Increasing Demand in the ERCOT Responsive Reserve Market:

One Approach:
Using Historical Bid Stacks

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Objective

- The Question:

  "What is the impact on the price of RRS of adding the additional 500 MW of RRS from Generators (change in price)?

Methodology

- Approach:
  - A question of supply and demand.
  - Supply curve:
    - Responsive reserves bid stacks.
  - Demand curve:
    - D_1: 2300 MW
    - D_2: 2800 MW
- Note: This approach uses actual historical bid stacks or supply curves. Other approaches are also possible.

Assumptions

- ERCOT presently requires 2300 MW of Responsive Reserves at any given time.

- Approximately half of this 2300 MW is self-arranged through bilateral contracts and half is provided through the ERCOT bidding process.

- About half of the 1150 MW of LaaR is acquired through the market, or 575 MW.

Methodology: Developing a Supply Curve

- Identifying the suppliers:
  - Generators
  - Loads Acting As a Resource (LaaR)
- LaaRs and generators have different bidding behaviors in the ERCOT RR Market.
  - LaaRs usually bid zero.
  - Generators bid at some price.
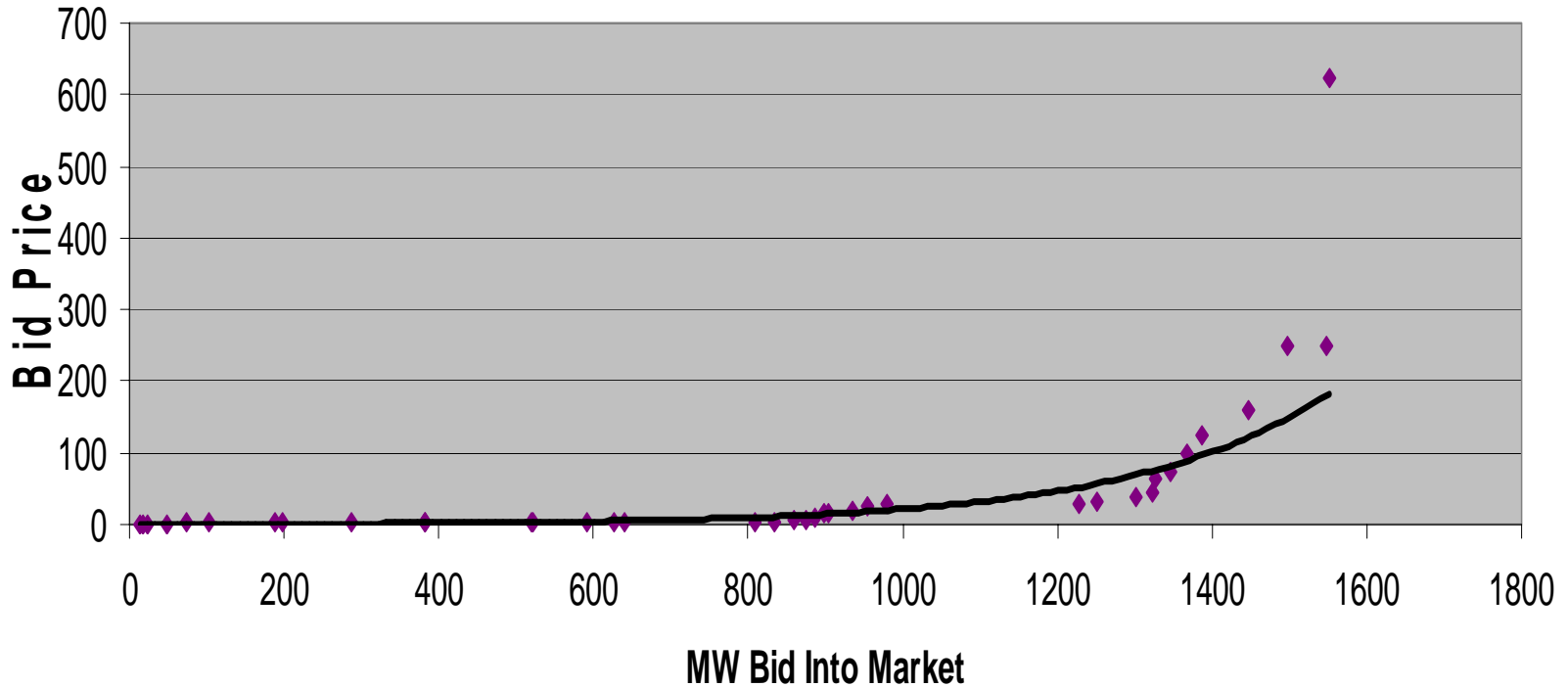
Methodology: Developing a Supply Curve

- Critical Assumptions:

    1. The additional 500 MW of Responsive Reserves will come through the ERCOT bidding process, not self-arranged through bilateral contracts.

    2. ERCOT will continue to limit LaaRs' contribution to Responsive Reserves to 1150 MW overall, with about one-half coming from through the market.

Methodology: Developing a Supply Curve

- Refining the Question:
  - Under our assumptions, generating entities will provide the additional 500 MW of Responsive Reserves.
  - Eliminating the LaaR bids
    - LaaRs always bid in at $0.
    - There are always more LaaRs bid in at $0 than accepted.
    - LaaRs do not set the market price for Responsive Reserves.
  - A New Supply Curve: Plot generators' bid price against the cumulative MW bid into ERCOT market by generating entities.

Methodology: Developing a Supply Curve

Supply Curve, 1-1-07 12:00PM

Methodology: Developing a Supply Curve

Generators' Responsive Reserves Supply Curve: 12 Noon
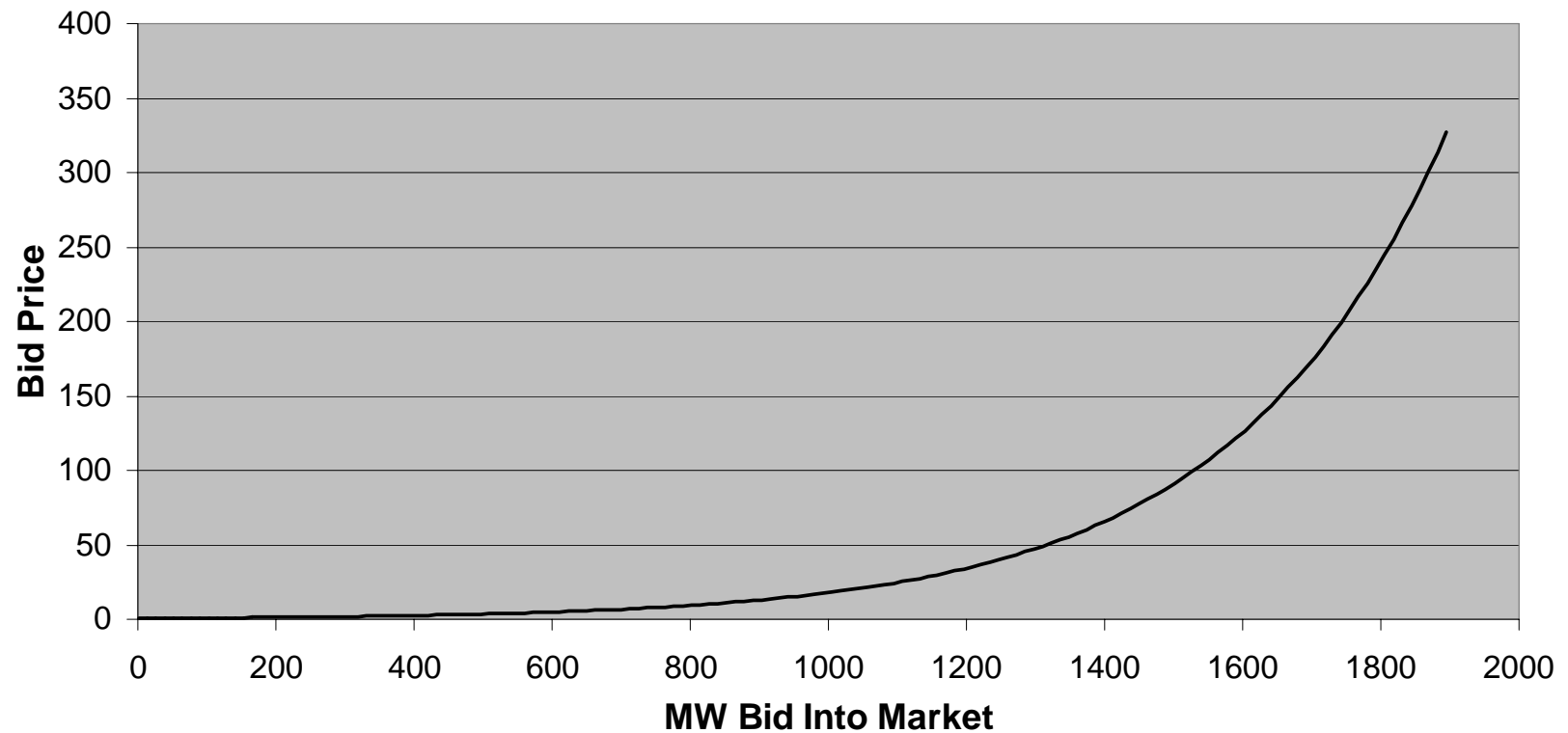
Methodology: Using the Supply Curve

- In order to determine the effect on prices, we move up the supply curve from approx. 575 MW to approx. 1075 MW.

- The market-clearing price will be the least expensive bid price that will satisfy the increased market demand.

Methodology: Using the Supply Curve

- **Important Caveats:**
  - A static supply curve
    - This analysis uses historical data to illustrate the effect on prices of increasing the demand for Responsive Reserves by 500 MW.
    - This analysis does NOT take into account any change in bidding behavior on the part of RR suppliers.
    - It is likely that at higher prices, more generators will be motivated to bid into the Responsive Reserves market, thus shifting the supply curve out and moderating prices.
  - Actual prices will depend on how much the supply curve moves out.
    - Example: During summer peaks, the ability of the supply curve to shift out is severely constrained, so one expects a much higher price relative to off-peak times.

Methodology: Using the Supply Curve

Change in MCPC in RR Market: January 2007 12:00PM

Results: Hourly Supply Curves

Generators' Responsive Reserve Supply Curve: 0600

$R^2 = 0.7351$
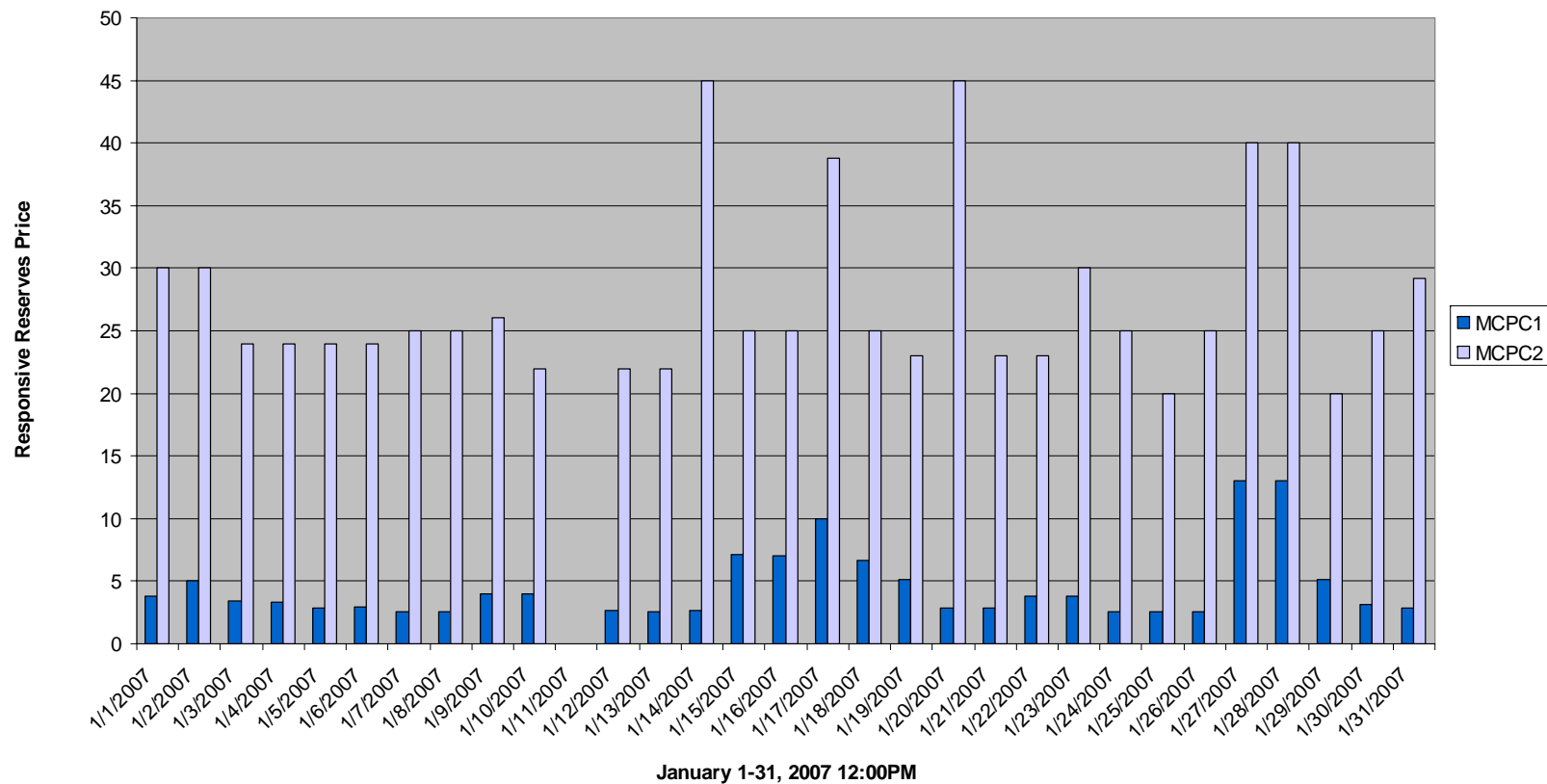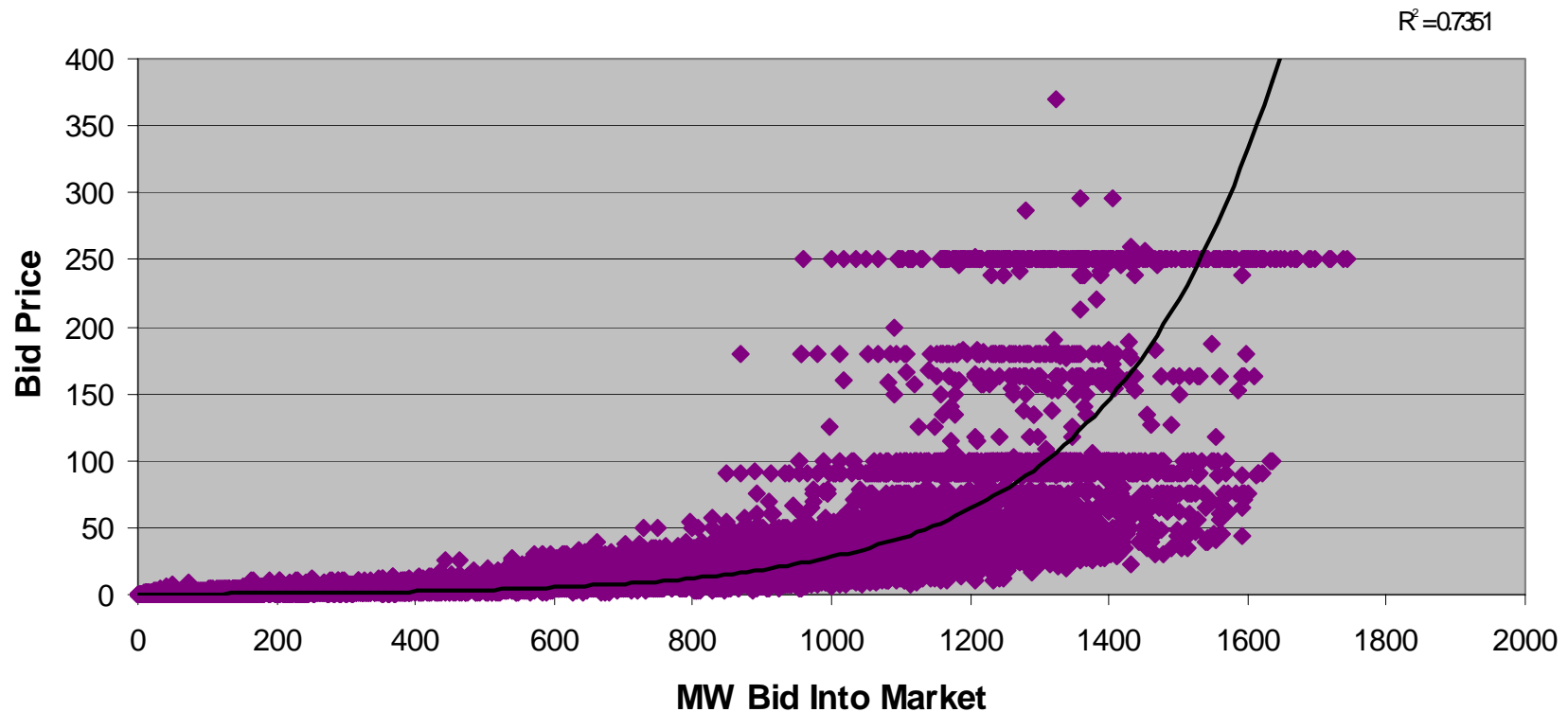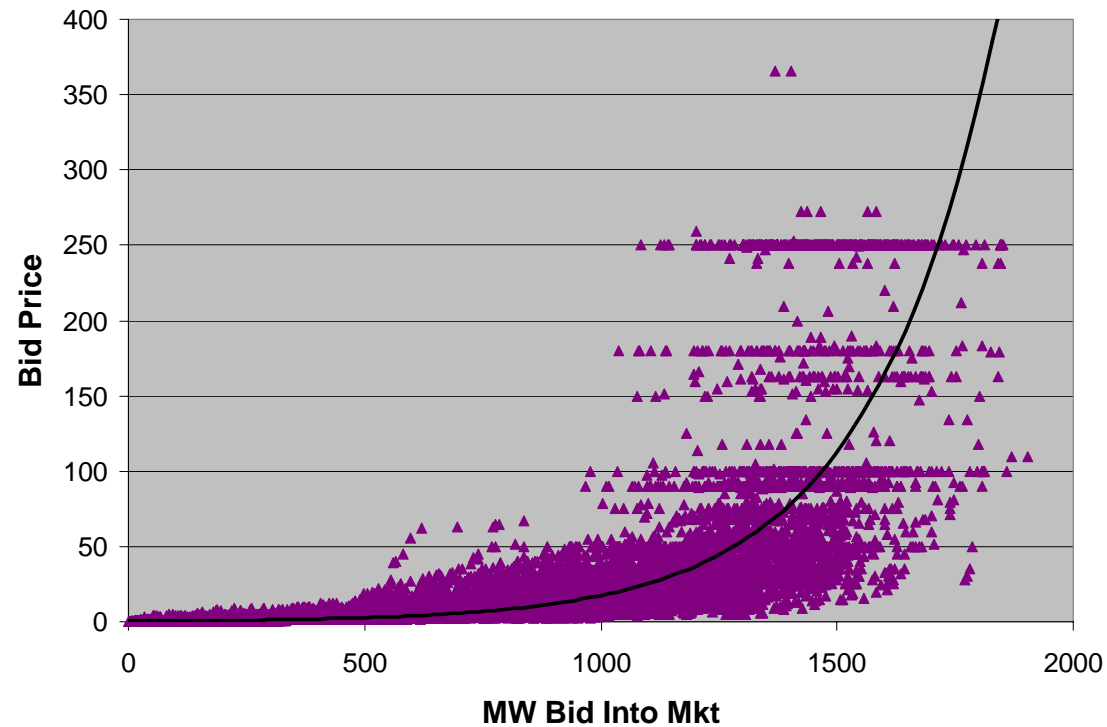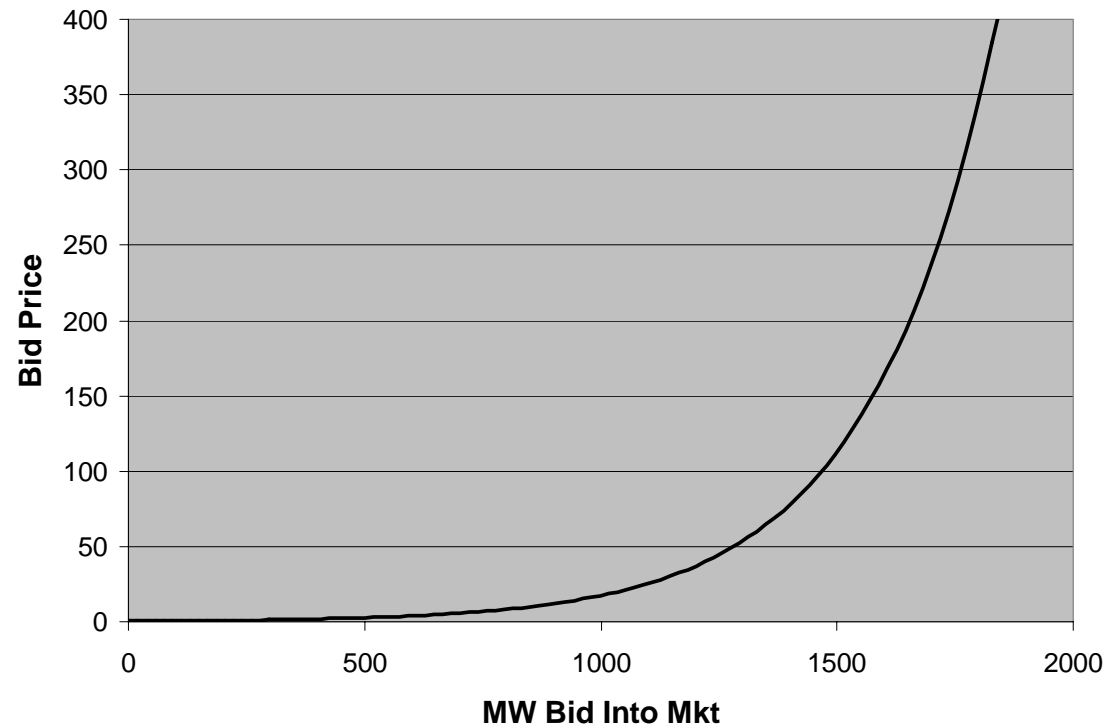
Results: Hourly Supply Curves

