PENNVEST

NUTRIENT CREDIT TRADING PROGRAM

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ACES and Ecosystem Markets conference
December 12, 2012
Chesapeake Bay Watershed
Pennsylvania
Basic facts

- The Bay watershed in Pennsylvania includes all or parts of 34 counties.
- There are almost 800 wastewater treatment plants in the Bay watershed, serving almost 100,000 customers, that are likely candidates to purchase credits - some larger systems may purchase as well.
- There are 35,000 farms in the Bay watershed that could potentially benefit from selling credits.
Nutrient Credit Trading

- Problem: wastewater treatment plants face potentially expensive upgrades in order to meet nitrogen and phosphorous discharge limits to comply with Chesapeake Bay requirements

- This effort is aimed at facilitating nutrient credit trades between:
  - wastewater treatment plants, and
  - farming operations

  to foster a less expansive solution for wastewater treatment plants to meet their discharge requirements
Two Approaches to Purchasing Credits

- Over-the-counter bilateral trades
- PENNVEST nutrient credit auctions – focus of this discussion
PENNVEST’S Role

- The fundamental issue inhibiting nutrient credit trades is risk in the nutrient credit market.

- PENNVEST, working with the Pennsylvania Department of Environmental Protection (DEP) and Markit has established itself as the clearinghouse for nutrient credits sales in Pennsylvania. We both buy and sell nutrient credits in order to reduce market risk for participants.
Clearinghouse Summary

- Benefits of purchasing credits through PENNVEST nutrient credit clearinghouse – absolves regulated point sources of:
  - Adhering to regulatory procurement requirements
  - Search costs
  - Negotiation costs
  - Evaluating counterparty credit-worthiness
  - Contract enforcement
- Benefits to credit sellers: can facilitate an increase in demand that makes undertaking credit-generating projects more viable
- Participants free to execute transactions bilaterally & not use PENNVEST
PENNVEST Nutrient Trading Program Website

Nutrient Credit Trading Program (NCT)

**Forward Auction Dates**
- March 21, 2012
- June 13, 2012
- September 12, 2012

**Spot Auction Dates**
- November 9, 2012

NOTICE: Due to the severe weather impacting the Northeastern United States, the November 7th Spot Auction has been rescheduled to November 9th. If you have any questions regarding this notice please contact Robert Roos at rboos@pa.gov or 717-783-4693.

What Is the NCT Program: The Pennsylvania Infrastructure Investment Authority (PENNVEST), working in conjunction with the Department of Environmental Protection (DEP), is hosting auctions for the sale and purchase of nutrient credits in the Susquehanna and Potomac watersheds. PENNVEST’s Nutrient Credit Trading program provides a cost-effective means for regulated public and private waste water treatment plants and other parties to purchase credits to meet their nitrogen and phosphorus discharge limits for the compliance year. PENNVEST will serve as central counterparty and clearinghouse for auction transactions. Credit buyers and sellers will be contracting with PENNVEST thereby reducing risk for buyers and sellers, which in turn should help create a stable nutrient credit trading market in Pennsylvania.

Enroll in NCT Auctions: Market is providing enrollment and eligibility, auctions and registry services to PENNVEST to facilitate these auctions. To access the Market Environmental Registry and Auction select the link:


Additional Information: To read about Auctions Rules and other information about the PENNVEST Nutrient Credit Trading program please select the Documents section on the left navigation under Nutrient Credit Trading. The PENNVEST Nutrient Credit Clearinghouse Rulebook has been revised as of 09/06/2012 to reflect changes in the enrollment process, due to the implementation of an online auction platform, and to further provide additional information on the methodology used to calculate auction results. If you have any questions about the revised Rulebook, please contact Shawn Wiese at swiese@pa.gov or 717-783-6776.
Types of Market Auctions

- Forward auctions for multiyear delivery for certified credits that are certified but not yet verified.

