/files/2013_Indiana_Municipal_Power_Agency_(IMPA) - IRP_Report.pdf">http://www.in.gov/iurc/files/2013_Indiana_Municipal_Power_Agency_(IMPA) - IRP_Report.pdf</a>
IN/MI IN-MI Power (2013)	IN-MI Power (AEP)	2013	<a href="https://www.indianamichiganpower.com/info/projects/IntegratedResourcePlan/">https://www.indianamichiganpower.com/info/projects/IntegratedResourcePlan/</a>
CA LADWP (2012)	LADWP	2012	<a href="https://www.ladwp.com/ladwp/faces/wcnav_externalId/a-p-doc;jsessionid=WMYSS9YYGgHPSsL3bB4cqCTVhyCL63sN5b64p69dWVfdJK8pXCNq!1849933180?_adf.ctrl-state=s9dhn2br9_4&amp;_afrLoop=501163834622451&amp;_afrWindowMode=0&amp;_afrWindowId=null#%40%3F_afrWindowId%3Dnull%26_afrLoop%3D501163834622451%26_afrWindowMode%3D0%26_adf.ctrl-state%3D36wezhize_4">https://www.ladwp.com/ladwp/faces/wcnav_externalId/a-p-doc;jsessionid=WMYSS9YYGgHPSsL3bB4cqCTVhyCL63sN5b64p69dWVfdJK8pXCNq!1849933180?_adf.ctrl-state=s9dhn2br9_4&amp;_afrLoop=501163834622451&amp;_afrWindowMode=0&amp;_afrWindowId=null#%40%3F_afrWindowId%3Dnull%26_afrLoop%3D501163834622451%26_afrWindowMode%3D0%26_adf.ctrl-state%3D36wezhize_4</a>
<i>CONFIDENTIAL</i>	Northern Indiana Public Service Company	2012	<a href="http://www.in.gov/iurc/files/NIPSCO_IRP_Revised-Redacted_1-24-12(1).pdf">http://www.in.gov/iurc/files/NIPSCO_IRP_Revised-Redacted_1-24-12(1).pdf</a>
NE NPPD (2013)	NPPD	2013	<a href="http://www.nppd.com/assets/2013irp.pdf">http://www.nppd.com/assets/2013irp.pdf</a>
NV Nevada Power (2012) Mid-Carbon Case	NV Energy	2012	<a href="https://www.nvenergy.com/company/rates/filings/IRP/NPC_IRP/index.cfm">https://www.nvenergy.com/company/rates/filings/IRP/NPC_IRP/index.cfm</a>
UT PacifiCorp 2012 Base Case (\$16 CO2) (Dec 2011)/OR Pacificorp (2013)	Pacificorp	2012/2013	<a href="http://www.pacificorp.com/es/irp/pip.html">http://www.pacificorp.com/es/irp/pip.html</a>

Base			
OR Portland G&E (2012)	Portland G&E	2013	<a href="http://www.portlandgeneral.com/our_company/energy_strategy/resource_planning/irp.aspx#2013irp">http://www.portlandgeneral.com/our_company/energy_strategy/resource_planning/irp.aspx#2013irp</a>
SC Progres (2012)	Progress Carolinas	2012	<a href="http://www.energy.sc.gov/files/view/ProgressEnergyResource%20Plan2012.pdf">http://www.energy.sc.gov/files/view/ProgressEnergyResource%20Plan2012.pdf</a>
OK Public Service Co of OK (2012) Fleet Transition: CSAPR	Public Service Co. of OK	2012	<a href="http://occeweb.com/pu/PSO%202012%20IRP.pdf">http://occeweb.com/pu/PSO%202012%20IRP.pdf</a>
WA Puget Sound Energy Base	Puget Sound Energy	2013	<a href="http://pse.com/aboutpse/EnergySupply/Pages/Resource-Planning.aspx">http://pse.com/aboutpse/EnergySupply/Pages/Resource-Planning.aspx</a>
CA PWP (2012)	PWP	2012	<a href="http://ww2.cityofpasadena.net/waterandpower/irp/">http://ww2.cityofpasadena.net/waterandpower/irp/</a>
WA Seattle City Light (2012)	Seattle City Light	2012	<a href="https://www.seattle.gov/light/news/issues/irp/docs/SCL_2012_IRP.pdf">https://www.seattle.gov/light/news/issues/irp/docs/SCL_2012_IRP.pdf</a>
WA Snohomish County PUD Base Carbon Price	Snohomish County PUD	2013	<a href="http://www.snopud.com/Site/Content/Documents/custpubs/IRPfinal_012114.pdf">http://www.snopud.com/Site/Content/Documents/custpubs/IRPfinal_012114.pdf</a>
NM Southwestern PS (2012)	Southwestern PS (Xcel)	2012	<a href="http://www.xcelenergy.com/About_Us/Rates_&amp;_Regulations/Resource_Plans/SPS_Integrated_Resource_Plan_2013-2032">http://www.xcelenergy.com/About_Us/Rates_&amp;_Regulations/Resource_Plans/SPS_Integrated_Resource_Plan_2013-2032</a>
WA Tacoma Electric (2012)	Tacoma Electric	2012	<a href="http://www.mytpu.org/files/library/2012-irp.pdf">http://www.mytpu.org/files/library/2012-irp.pdf</a>
AZ Tuscon Electric (2012)	Tuscon Electric	2012	<a href="http://files.shareholder.com/downloads/UNIS/2951310529x0x557199/806B57DB-06CF-4E46-BB16-124E53DCAC74/2012_TEP_IRP_1.pdf">http://files.shareholder.com/downloads/UNIS/2951310529x0x557199/806B57DB-06CF-4E46-BB16-124E53DCAC74/2012_TEP_IRP_1.pdf</a>
AZ UniSource Electric Reference	UNS Electric, Inc	2012	<a href="http://files.shareholder.com/downloads/UNIS/2951310529x0x581799/A94A5E83-D73F-42F9-BDAA-F8685EF134F1/UNSE_2012_IRP_Final_Verson_04-02-2012.pdf">http://files.shareholder.com/downloads/UNIS/2951310529x0x581799/A94A5E83-D73F-42F9-BDAA-F8685EF134F1/UNSE_2012_IRP_Final_Verson_04-02-2012.pdf</a>