Generators' Responsive Reserve Supply Curve: 0600

Results: Hourly Supply Curves
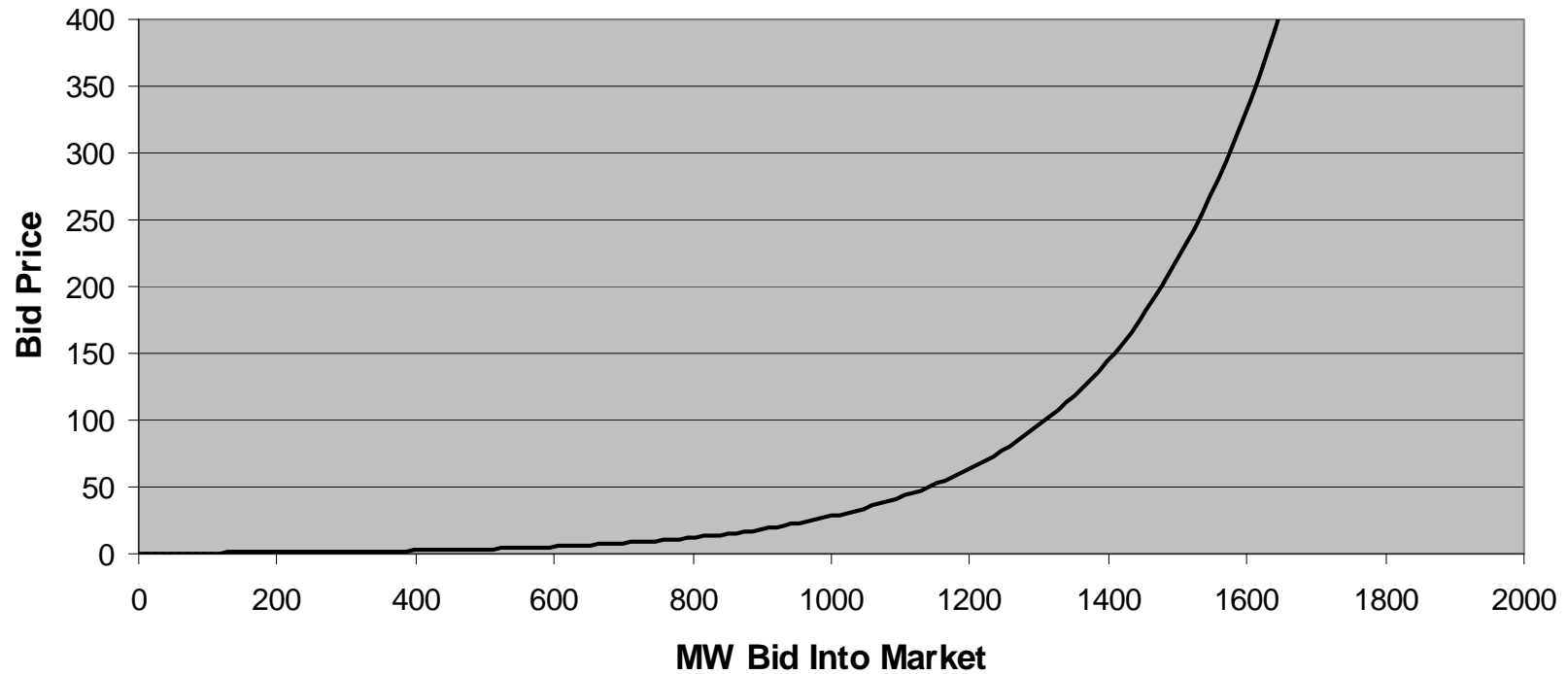
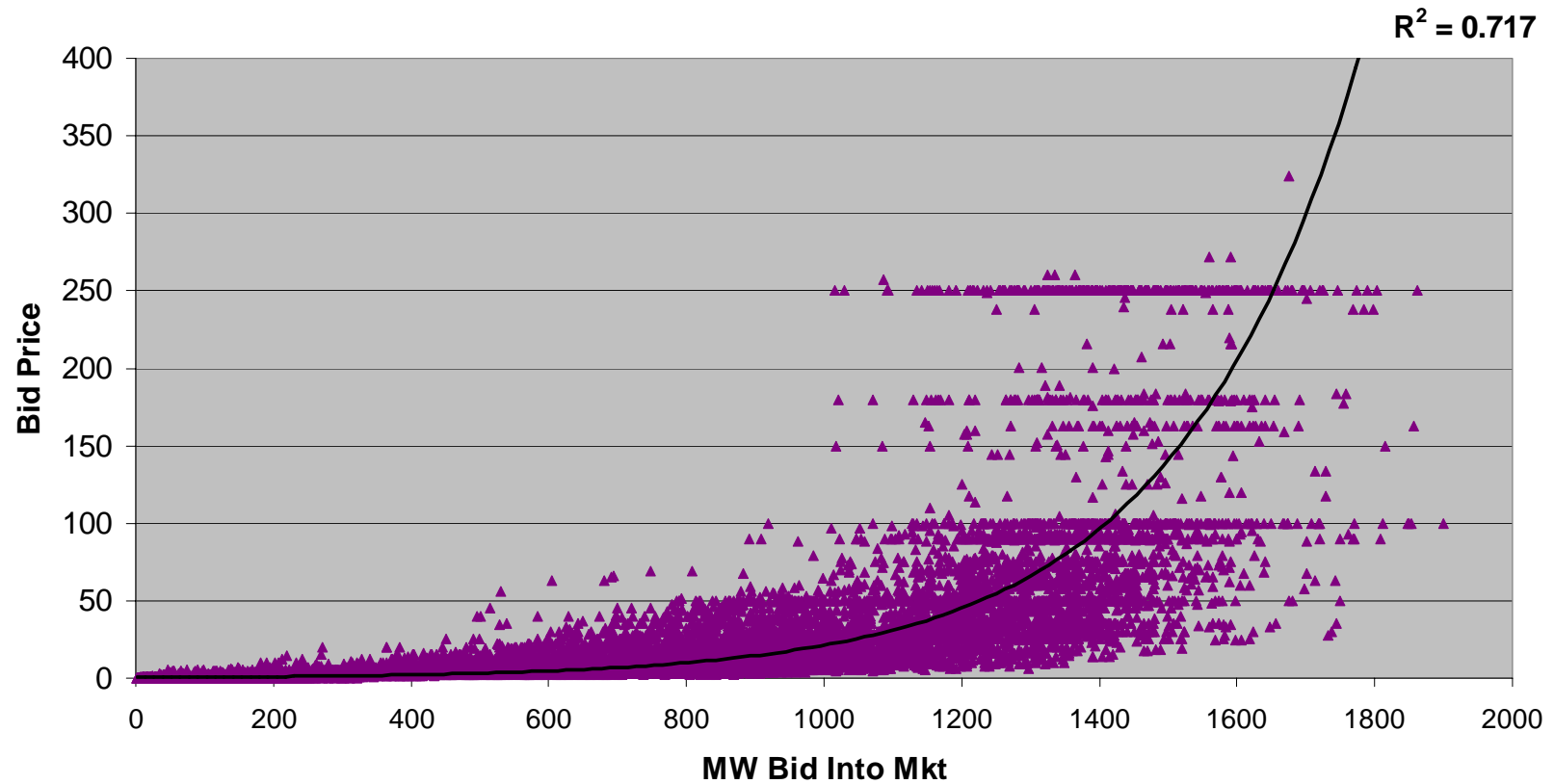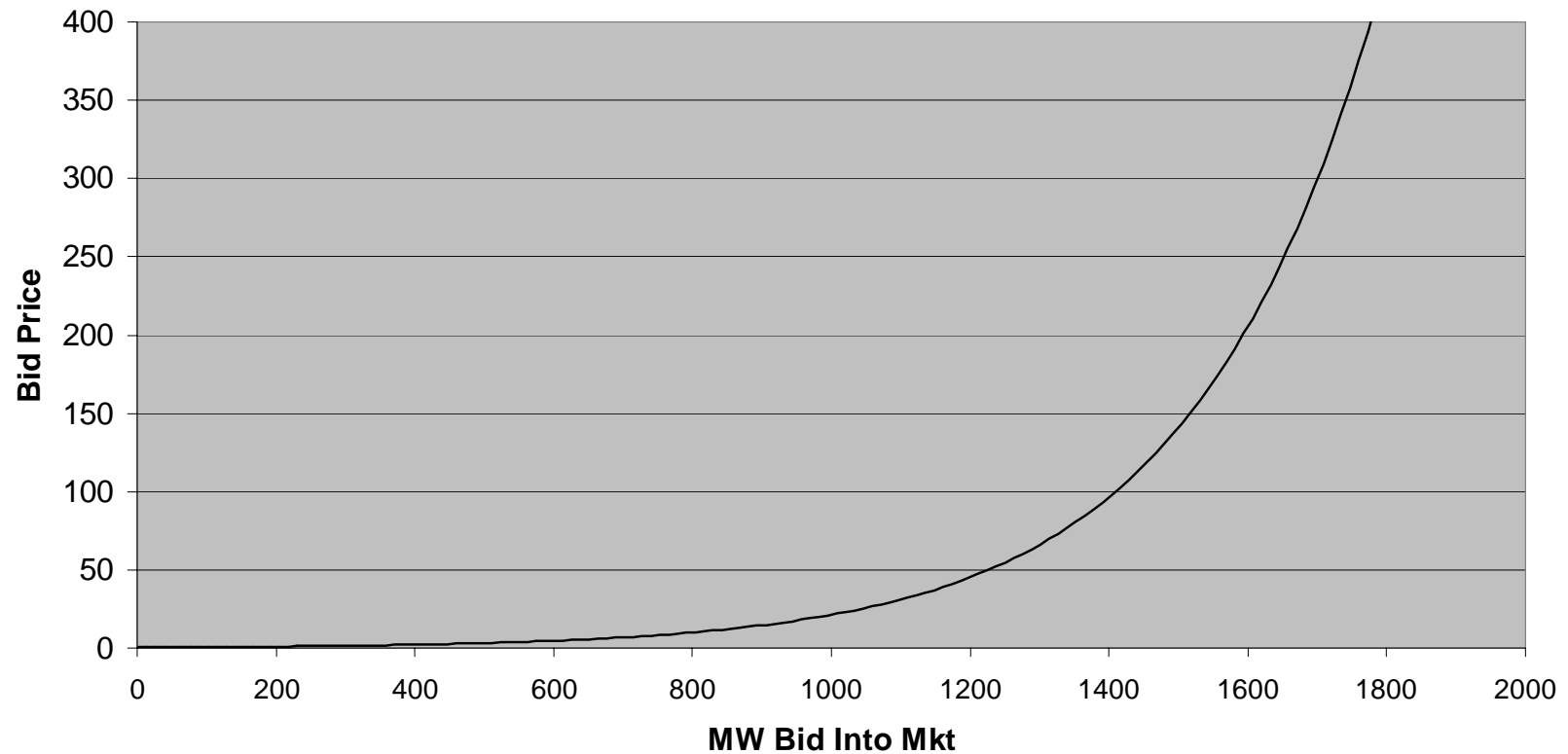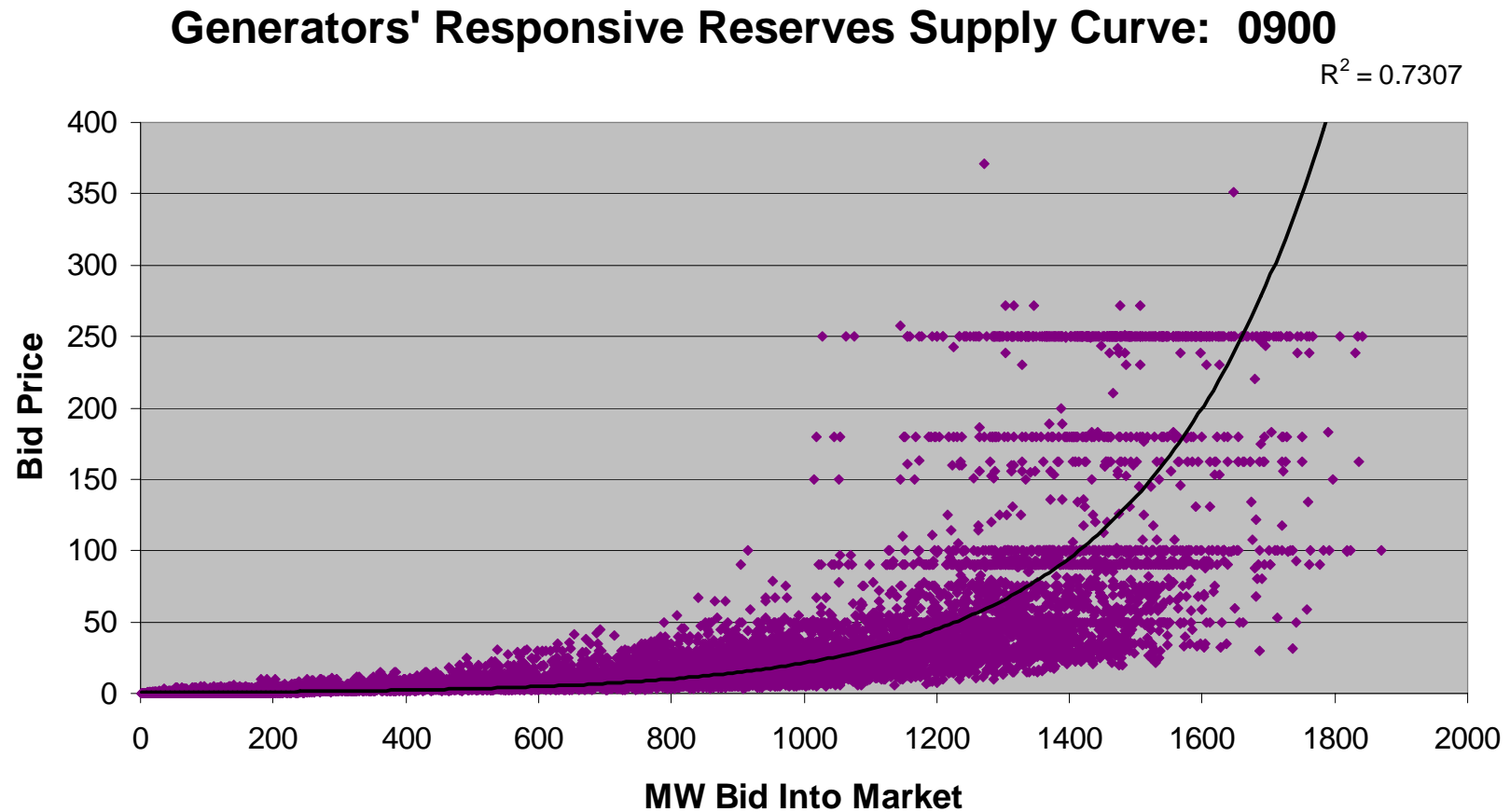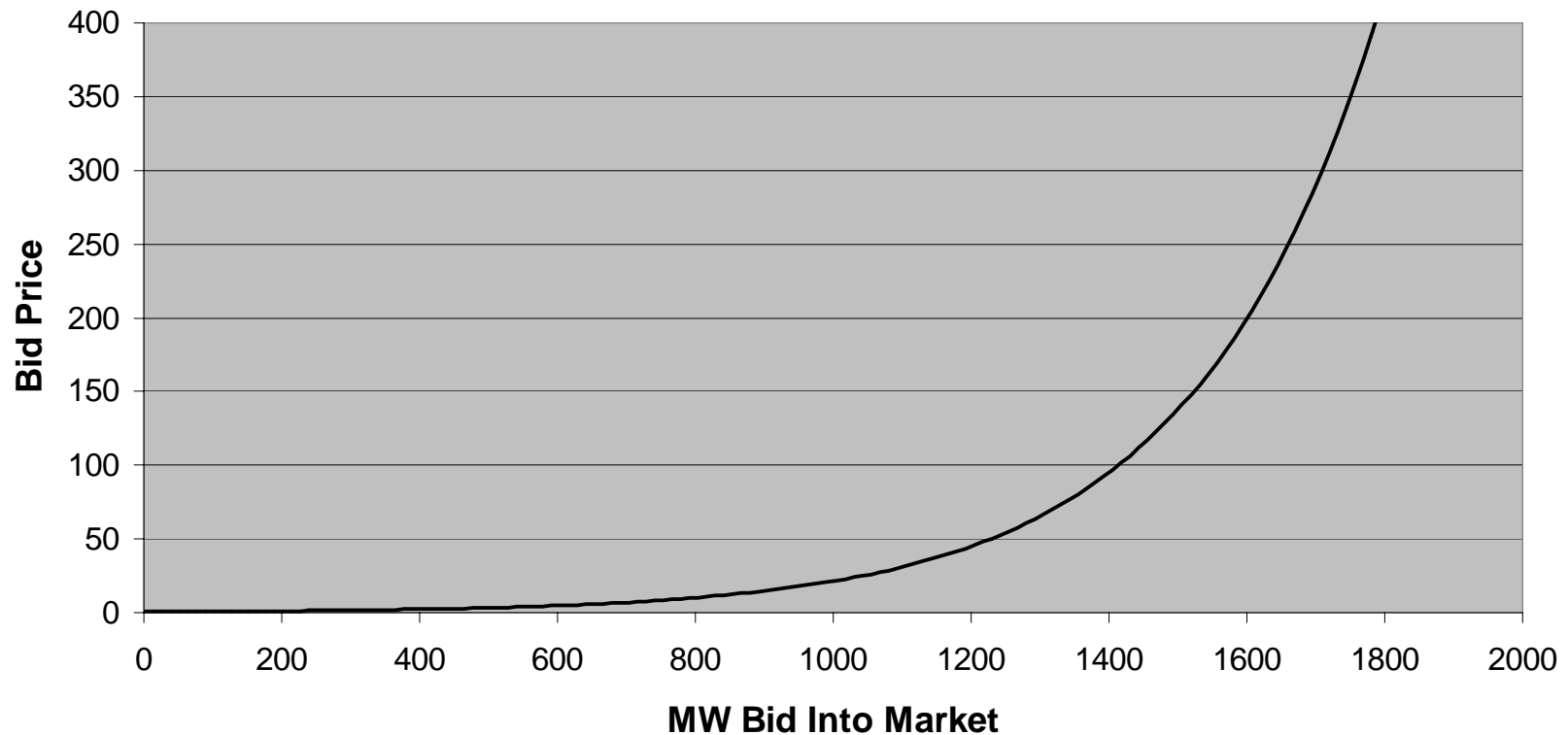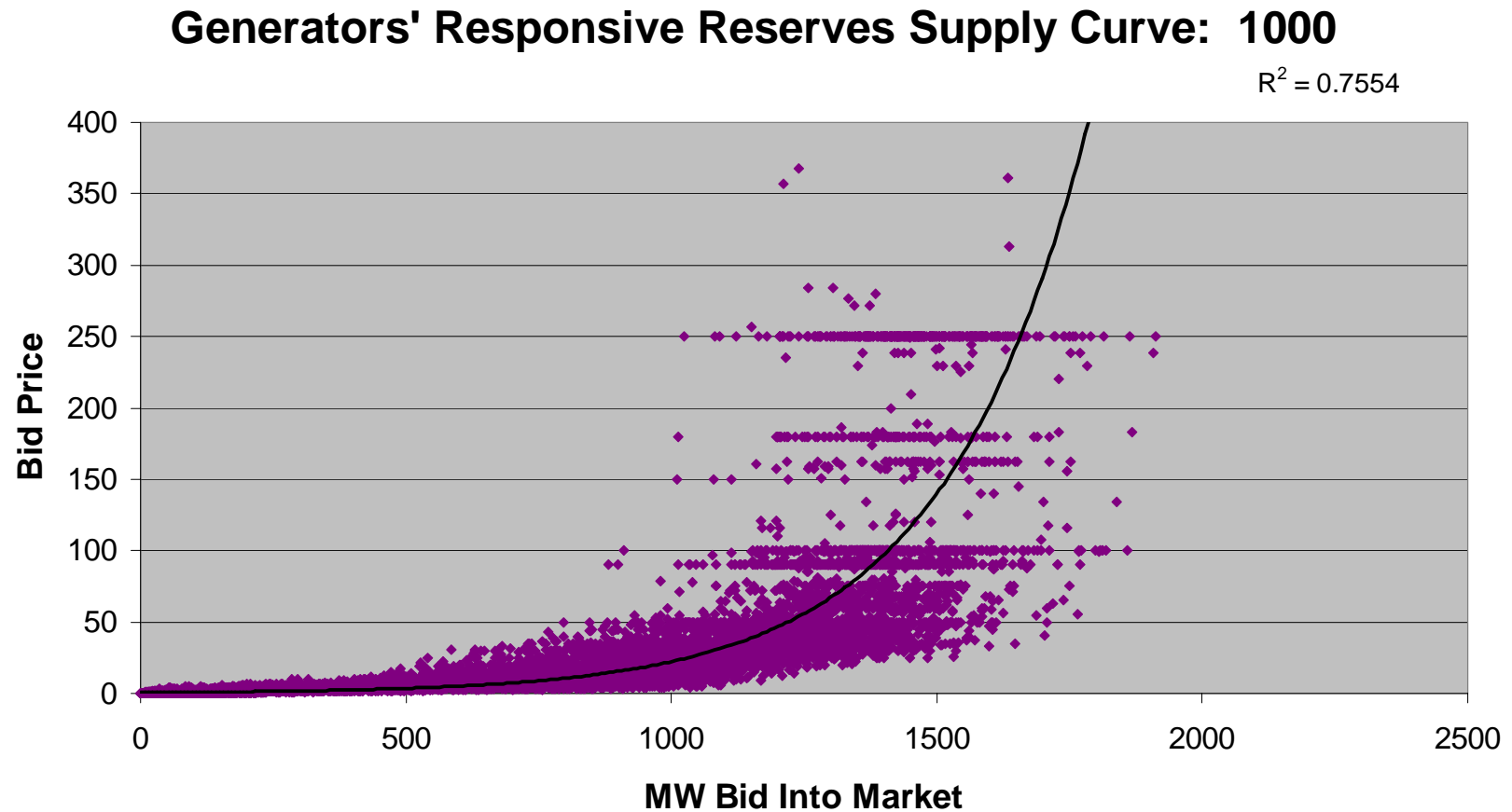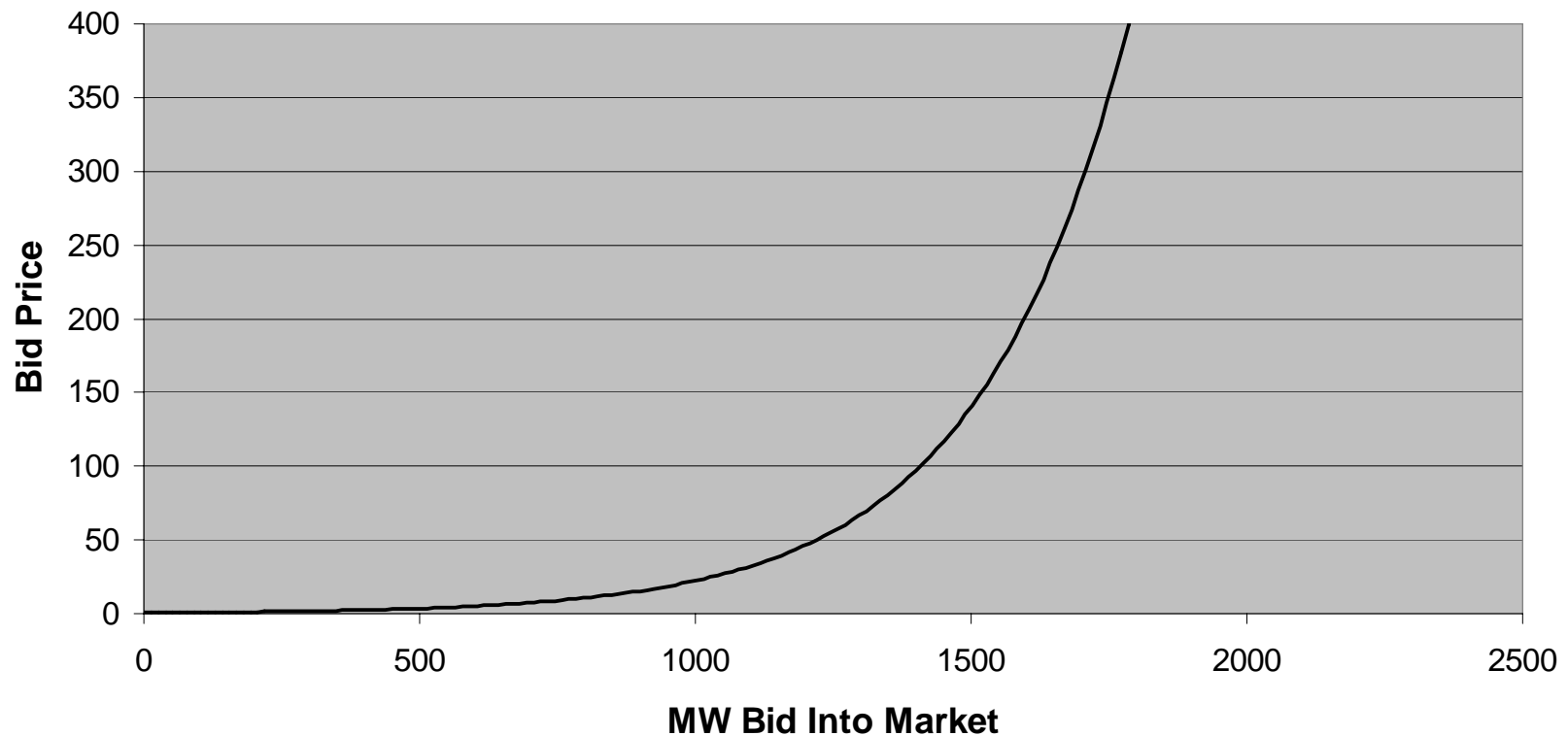**Generators' Responsive Reserves Supply Curve: 0700**
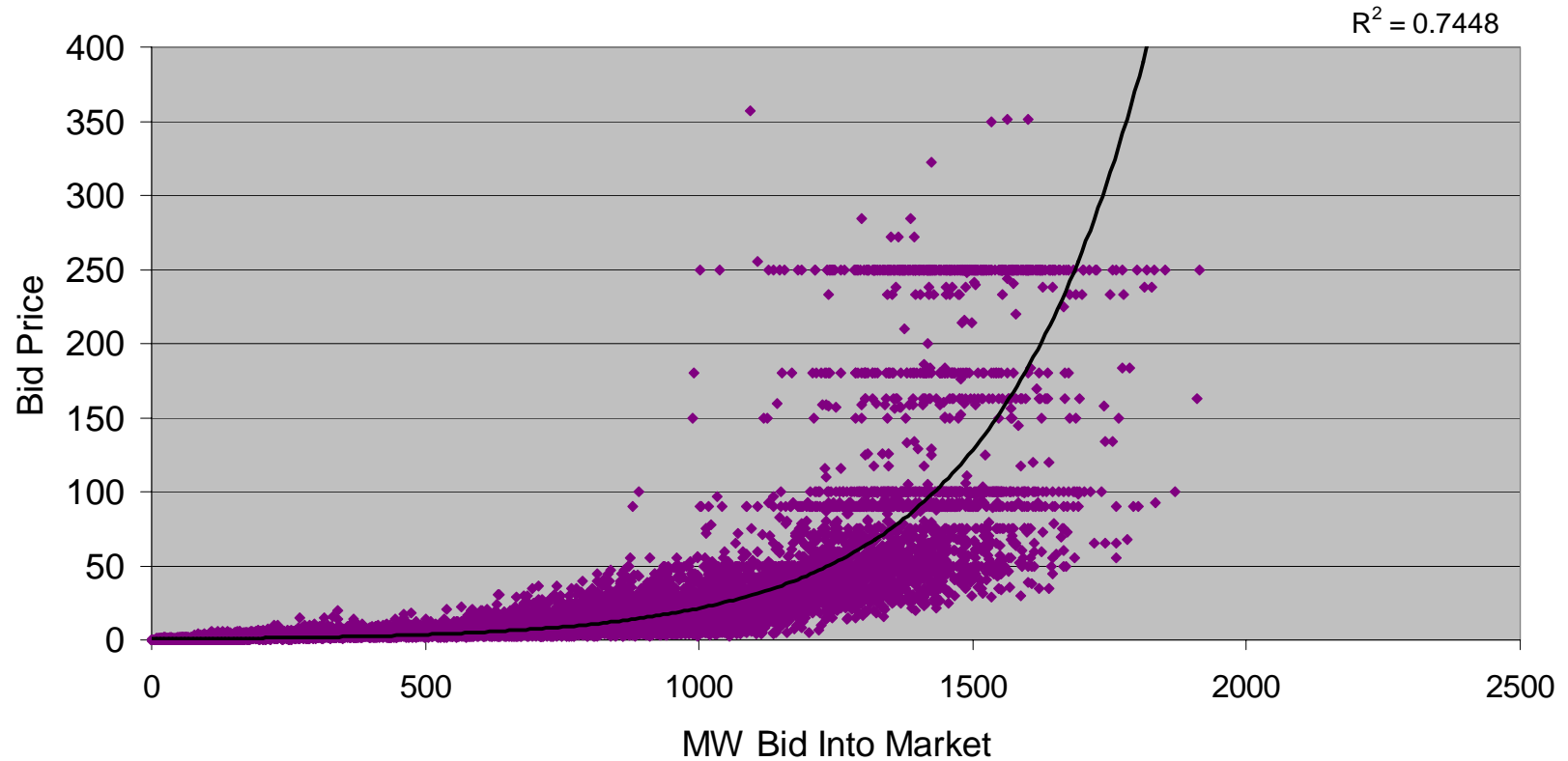
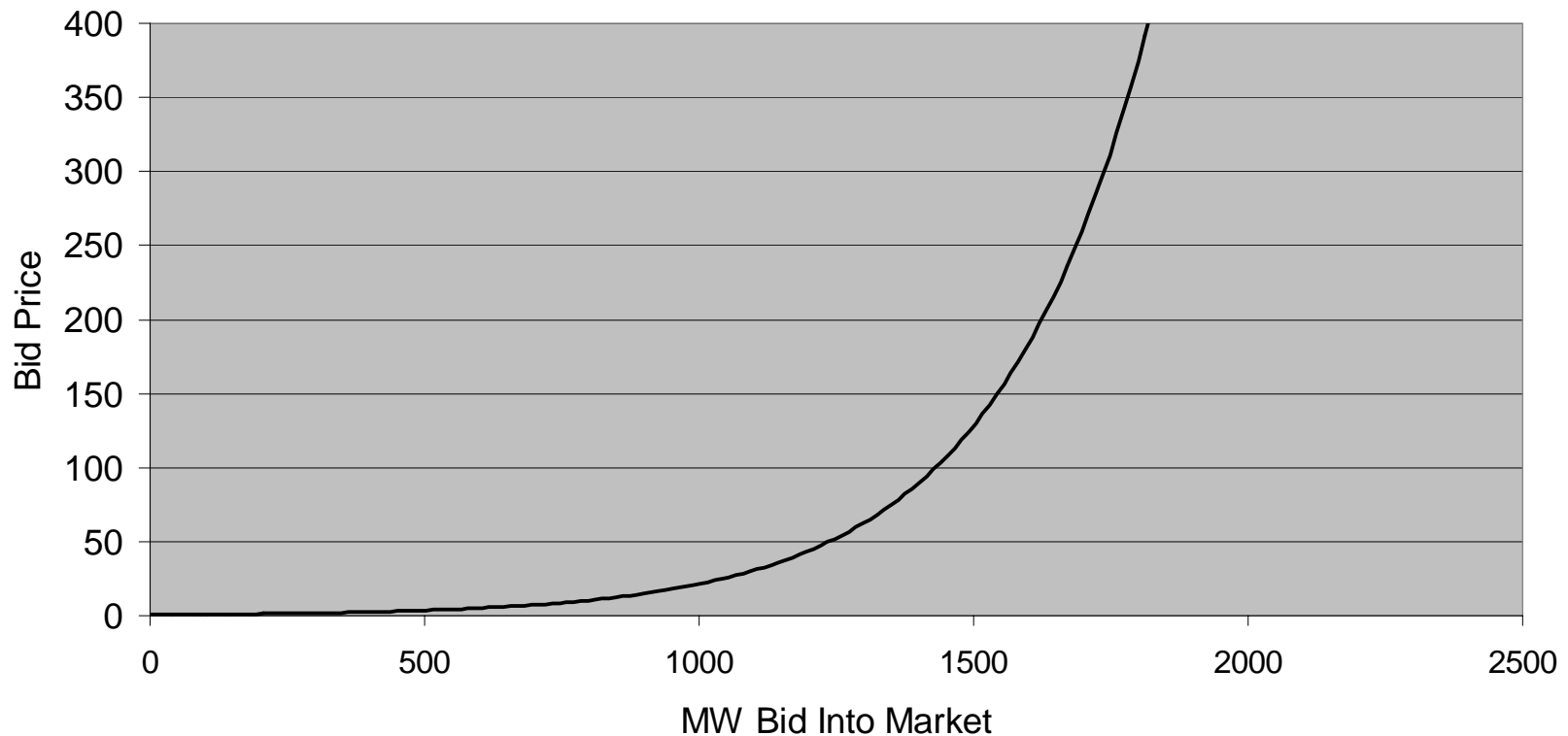$R^2 = 0.7246$