- Spot auctions for verified and issued credits. Currently anticipate holding one spot auction annually during “true-up” period (October- November)
Structural Issues

- Each auction contains separate “sub-markets” defined by:
  - Nutrient - nitrogen or phosphorous
  - Watershed - Susquehanna or Potomac
- Both bids to buy credits and offers to sell credits are accepted simultaneously in any given auction for each sub-market.
- Bids and offers can be either “partial” or “all-or-none”
- Two round, closed bid format. For any sub-market, participation in the second round is contingent on participation in the first round (avoids idle price discovery in round one).
- Each round lasts two hours, during which participants can modify their bids/offers.
- Each round results in final contracts to buy and sell at market clearing prices and quantities
For each sub-market, bids and offers are compared to achieve a market clearing price and quantity. Essentially, arrange bids to buy and offers to sell by price and move up the supply curve and down the demand curve until they cross.

The final price in any sub-market is a weighted (by quantity) average of the last bid to buy and offer to sell.

Over-all goal: maximize fill, i.e. the number of credits exchanged.

Need tie-breaking rules if more than one bid or offer qualifies as the “last”

Greatest difficulty is in dealing with “all or none” bids and offers.
Evidence of financial guarantee

- Letter of credit from qualified bank for payment in event point source defaults without sufficient escrow
- Performance funds / escrow
- Audited financial statements
- Other acceptable evidence
Sell-Side Eligibility Requirements for Forward Auctions

- Evidence of legal title / credit ownership
  - Copy of contract between aggregator & farmer in which farmer attests to owning credits
- Evidence that credits will be generated
  - Copy of DEP certification approval letter & verification schedule
  - Evidence of intent to implement for “contingent-on-sale” or “planned” projects
  - Evidence of permanence
    - Contract length between aggregator & farmer
    - Funds / personnel available to support verification
- Financial guarantee in event of nonperformance if PENNVEST forced to buy credits at higher price than contracted (optional)
  - To be evaluated on case-by-case basis – may depend on quantity offered relative to overall quantity certified
Force Majeure Provisions

Force majeure provisions:

• All parties absolved of contractual commitments if Tributary Strategy invalidated / overturned

• Guarantee for credit sellers that their crediting & eligibility conditions established in certification letter will be valid for length of forward contract with PENNVEST if the Tributary Strategy is not invalidated / overturned
## Auction Example

### Demand for Credits

<table>
<thead>
<tr>
<th>Bidder #</th>
<th>Price (per lb)</th>
<th>Quantity</th>
<th>&quot;All or None&quot; or &quot;Partial&quot;</th>
<th>Cum. Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$10.00</td>
<td>10,000</td>
<td>all/none</td>
<td>10,000</td>
</tr>
<tr>
<td>2</td>
<td>$9.00</td>
<td>25,000</td>
<td>all/none</td>
<td>35,000</td>
</tr>
<tr>
<td>3</td>
<td>$6.00</td>
<td>125,000</td>
<td>all/none</td>
<td>160,000</td>
</tr>
<tr>
<td>4</td>
<td>$5.00</td>
<td>250,000</td>
<td>all/none</td>
<td>410,000</td>
</tr>
<tr>
<td>5</td>
<td>$4.50</td>
<td>200,000</td>
<td>all/none</td>
<td>610,000</td>
</tr>
<tr>
<td>6</td>
<td>$4.00</td>
<td>75,000</td>
<td>all/none</td>
<td>685,000</td>
</tr>
</tbody>
</table>

### Supply of Credits

<table>
<thead>
<tr>
<th>Offer #</th>
<th>Price (per lb)</th>
<th>Quantity</th>
<th>&quot;All or None&quot; or &quot;Partial&quot;</th>
<th>Cum. Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$2.50</td>
<td>25,000</td>
<td>partial</td>
<td>25,000</td>
</tr>
<tr>
<td>2</td>
<td>$3.75</td>
<td>150,000</td>
<td>partial</td>
<td>175,000</td>
</tr>
<tr>
<td>3</td>
<td>$5.25</td>
<td>225,000</td>
<td>partial</td>
<td>400,000</td>
</tr>
<tr>
<td>4</td>
<td>$7.00</td>
<td>100,000</td>
<td>partial</td>
<td>500,000</td>
</tr>
<tr>
<td>5</td>
<td>$8.00</td>
<td>80,000</td>
<td>partial</td>
<td>580,000</td>
</tr>
</tbody>
</table>