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 0700

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 0700

$R^2 = 0.7246$

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 0700

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 0800

$R^2 = 0.717$
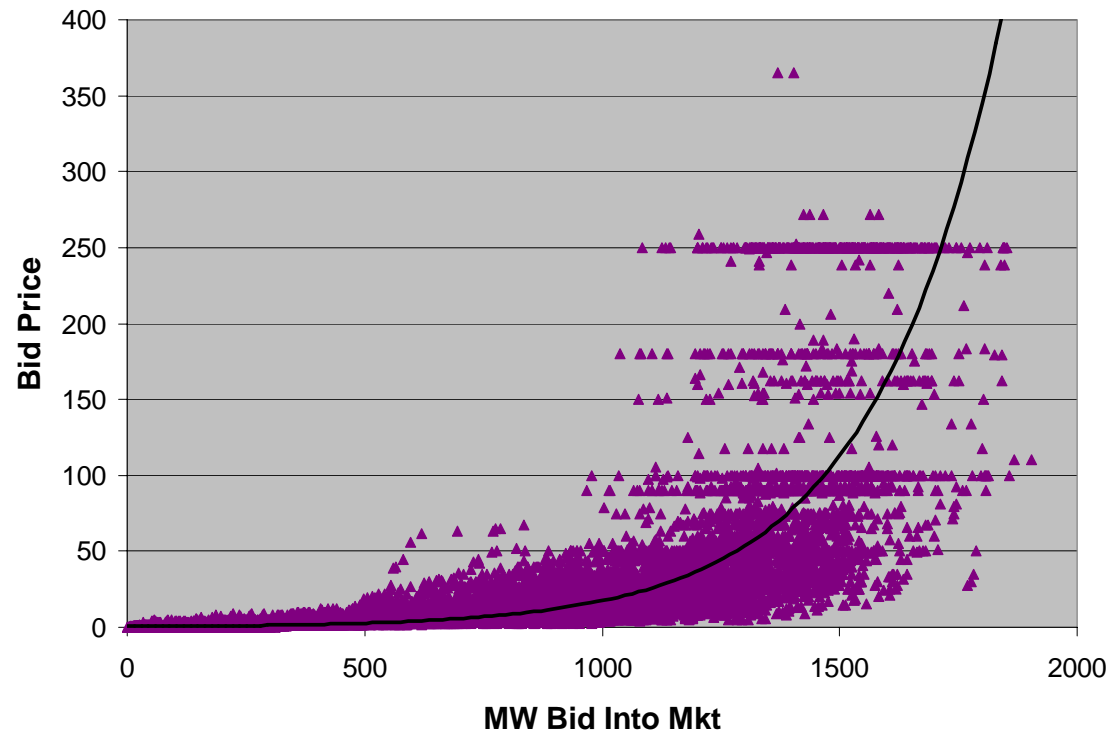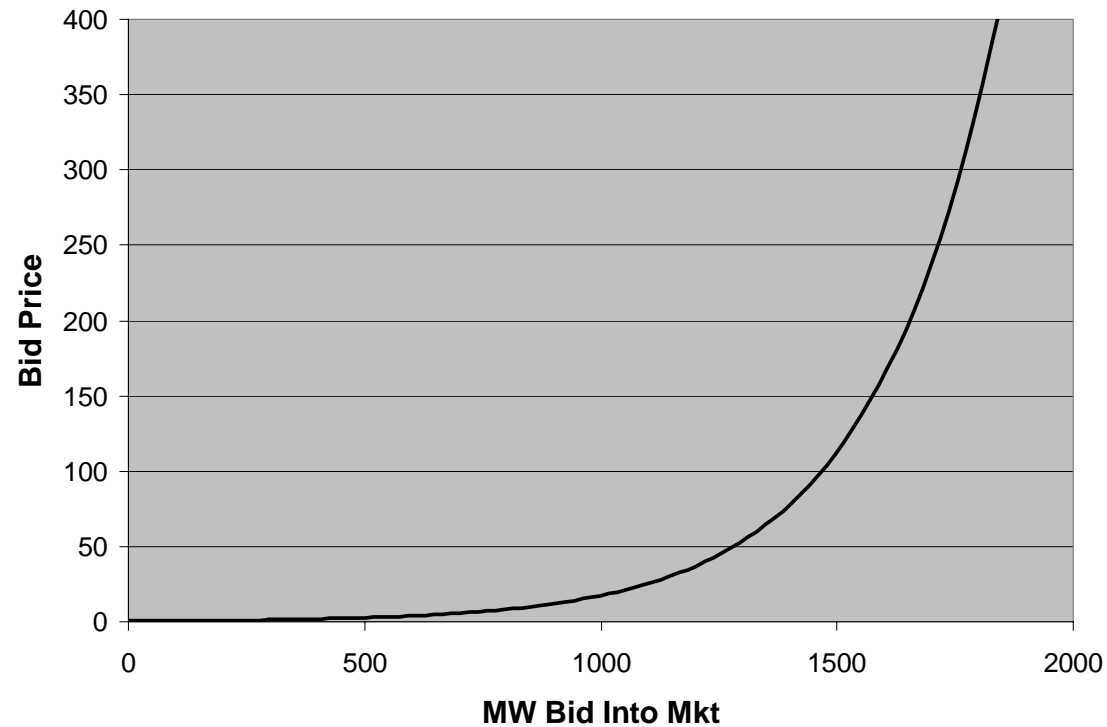
Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 0800

Results: Hourly Supply Curves

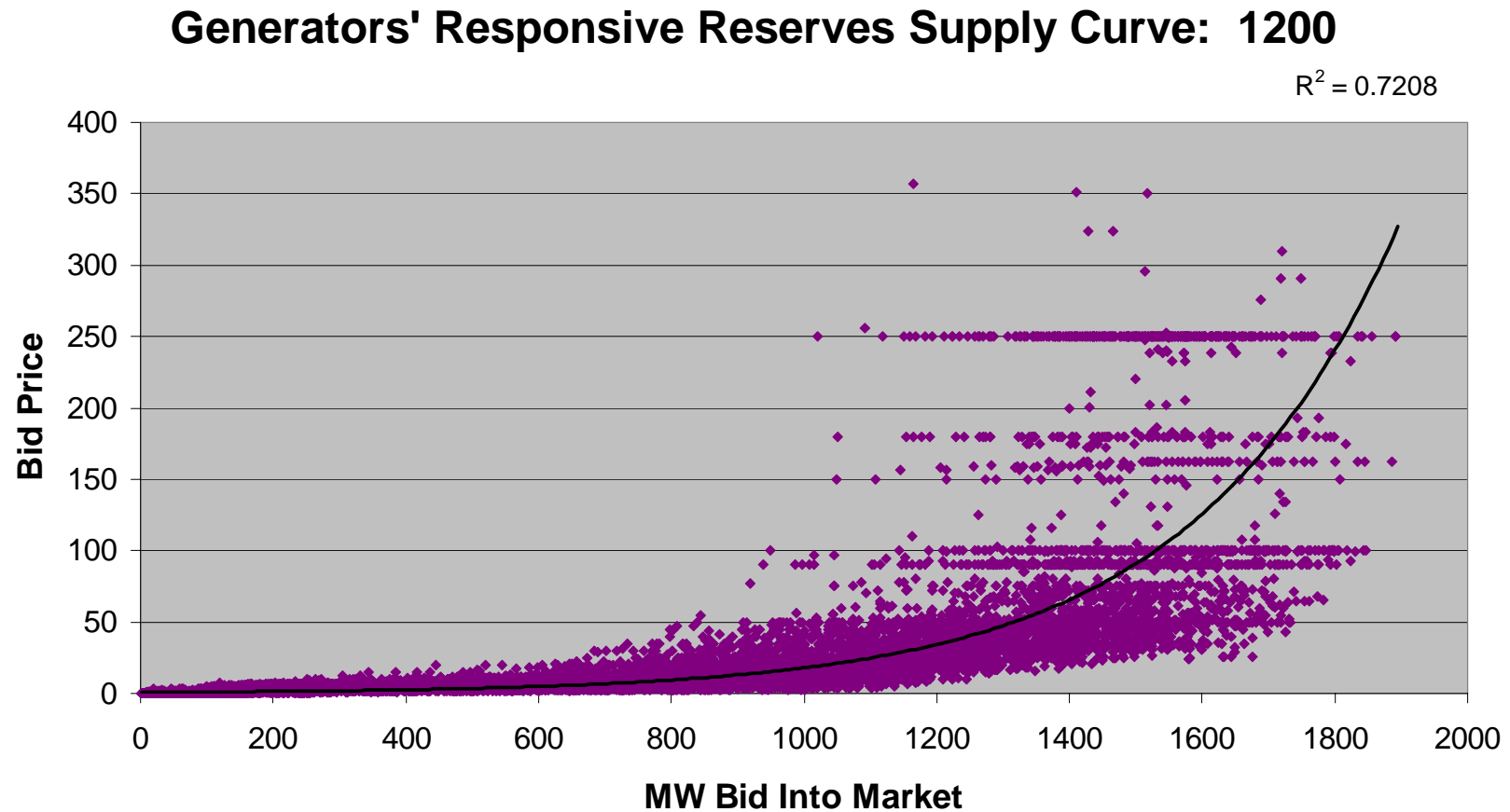

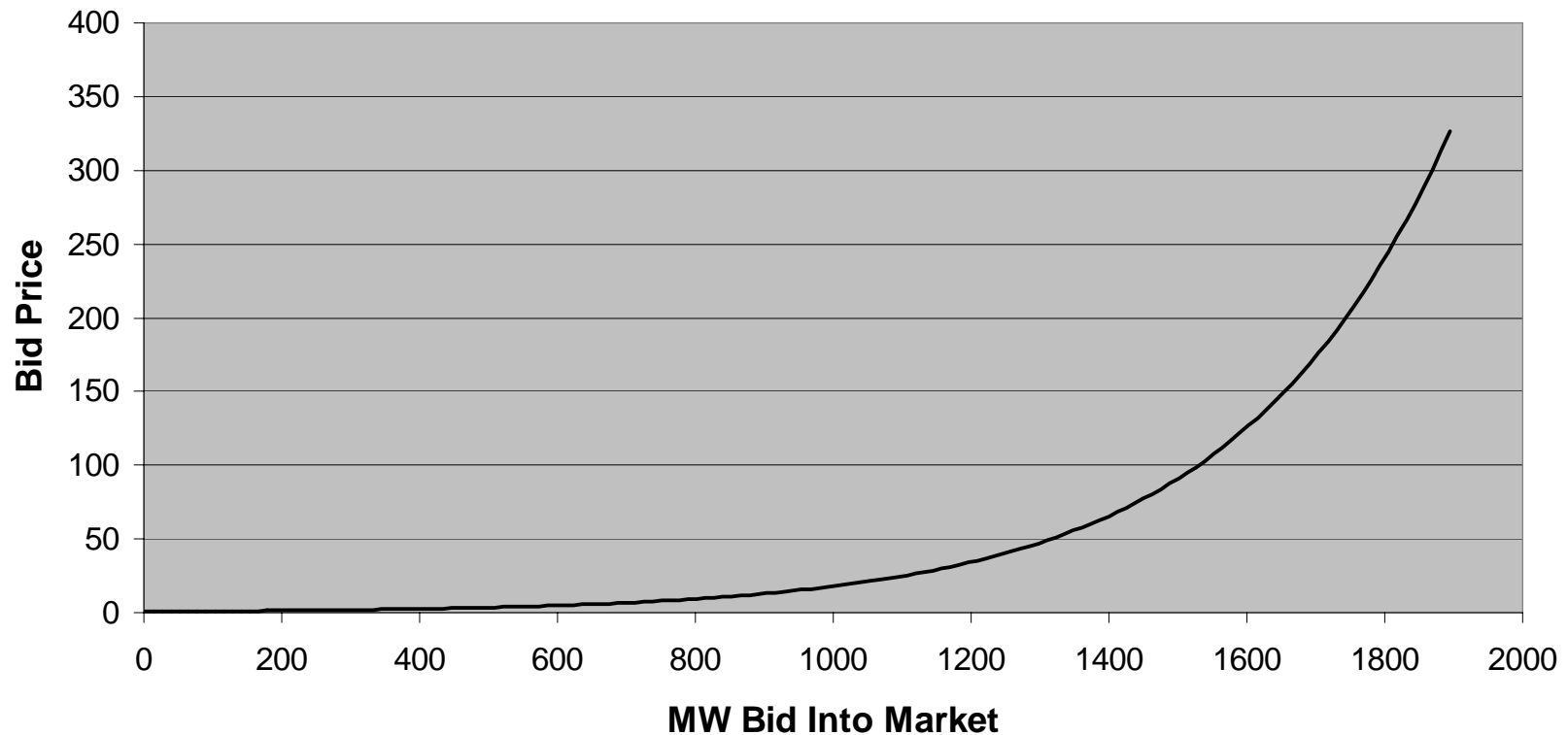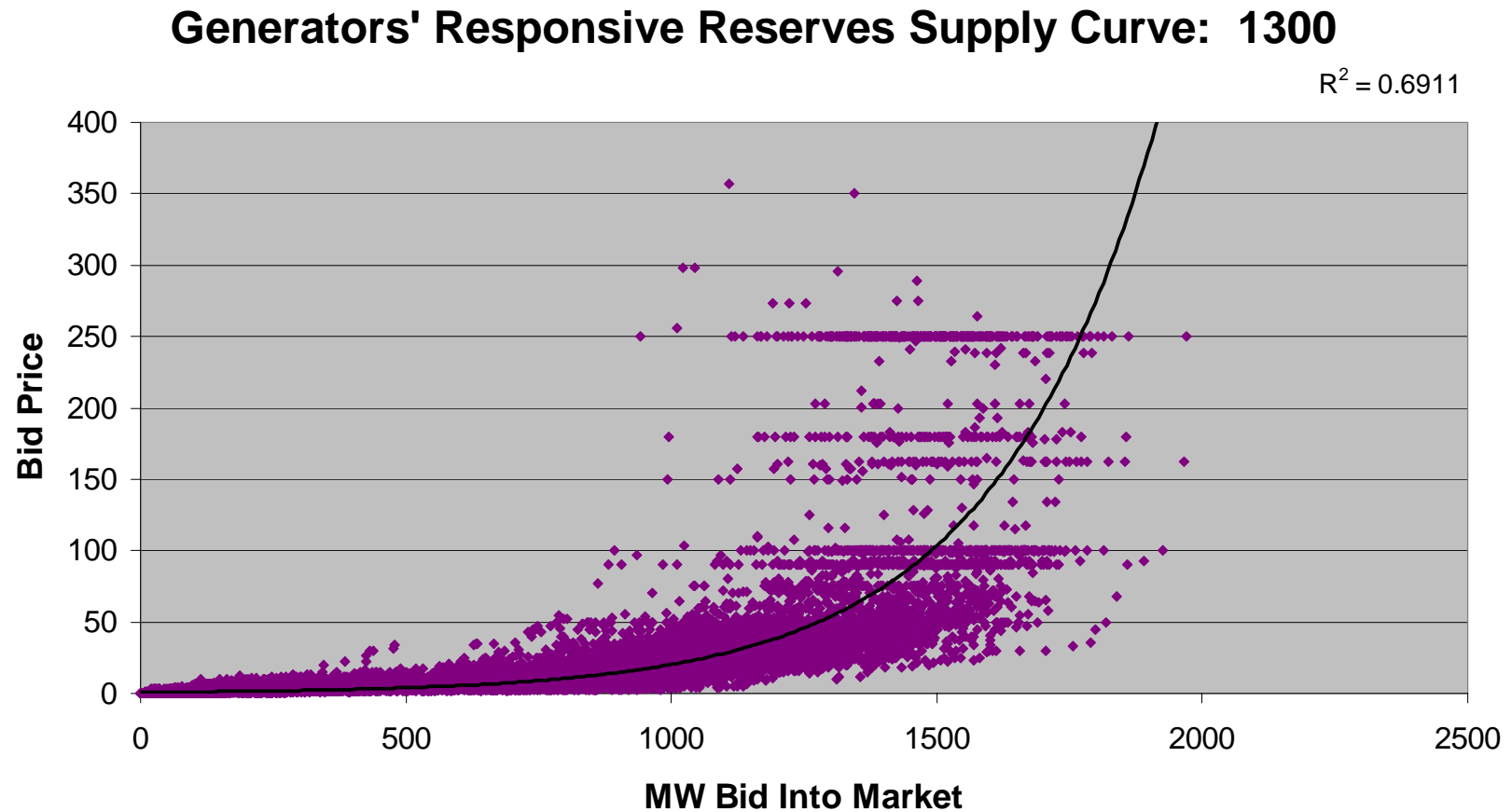**Generators' Responsive Reserves Supply Curve: 0900**

$R^2 = 0.7307$

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 0900

Results: Hourly Supply Curves
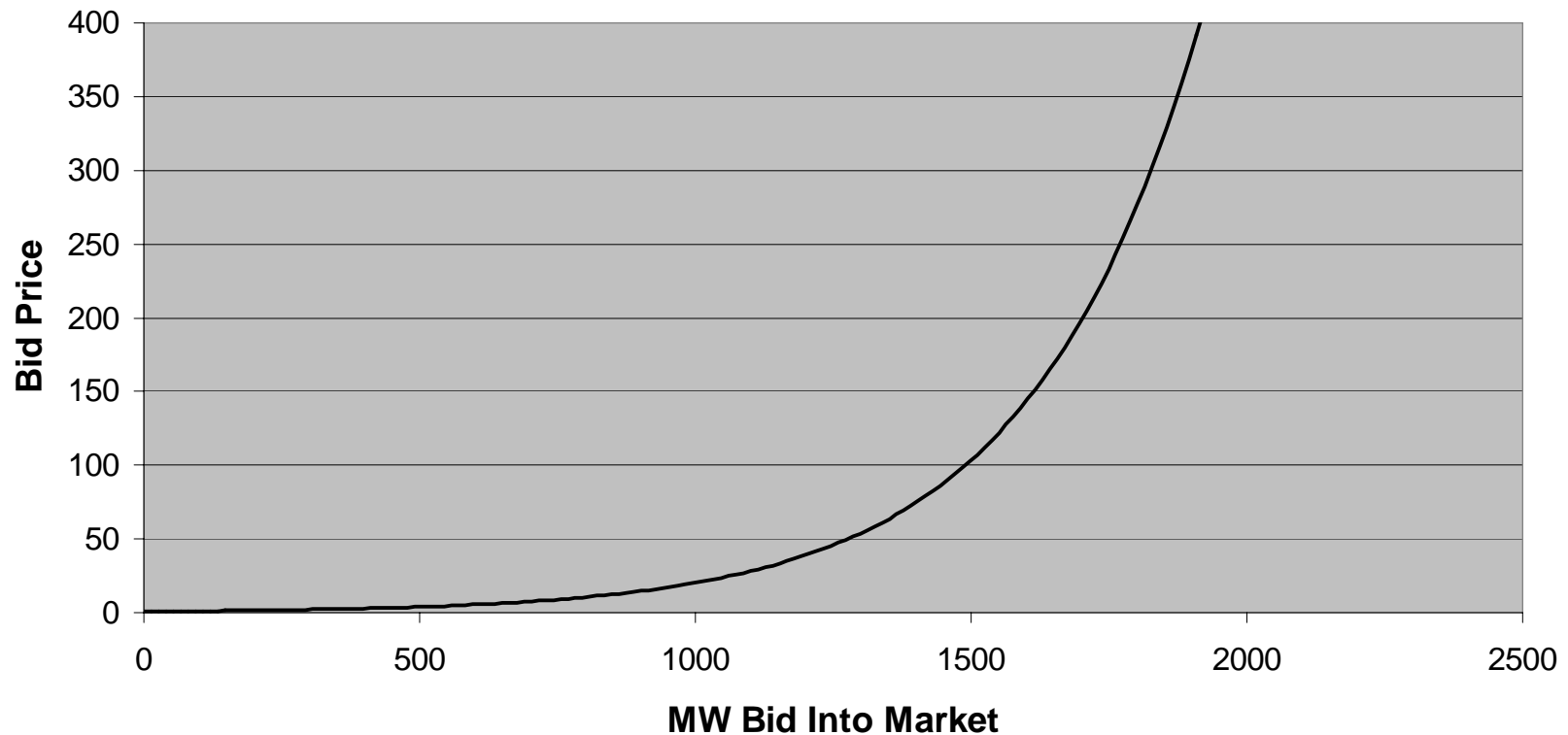
Generators' Responsive Reserves Supply Curve: 1000

$R^2 = 0.7554$

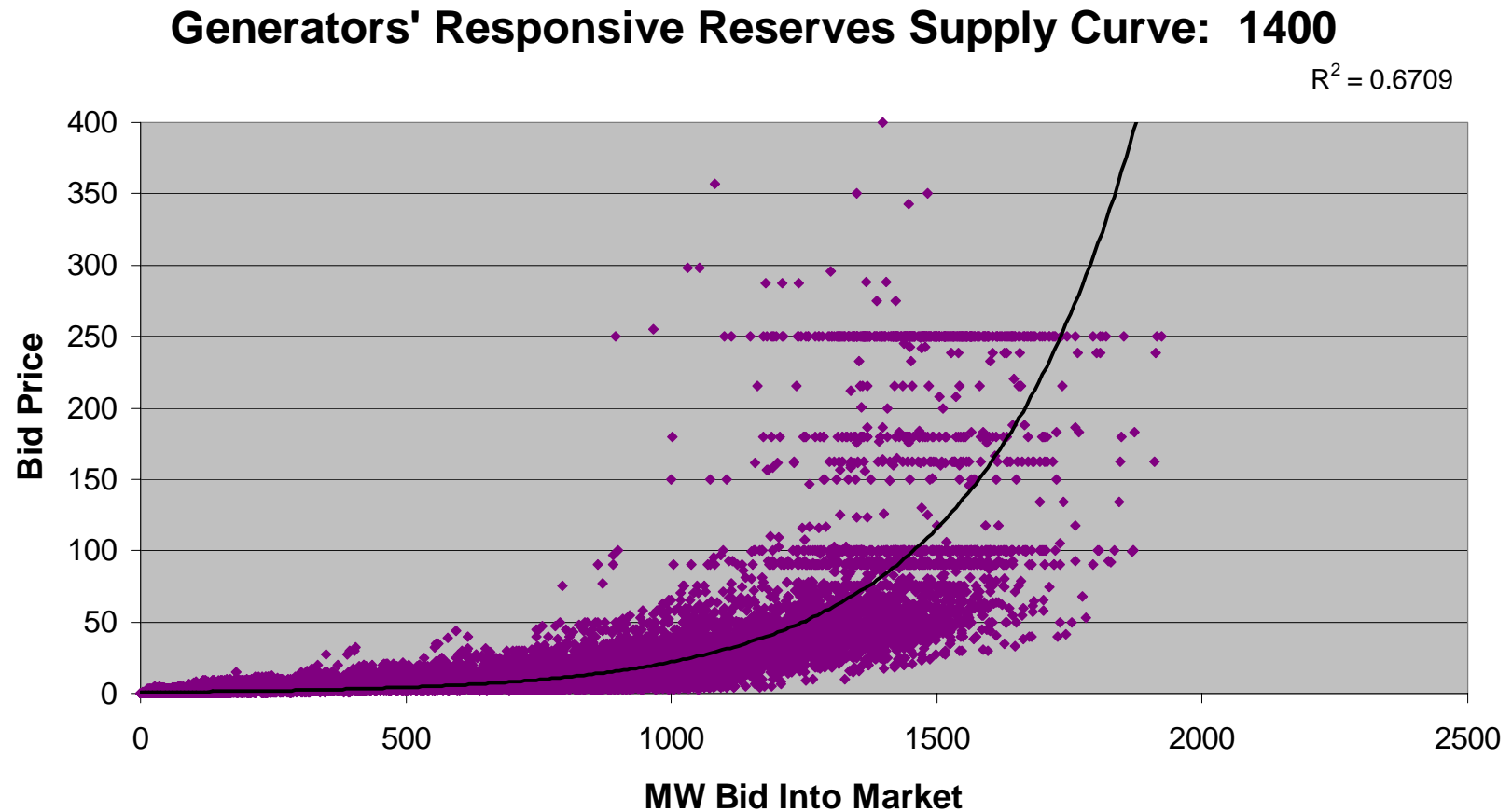# Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1000

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1100

$R^2 = 0.7448$

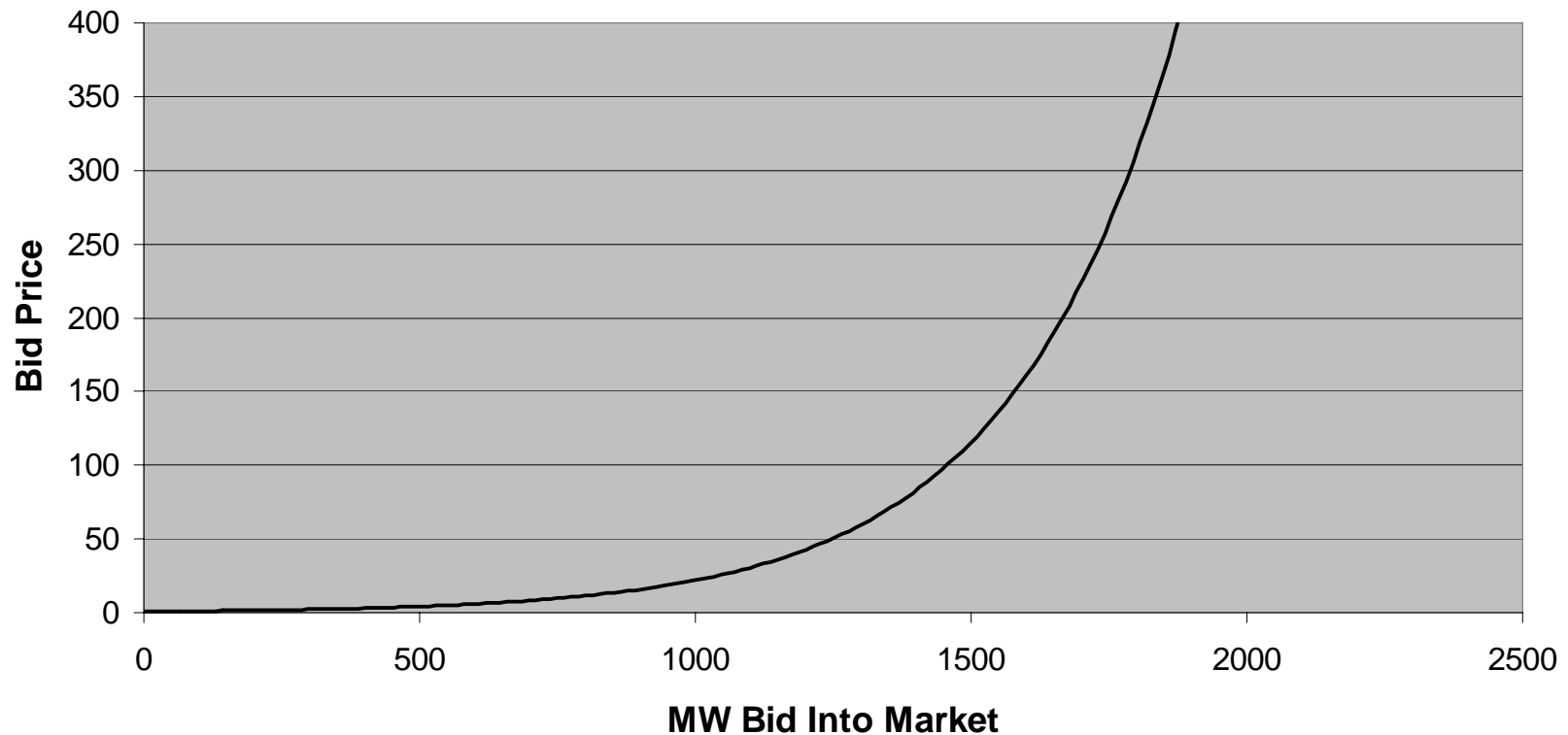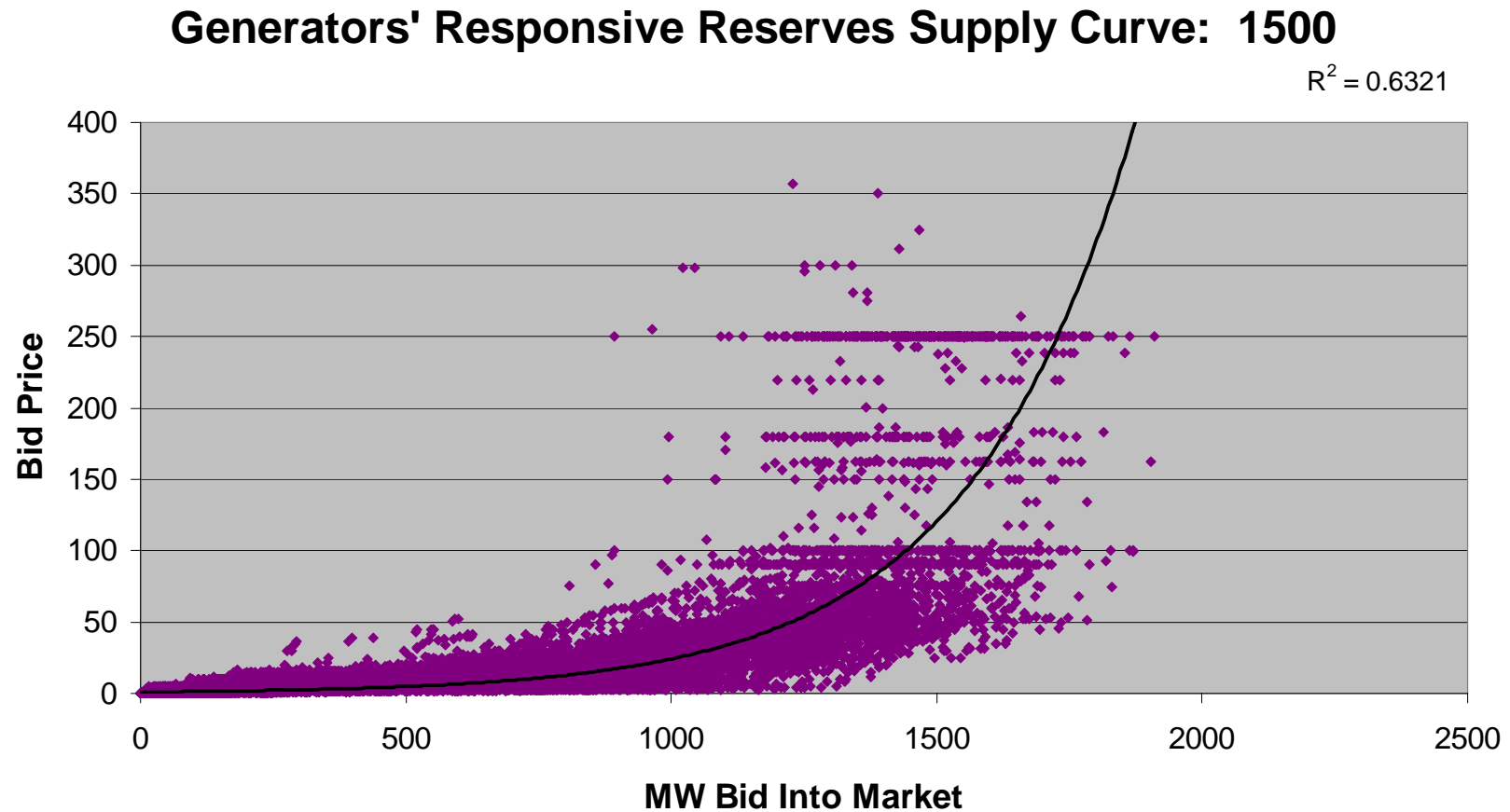# Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1100