### Auction Results:

- **160,000 credits purchased and sold.**
- **Buyers 1, 2, and 3 have bids completely filled.**
- **Offer 1 sells 25,000 credits and offer 2 sells 135,000 credits.**
- **Market-clearing price is $4.88 – weighted average of lowest winning bid ($6.00) and highest winning offer ($3.75).**
Results from Past Auctions

- **September 12, 2012 forward auction**
  - Compliance years included: 2012 - 2015
  - Two round auction
  - Nutrients: both nitrogen and phosphorous
  - Watersheds: both Susquehanna and Potomac

- **Results:**
  - **Round 1**
    - 24,650 Susquehanna nitrogen credits for compliance years 2012 – 2015 traded at prices ranging from $3.17 to $3.23
    - 200 Potomac phosphorous credits for compliance year 2012 traded at $2.60
  - **Round 2**
    - 12,000 Susquehanna nitrogen credits for compliance years 2012, 2014 and 2015 traded at prices ranging from $2.25 to $3.18
    - 400 Potomac phosphorous credits for compliance year 2012 traded at $2.25
### Public Results for PennInvest Auction Round 1 September 12, 2012

#### Credit: SU-N-12

<table>
<thead>
<tr>
<th>Winners</th>
<th>Bid/Offer</th>
<th>Total Quantity Won</th>
<th>Total Quantity Traded</th>
<th>Final Price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GREATER HAZLETON JOINT SEWER AUTHORITY</td>
<td>BID</td>
<td>2,000</td>
<td>16,650</td>
<td>3.17</td>
</tr>
<tr>
<td>PPL EnergyPlus, LLC</td>
<td>BID</td>
<td>4,650</td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Branch Regional Authority</td>
<td>BID</td>
<td>10,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chesapeake Nutrient Management, LLC</td>
<td>OFFER</td>
<td></td>
<td>16,650</td>
<td></td>
</tr>
</tbody>
</table>

#### Credit: SU-N-13

<table>
<thead>
<tr>
<th>Winners</th>
<th>Bid/Offer</th>
<th>Total Quantity Won</th>
<th>Total Quantity Traded</th>
<th>Final Price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPL EnergyPlus, LLC</td>
<td>BID</td>
<td>5,000</td>
<td>3,000</td>
<td>3.23</td>
</tr>
<tr>
<td>Chesapeake Nutrient Management, LLC</td>
<td>OFFER</td>
<td></td>
<td>3,000</td>
<td></td>
</tr>
</tbody>
</table>

#### Credit: SU-N-14

<table>
<thead>
<tr>
<th>Winners</th>
<th>Bid/Offer</th>
<th>Total Quantity Won</th>
<th>Total Quantity Traded</th>
<th>Final Price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPL EnergyPlus, LLC</td>
<td>BID</td>
<td>2,000</td>
<td>2,000</td>
<td>3.23</td>
</tr>
<tr>
<td>Chesapeake Nutrient Management, LLC</td>
<td>OFFER</td>
<td></td>
<td>2,000</td>
<td></td>
</tr>
</tbody>
</table>

#### Credit: SU-N-15

<table>
<thead>
<tr>
<th>Winners</th>
<th>Bid/Offer</th>
<th>Total Quantity Won</th>
<th>Total Quantity Traded</th>
<th>Final Price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPL EnergyPlus, LLC</td>
<td>BID</td>
<td>3,000</td>
<td>3,000</td>
<td>3.23</td>
</tr>
<tr>
<td>Chesapeake Nutrient Management, LLC</td>
<td>OFFER</td>
<td></td>
<td>3,000</td>
<td></td>
</tr>
</tbody>
</table>

#### Credit: SU-P-12

<table>
<thead>
<tr>
<th>Winners</th>
<th>Bid/Offer</th>
<th>Total Quantity Won</th>
<th>Total Quantity Traded</th>
<th>Final Price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Towanda Municipal Authority</td>
<td>BID</td>
<td>50</td>
<td>200</td>
<td>2.6</td>
</tr>
<tr>
<td>West Branch Regional Authority</td>
<td>BID</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chesapeake Nutrient Management, LLC</td>
<td>OFFER</td>
<td></td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>