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1200

$R^2 = 0.7208$

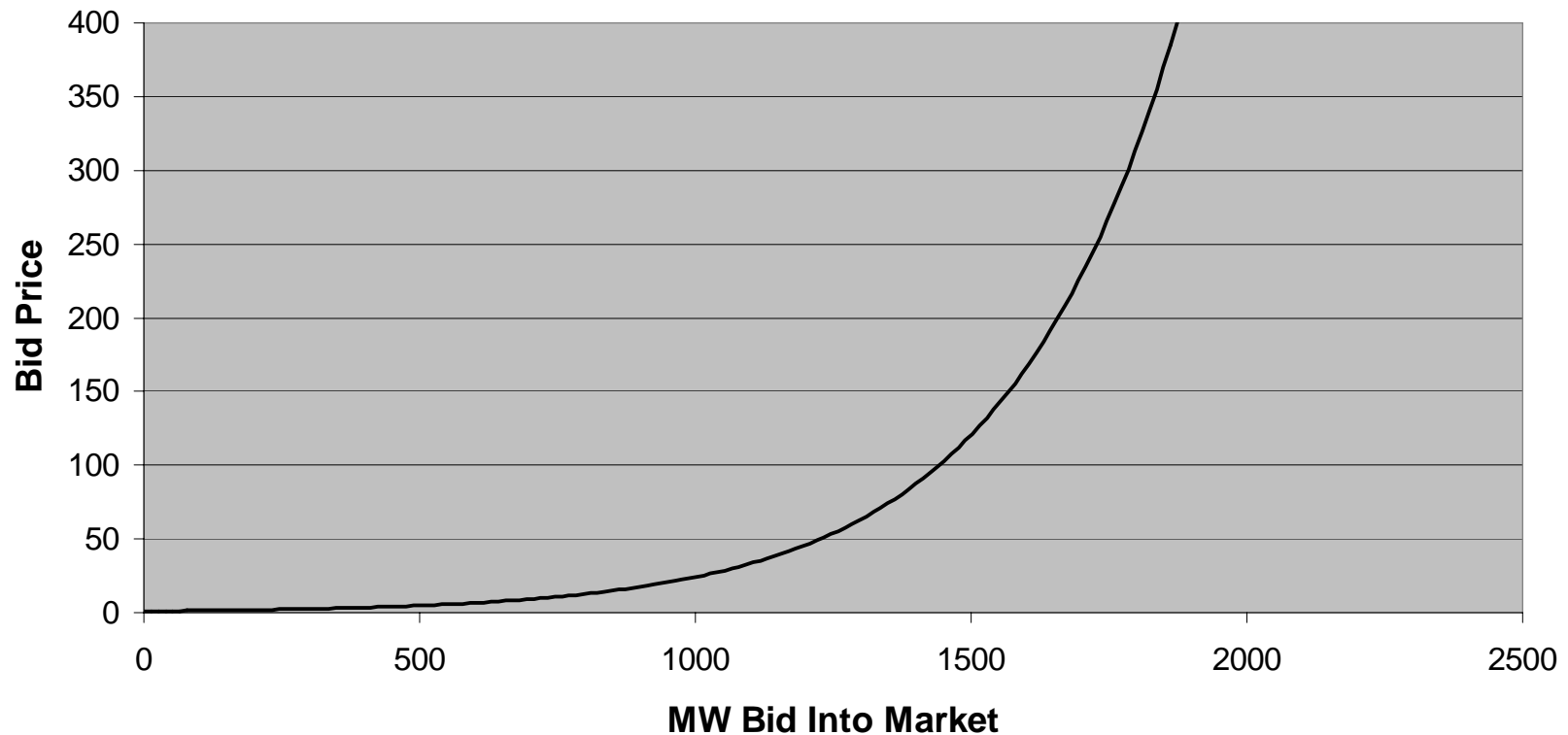Y-axis: **Bid Price** (0, 50, 100, 150, 200, 250, 300, 350, 400)

X-axis: **MW Bid Into Market** (0, 200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000)

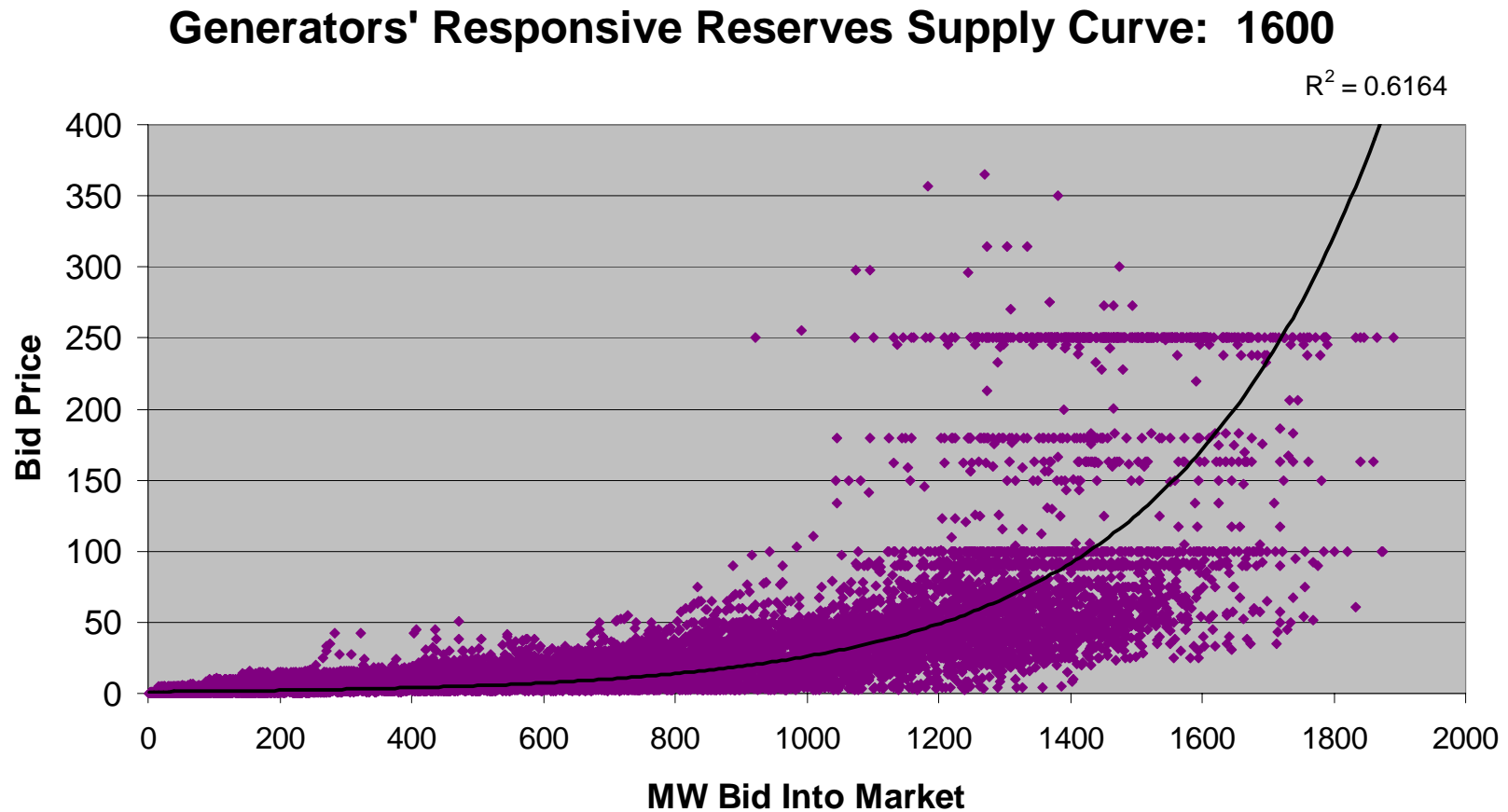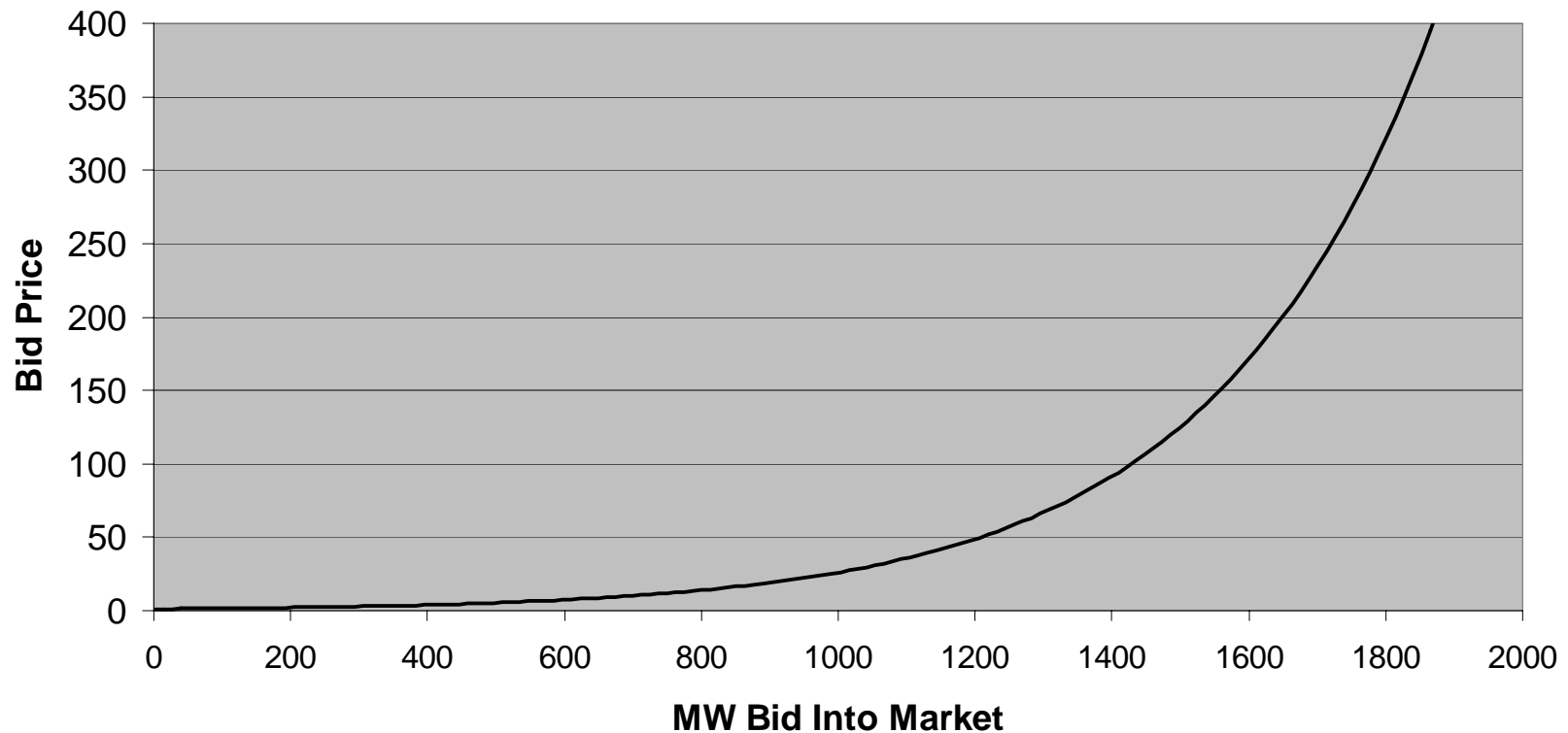# Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1200

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1300
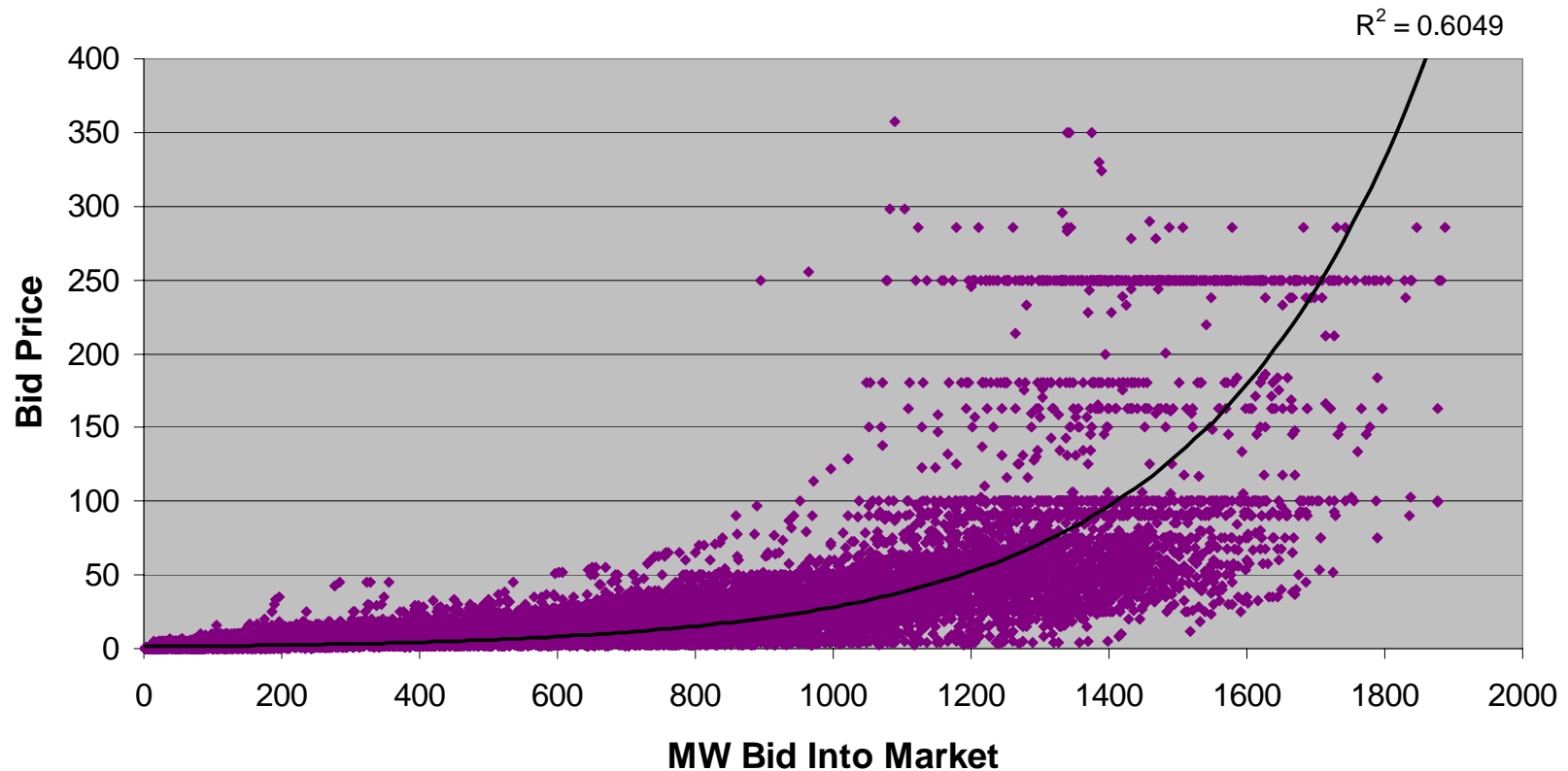
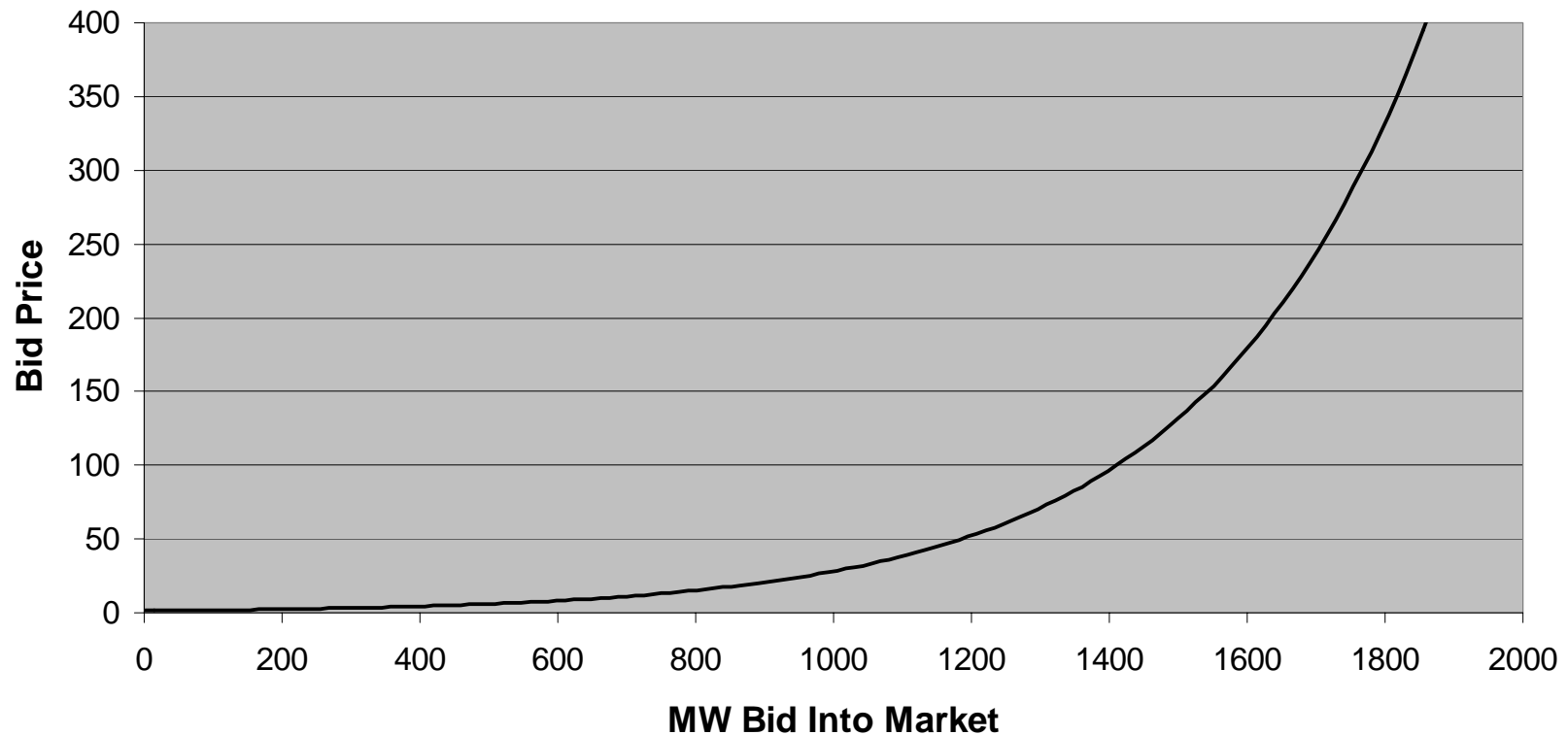$R^2 = 0.6911$

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1300

Results: Hourly Supply Curves

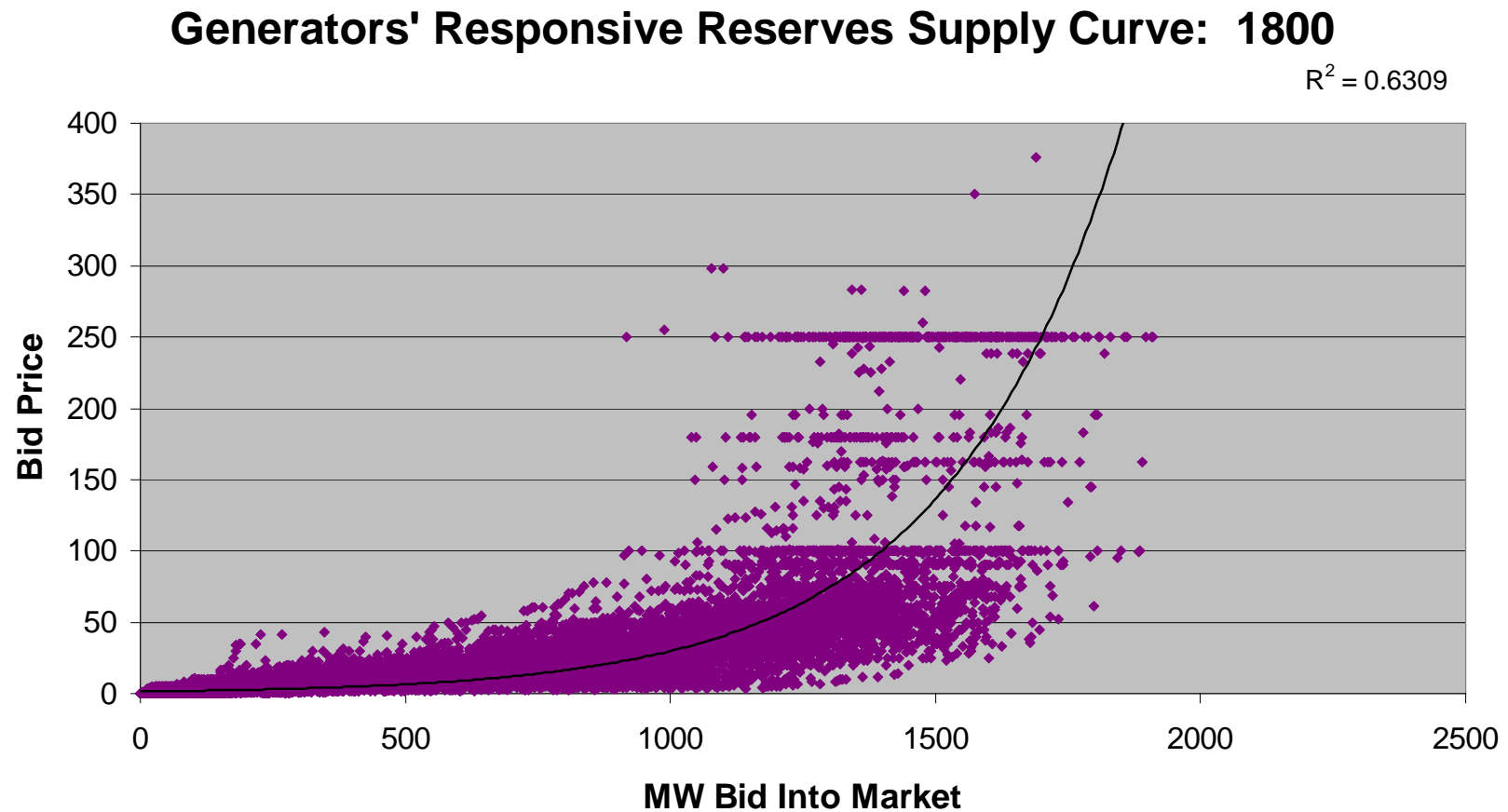**Generators' Responsive Reserves Supply Curve: 1400**

$R^2 = 0.6709$

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1400

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1500

$R^2 = 0.6321$

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1500

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1600

Results: Hourly Supply Curves

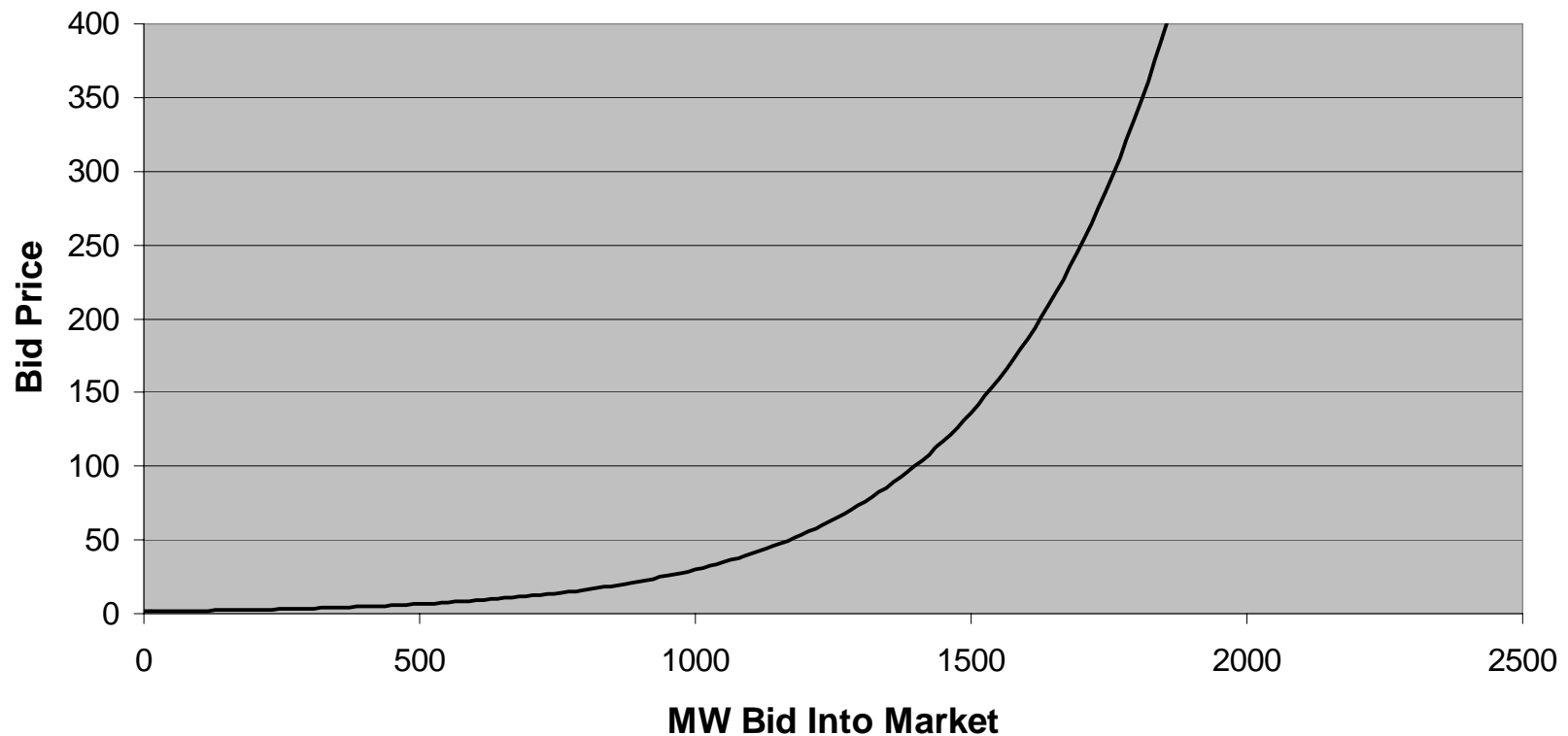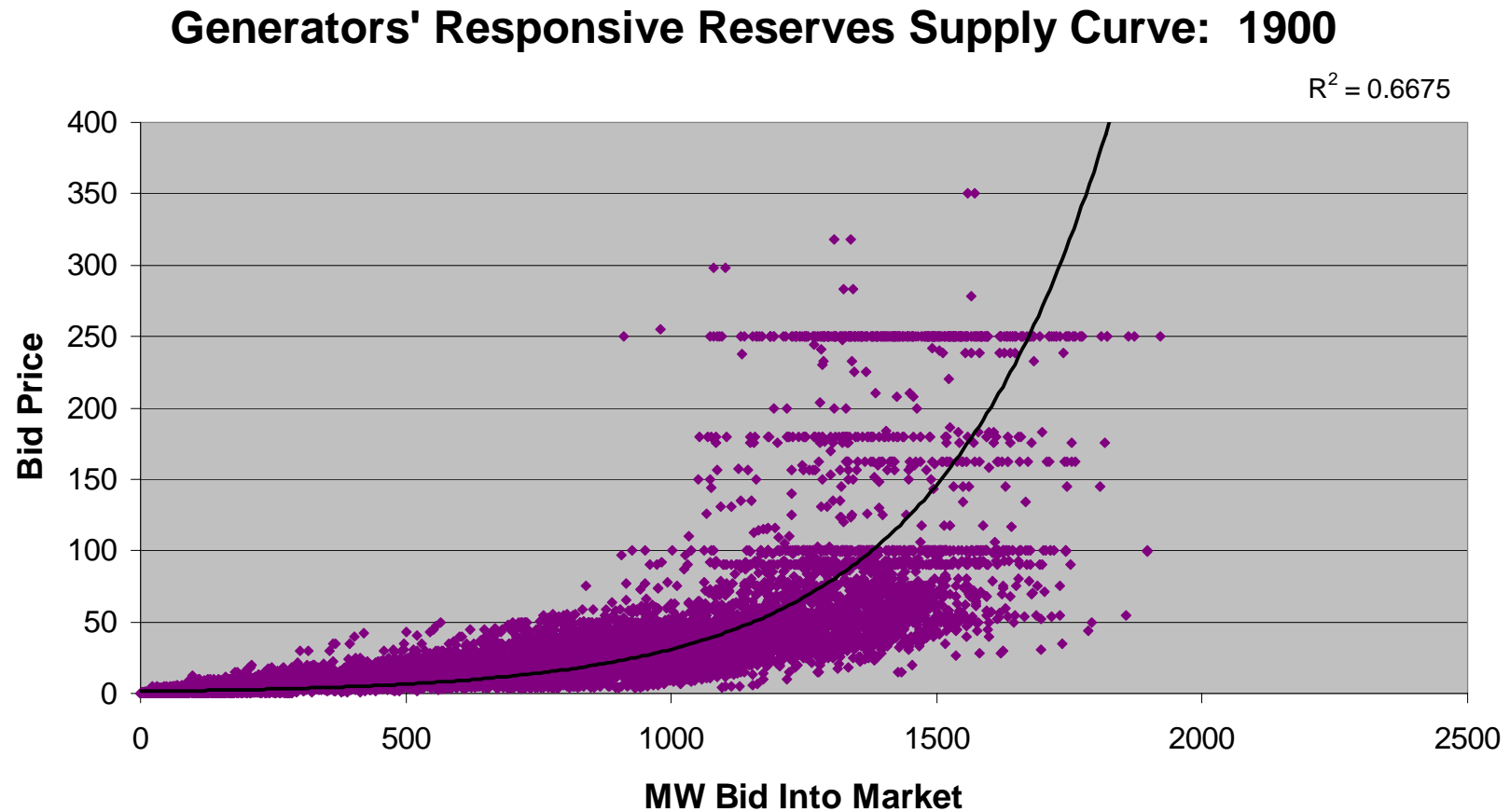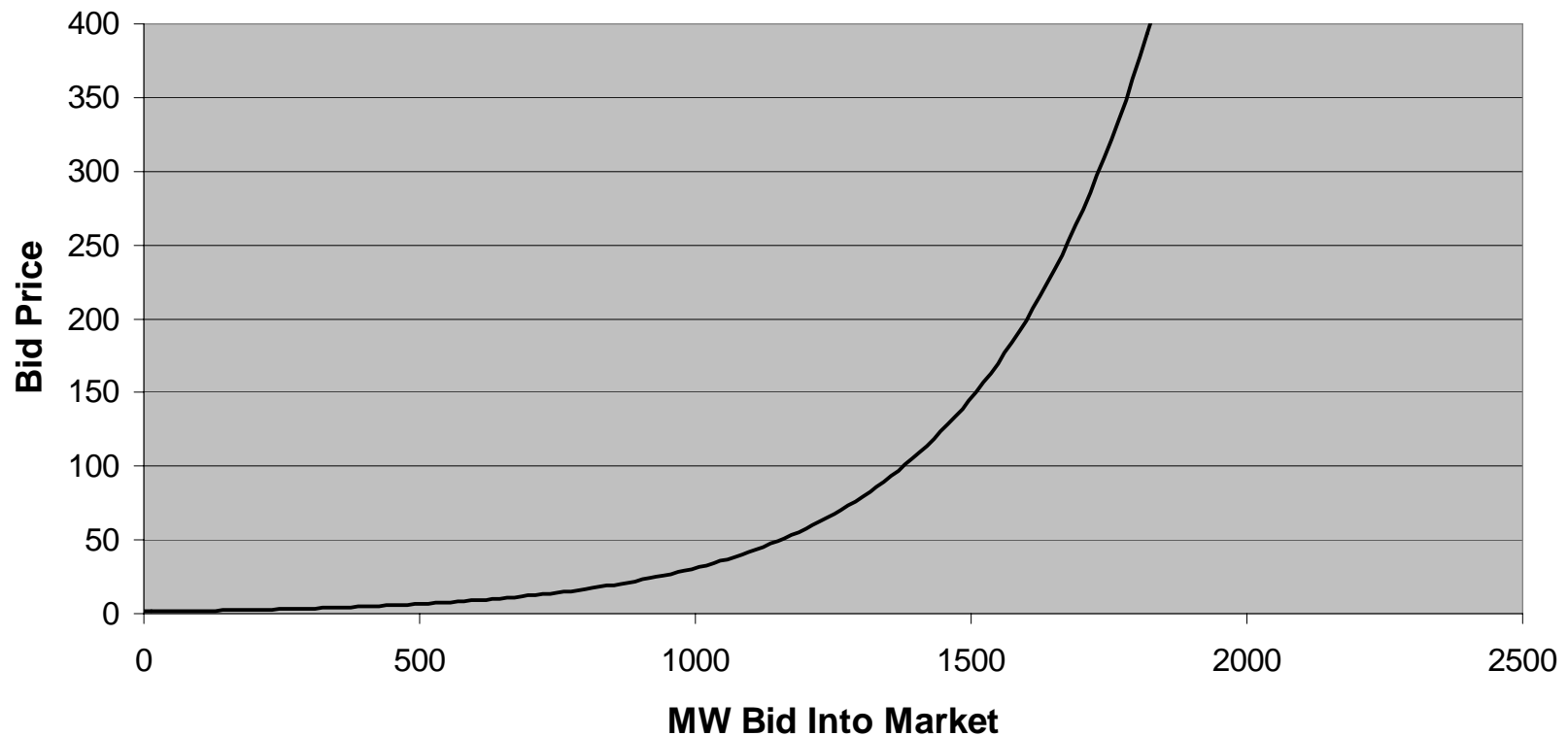**Generators' Responsive Reserves Supply Curve: 1600**

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1700
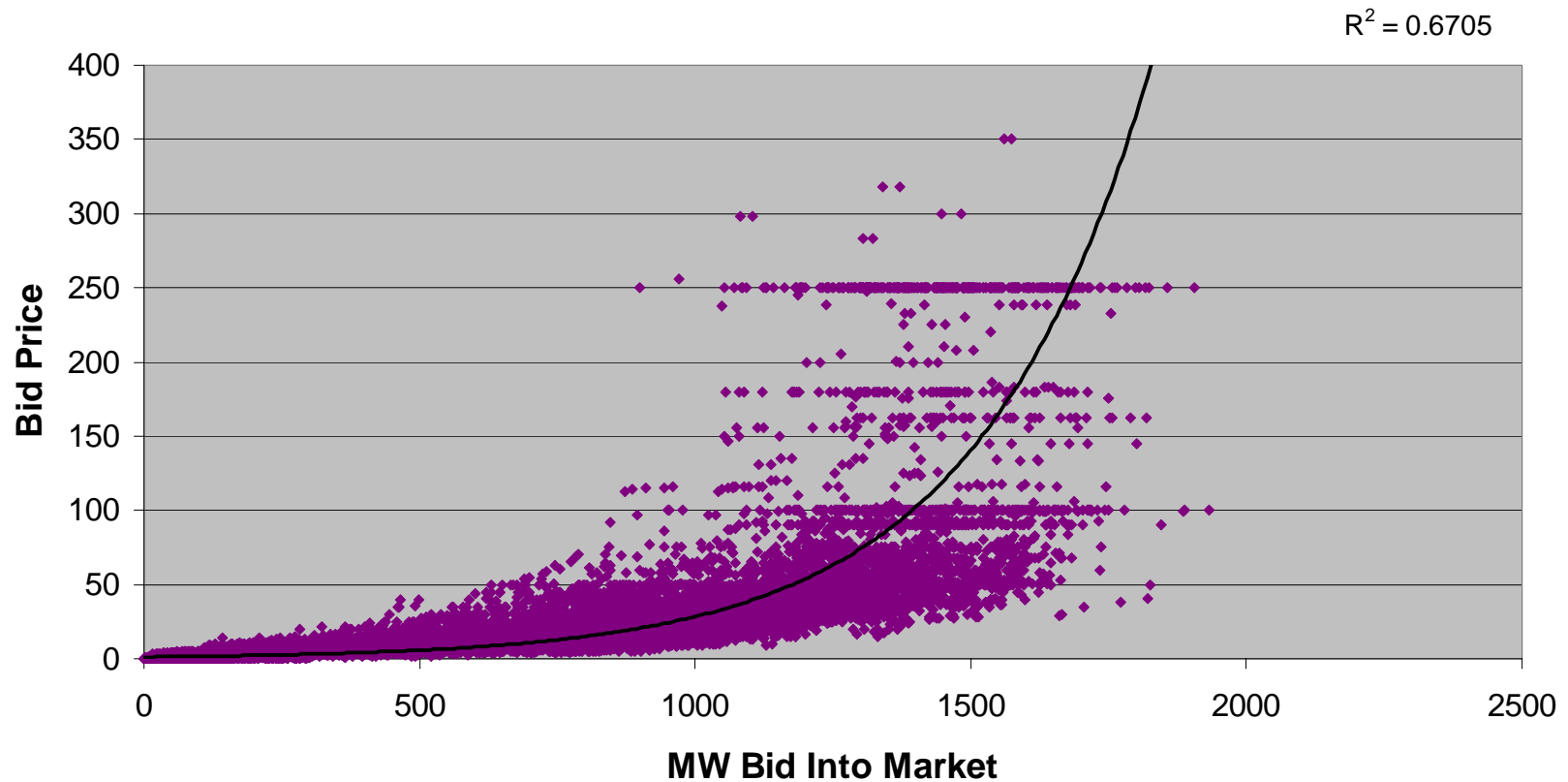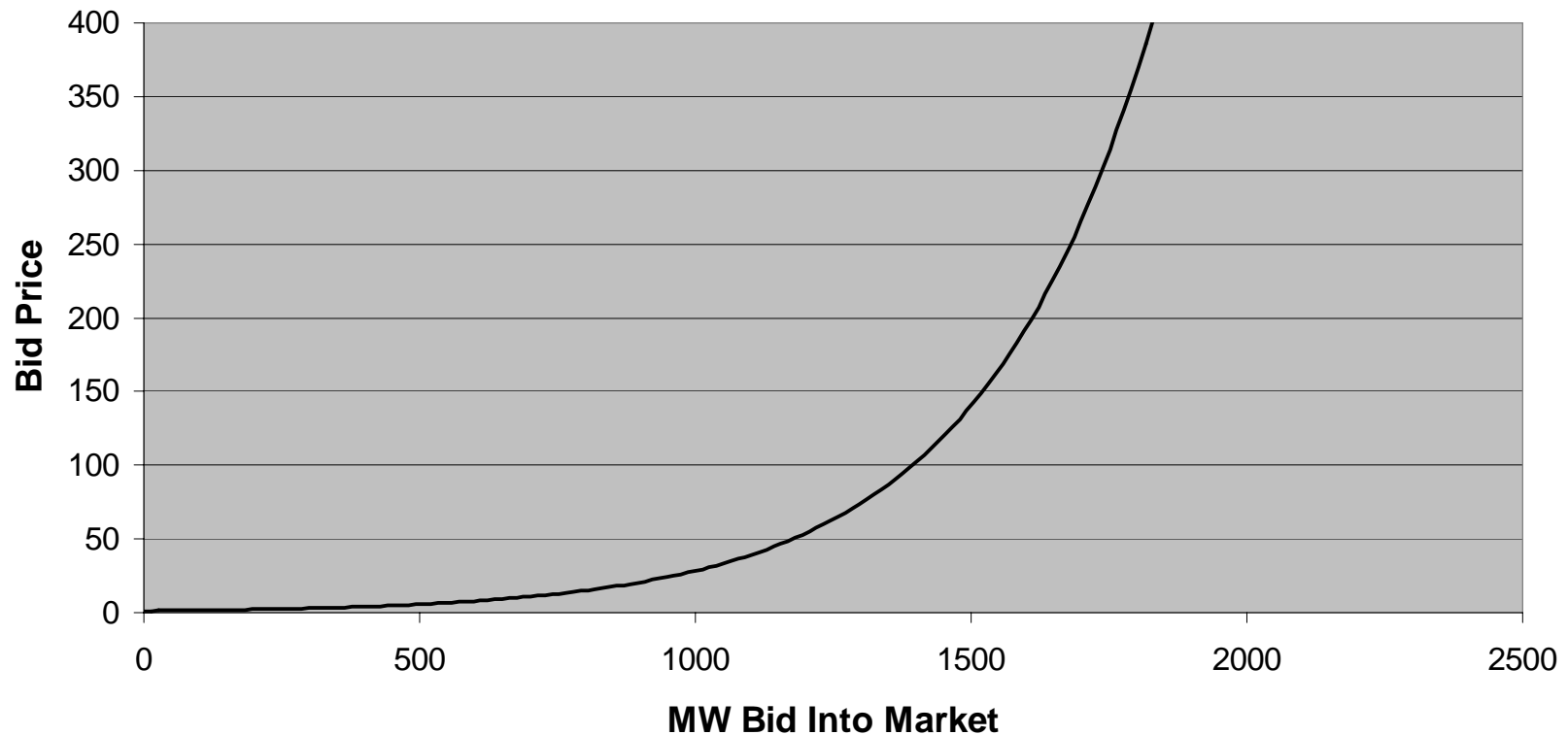