#### Credit: SU-P-13

No winners for the auction

#### Credit: SU-P-14

No winners for the auction

#### Credit: SU-P-15

No winners for the auction
## Public Results for Pennvest Auction Round 2 September 12, 2012

### Credit: SU-N-12

<table>
<thead>
<tr>
<th>Winners:</th>
<th>Bid/Offer</th>
<th>Total Quantity Won</th>
<th>Total Quantity Traded</th>
<th>Final Price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPL EnergyPlus, LLC</td>
<td>Bid</td>
<td>2,000</td>
<td></td>
<td>2,000</td>
</tr>
<tr>
<td>Chesapeake Nutrient Management, LLC</td>
<td>Offer</td>
<td>2,000</td>
<td></td>
<td>3.18</td>
</tr>
</tbody>
</table>

### Credit: SU-N-13

No winners for the auction

### Credit: SU-N-14

<table>
<thead>
<tr>
<th>Winners:</th>
<th>Bid/Offer</th>
<th>Total Quantity Won</th>
<th>Total Quantity Traded</th>
<th>Final Price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPL EnergyPlus, LLC</td>
<td>Bid</td>
<td>4,000</td>
<td></td>
<td>4,000</td>
</tr>
<tr>
<td>Chesapeake Nutrient Management, LLC</td>
<td>Offer</td>
<td>4,000</td>
<td></td>
<td>3.18</td>
</tr>
</tbody>
</table>

### Credit: SU-N-15

<table>
<thead>
<tr>
<th>Winners:</th>
<th>Bid/Offer</th>
<th>Total Quantity Won</th>
<th>Total Quantity Traded</th>
<th>Final Price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPL EnergyPlus, LLC</td>
<td>Bid</td>
<td>6,000</td>
<td></td>
<td>6,000</td>
</tr>
<tr>
<td>Chesapeake Nutrient Management, LLC</td>
<td>Offer</td>
<td>6,000</td>
<td></td>
<td>3.18</td>
</tr>
</tbody>
</table>

### Credit: SU-P-12

<table>
<thead>
<tr>
<th>Winners:</th>
<th>Bid/Offer</th>
<th>Total Quantity Won</th>
<th>Total Quantity Traded</th>
<th>Final Price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Towanda Municipal Authority</td>
<td>Bid</td>
<td>400</td>
<td></td>
<td>400</td>
</tr>
<tr>
<td>Chesapeake Nutrient Management, LLC</td>
<td>Offer</td>
<td>400</td>
<td></td>
<td>2.25</td>
</tr>
</tbody>
</table>
Auction Schedule

- **2012-2013 compliance year**
  - Forward auctions:
    - March 20, 2013
    - June 12, 2013
    - September 11, 2013
  - Spot auction:
    - November 6, 2013
Lessons learned

• There is value in having one platform (registry) for both over-the-counter trades and auctions. It provides more information to auction participants, particularly regarding price discovery.

• The “success” of the forward auctions and the spot auction are inversely related, i.e. for any compliance year, the greater the amount of demand that is met in the former, the less the need for the latter.

• Having more than one auction round seems to have value to participants.

• Participants want more information about auction participation, i.e. who bid and offered how much and at what prices, than you want to reveal, since it could lead to market manipulation.
Challenges

- Market manipulation:
  - Cornering the market on credits - how do we mitigate this possibility without jeopardizing the free functioning of the market?
  - Price collusion on either the buy or sell side – same question

- Auction losers:
  - How to deal with potential buyers who are unsuccessful in the spot auction but need credits for compliance – without undermining the auction process itself.

- How can the “market maker” mitigate uncertainty about future supply and demand for credits:
  - Comparison of credit purchase is to construction projects with long-term funding horizon. How to make annual credit purchases equivalent for making business decisions.

- Expansion of market across regulatory jurisdictions:
  - Different states in the Bay watershed have different regulatory requirements for nutrient discharges. These need to be reconciled.
PENNVEST Website

http://www.pennvest.state.pa.us
Questions or Follow-up?

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PENNVEST in general: www.pennvest.state.pa.us