$R^2 = 0.6049$

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1700

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1800

$R^2 = 0.6309$

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1800

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1900

$R^2 = 0.6675$

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 1900

Results: Hourly Supply Curves
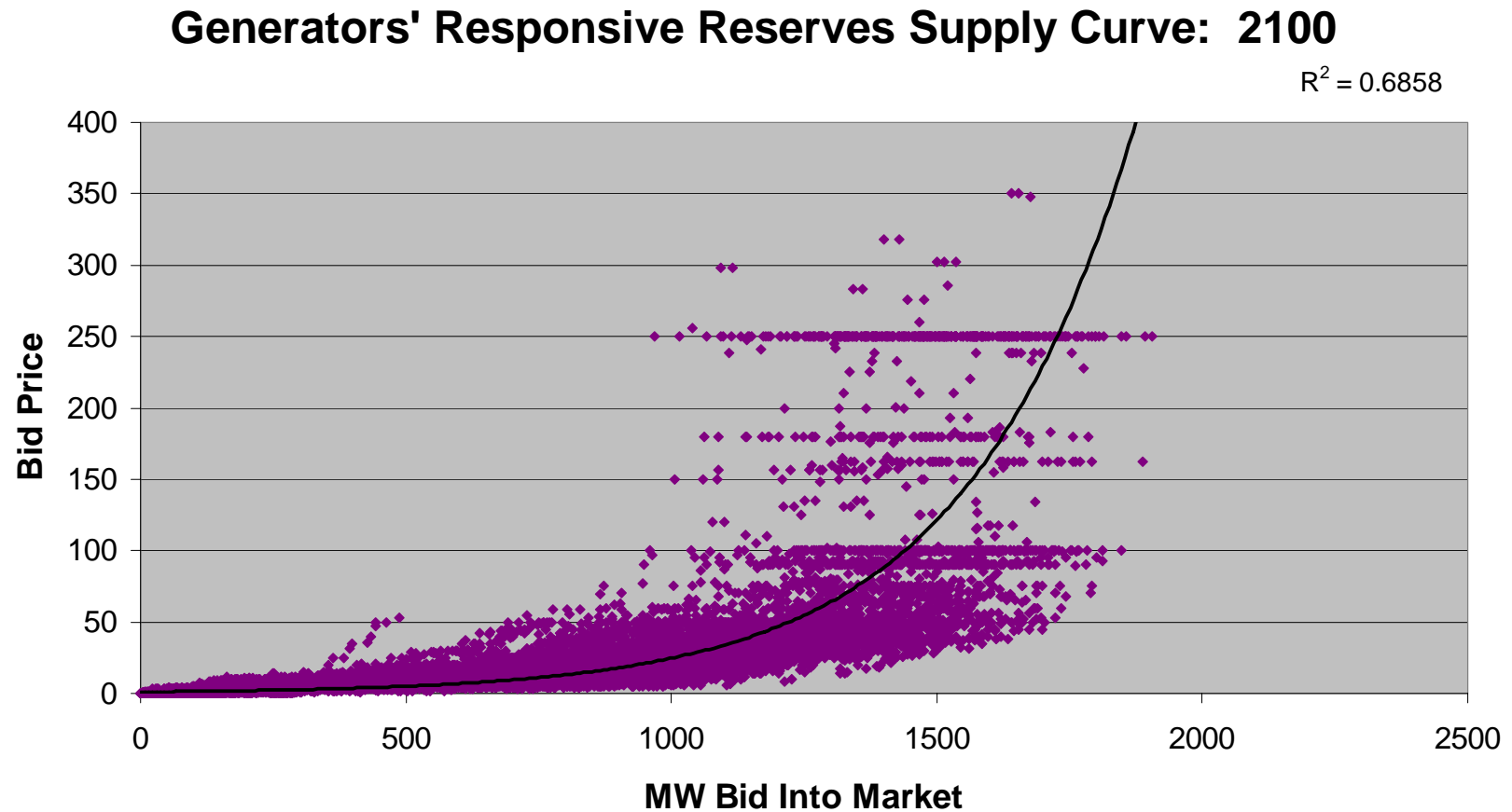

Generators' Response Reserves Supply Curve: 2000

$R^2 = 0.6705$

Results: Hourly Supply Curves

Generators' Response Reserves Supply Curve: 2000

Results: Hourly Supply Curves
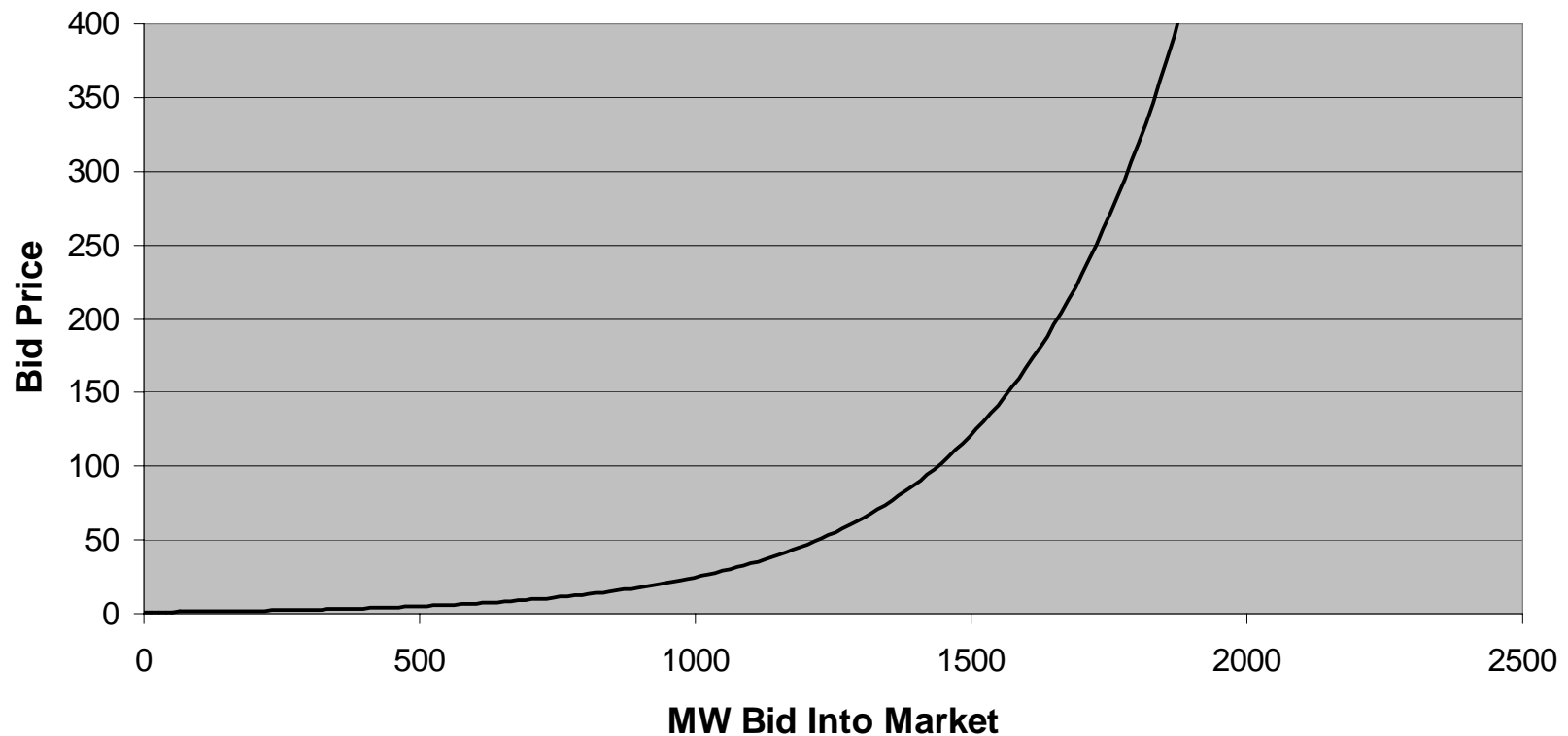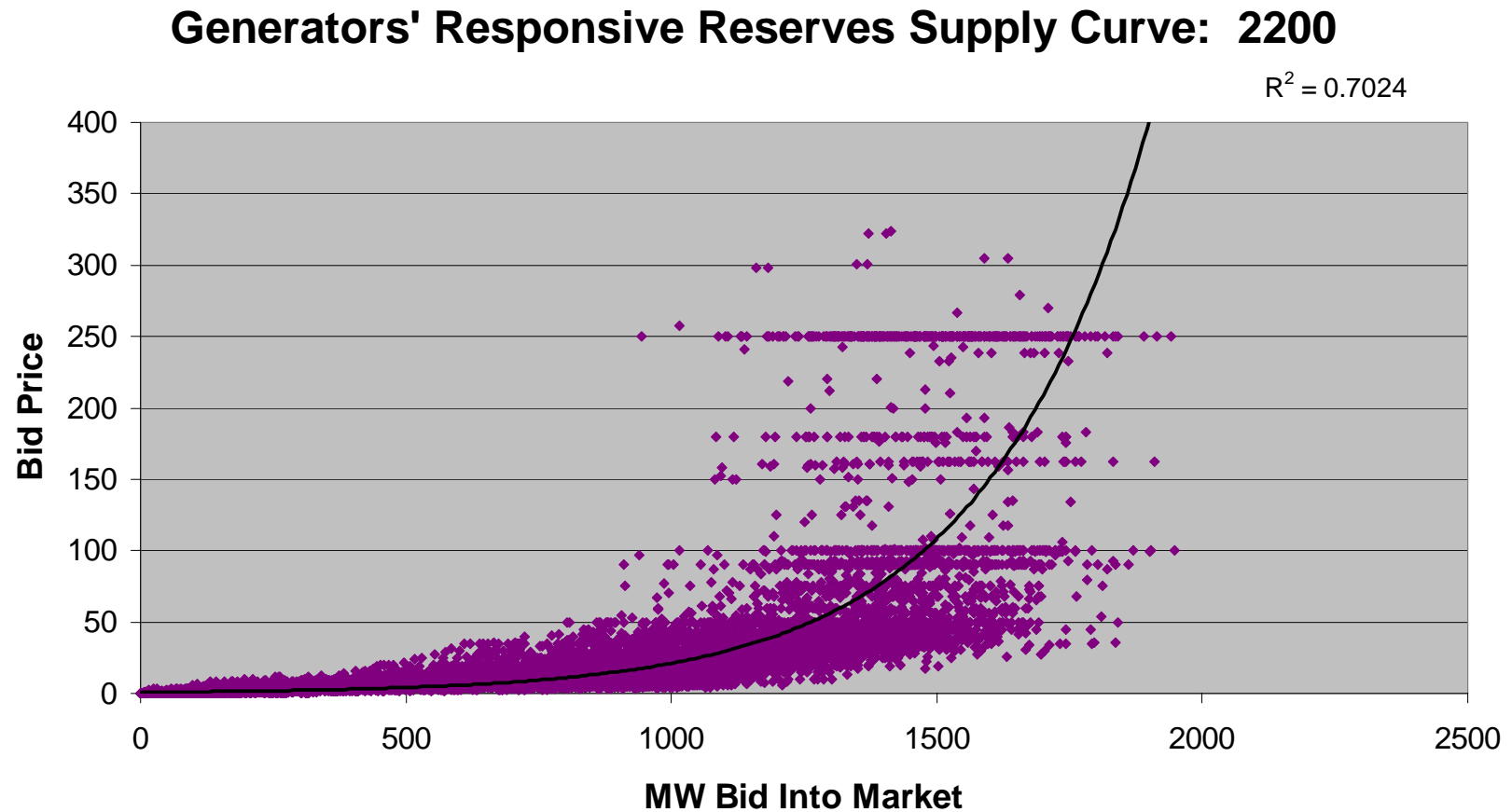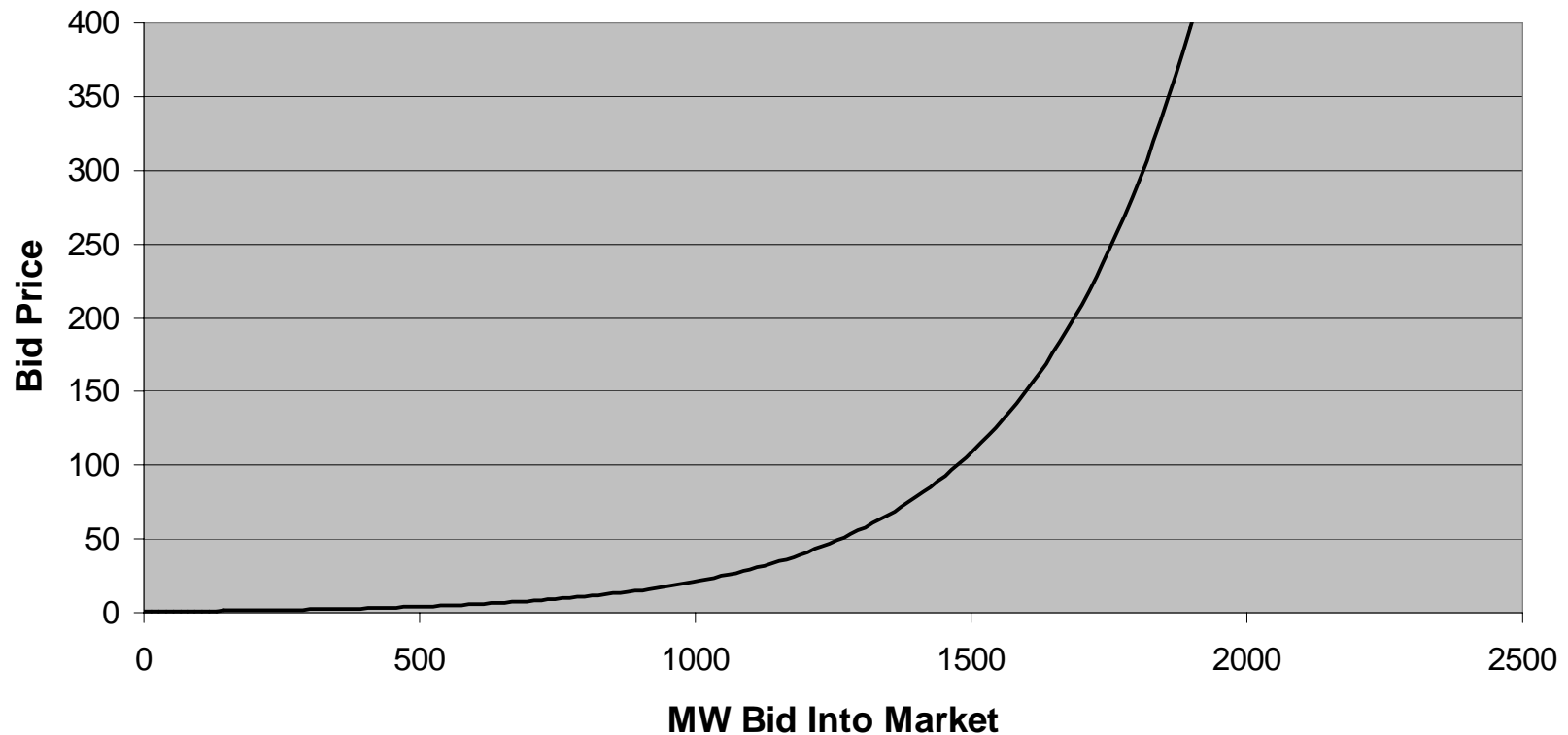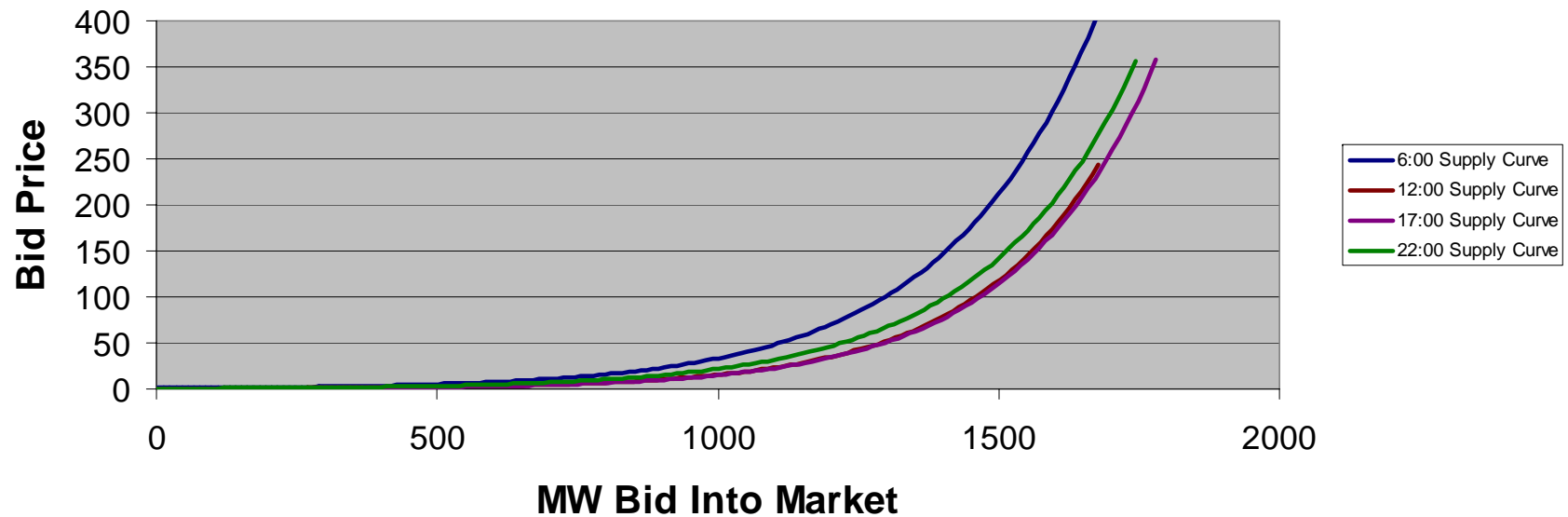

Generators' Responsive Reserves Supply Curve: 2100

$R^2 = 0.6858$

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 2100

Results: Hourly Supply Curves

Generators' Responsive Reserves Supply Curve: 2200

$R^2 = 0.7024$

Results: Hourly Supply Curves

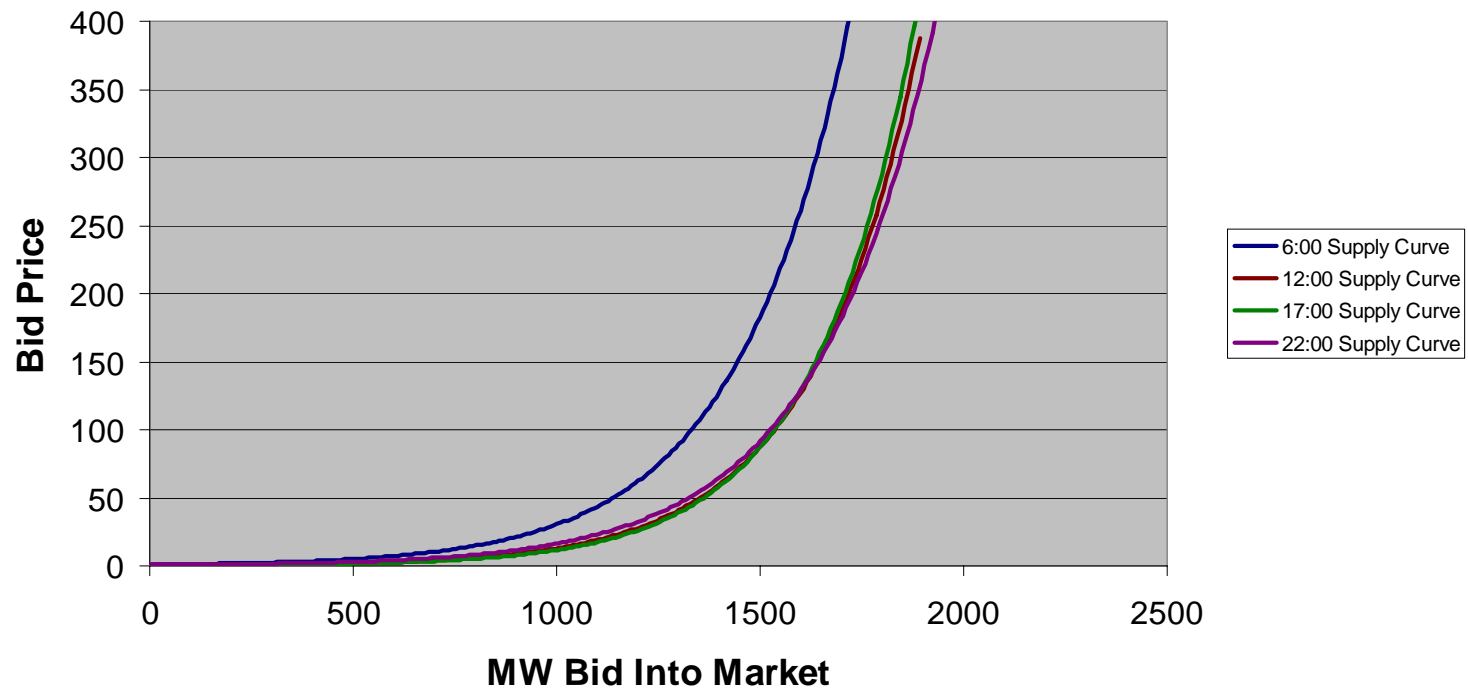**Generators' Responsive Reserves Supply Curve: 2200**

Results: Monthly Supply Curves

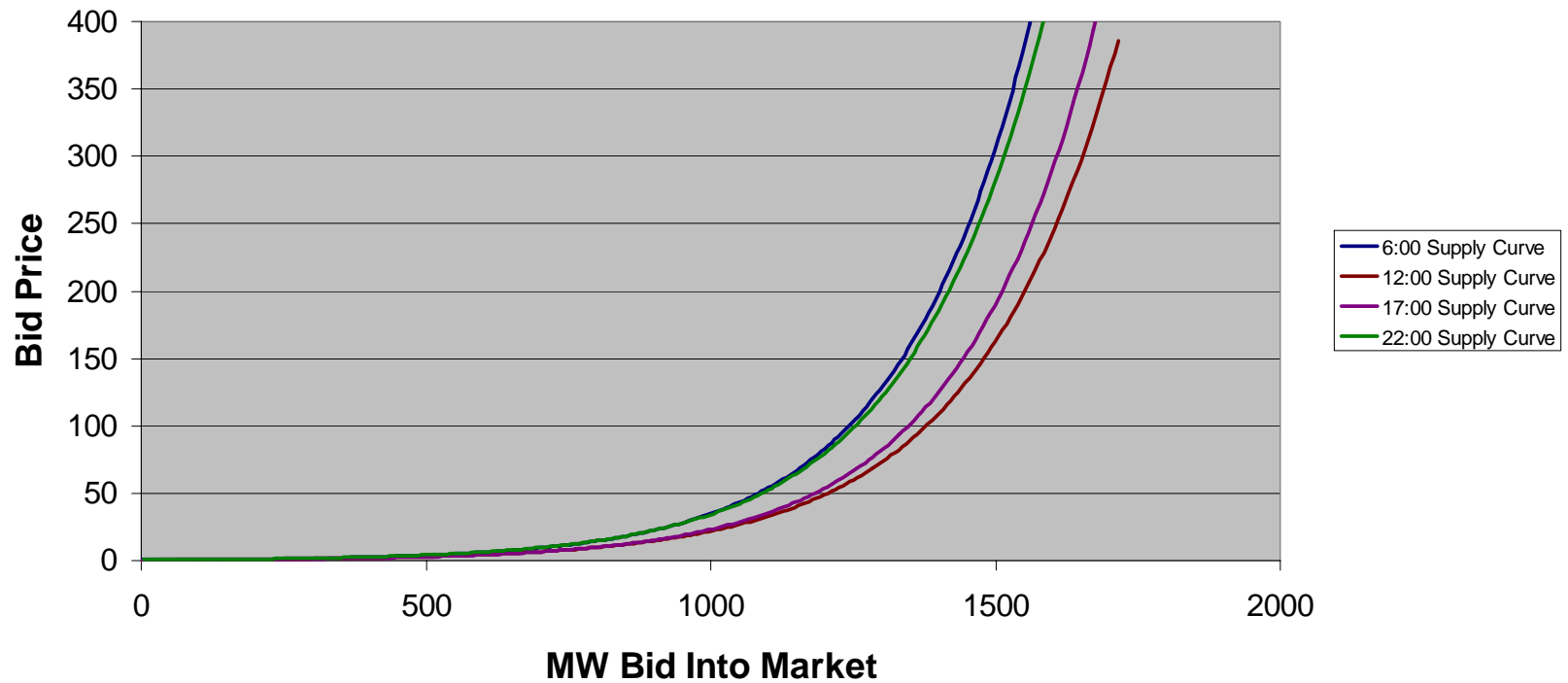**Generators' Responsive Reserves Supply Curve: Jan 2007**

Results: Monthly Supply Curves

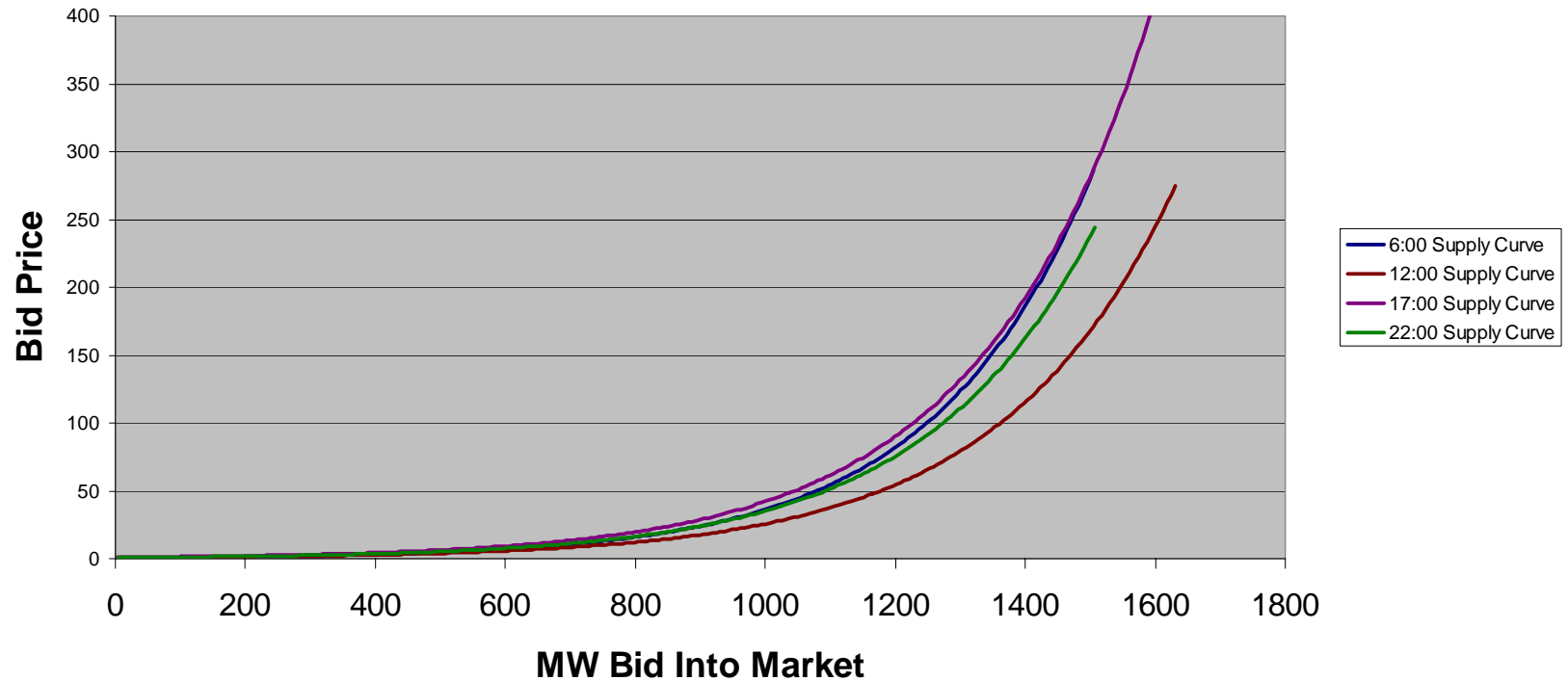
Generators' Responsive Reserves Supply Curve: Feb 2007

Results: Monthly Supply Curves

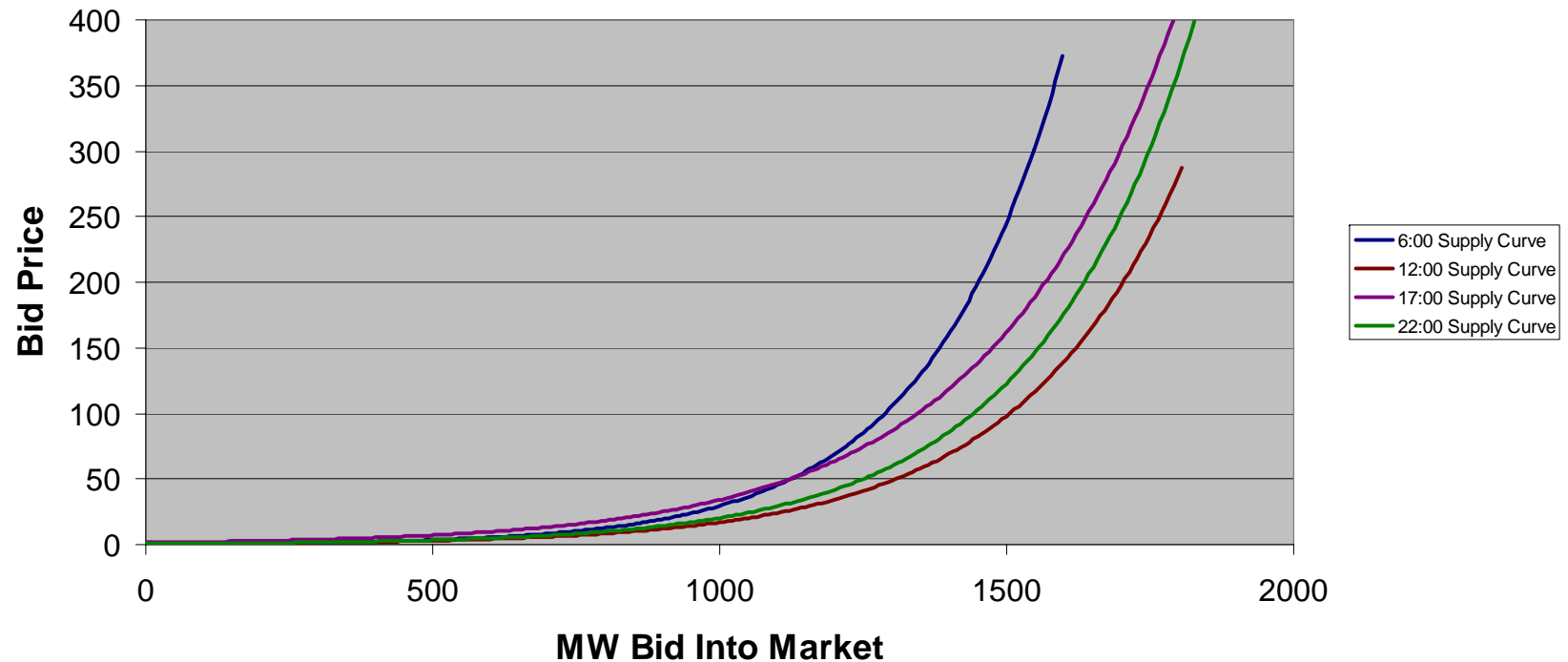**Generators' Responsive Reserves Supply Curve March 2007**

Results: Monthly Supply Curves
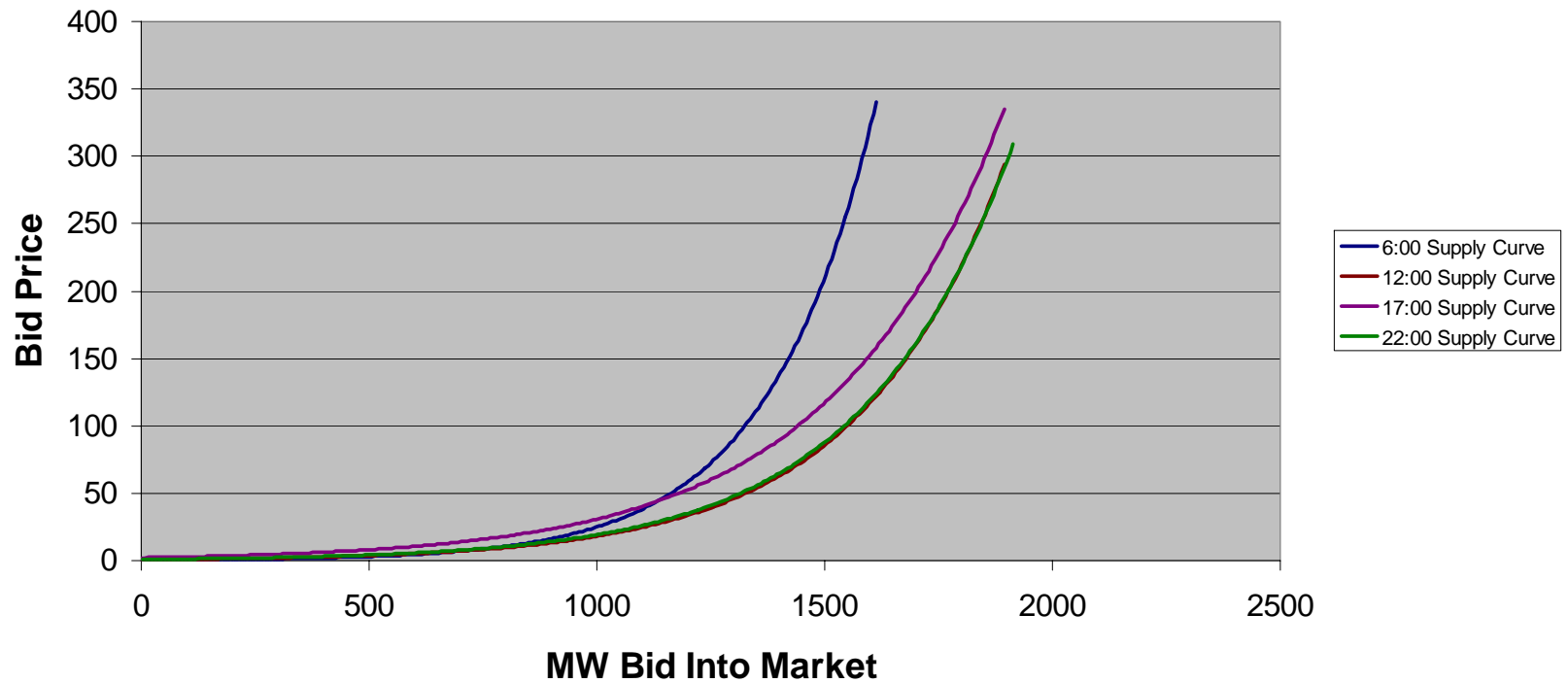

Generators' Responsive Reserves Supply Curve April 2007

Results: Monthly Supply Curves

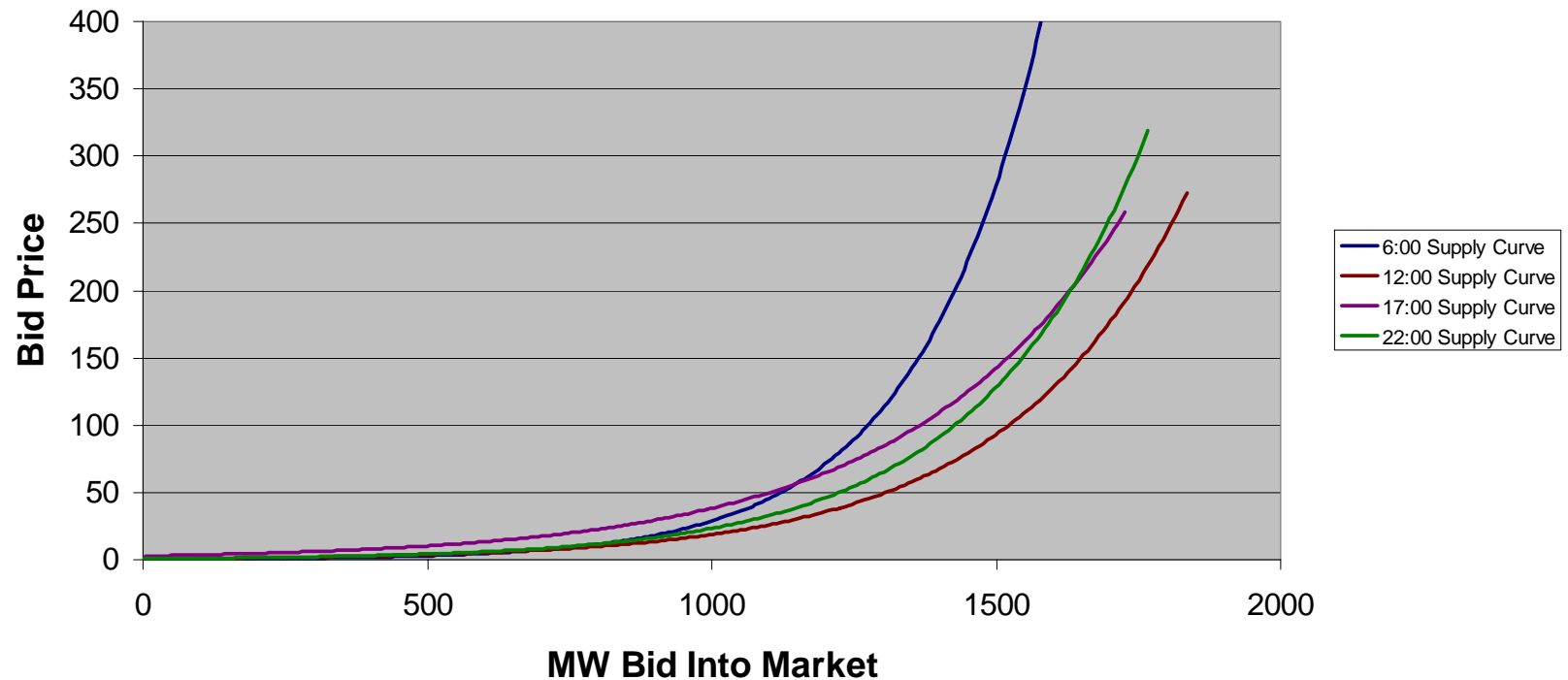**Generators' Responsive Reserves Supply Curve: May 2007**

Results: Monthly Supply Curves

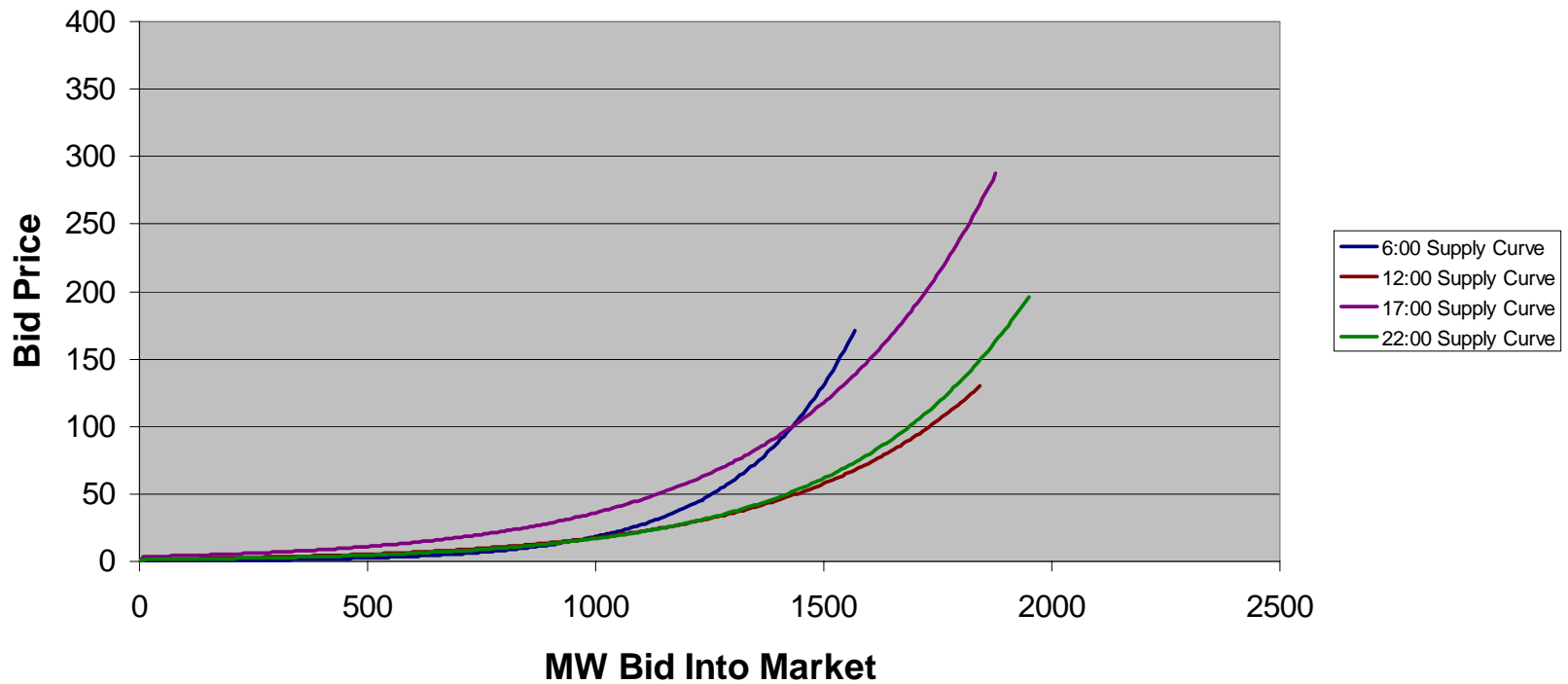**Generators' Responsive Reserves Supply Curve: June 2007**

Results: Monthly Supply Curves

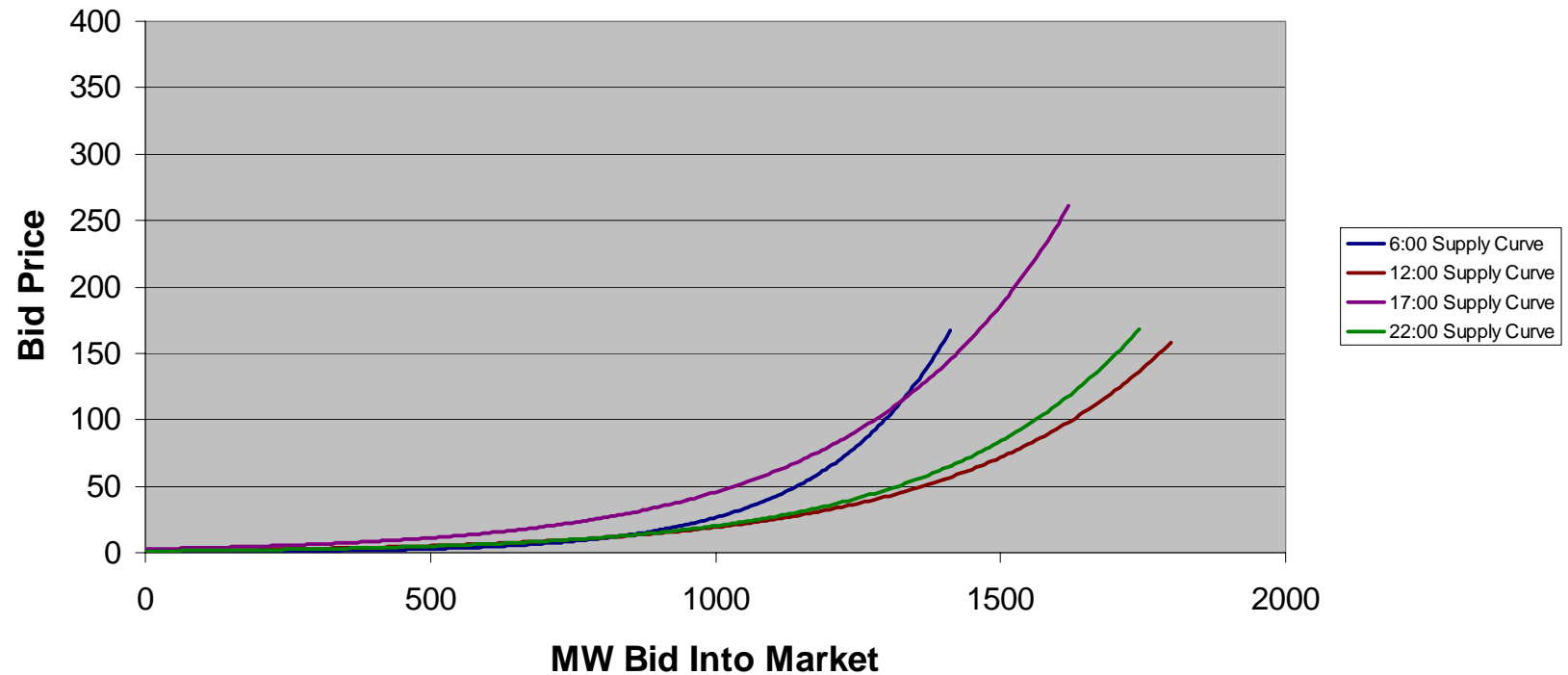Generators' Responsive Reserves Supply Curve: July 2007

Results: Monthly Supply Curves

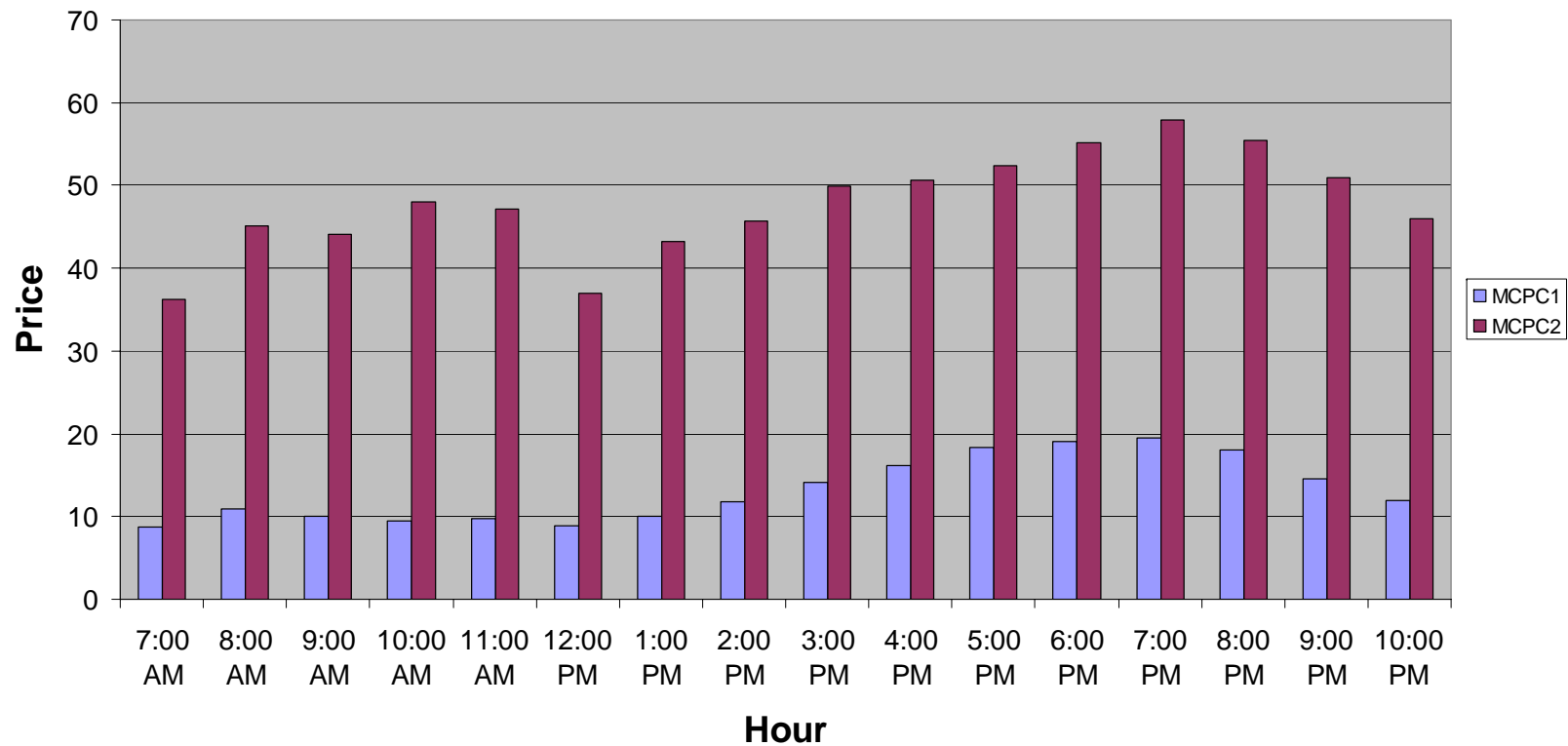Generators' Responsive Reserves Supply Curve:
August 2007

Results: Monthly Supply Curves

Generators' Responsive Reserves Supply Curve: September 2007

Implications: Increase in Price

Responsive Reserve Prices

MCPC1: MCPC assuming current levels of RRS procurement.
MCPC2: MCPC if additional 500 MW of RRS is procured and historical
bid stacks are offered.

Implications: Increase in Price

Average Responsive Reserve Prices (5pm)