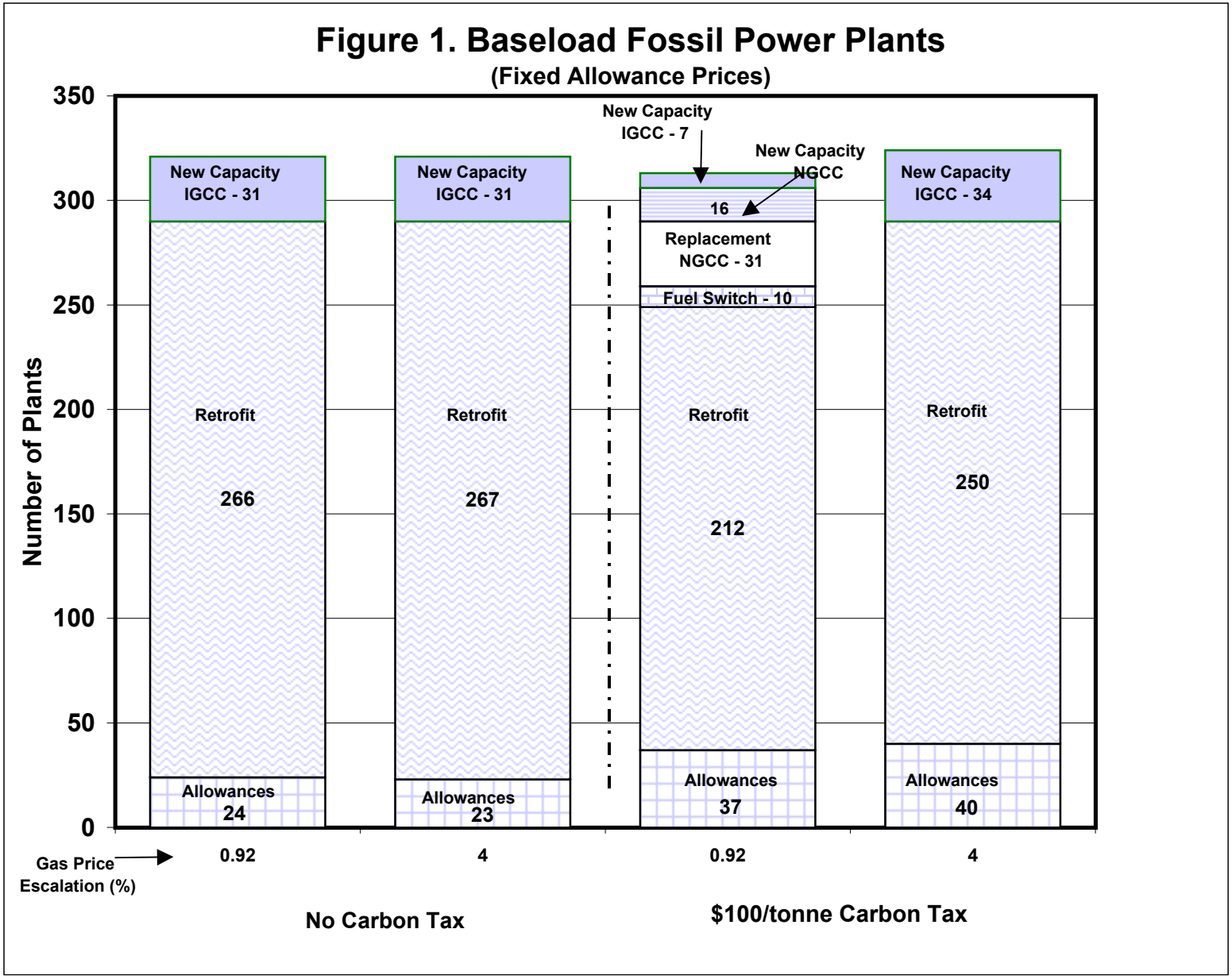


Figure 1. Baseload Fossil Power Plants
(Fixed Allowance Prices)
Number of Plants
350
300
250
200
150
100
50
0
New Capacity
IGCC - 31
Retrofit
266
Allowances
24
New Capacity
IGCC - 31
Retrofit
267
Allowances
23
New Capacity
IGCC - 7
New Capacity
NGCC
16
Replacement
NGCC - 31
Fuel Switch - 10
Retrofit
212
Allowances
37
New Capacity
IGCC - 34
Retrofit
250
Allowances
40
Gas Price
Escalation (%)
0.92
4
0.92
4
No Carbon Tax
$100/tonne Carbon Tax

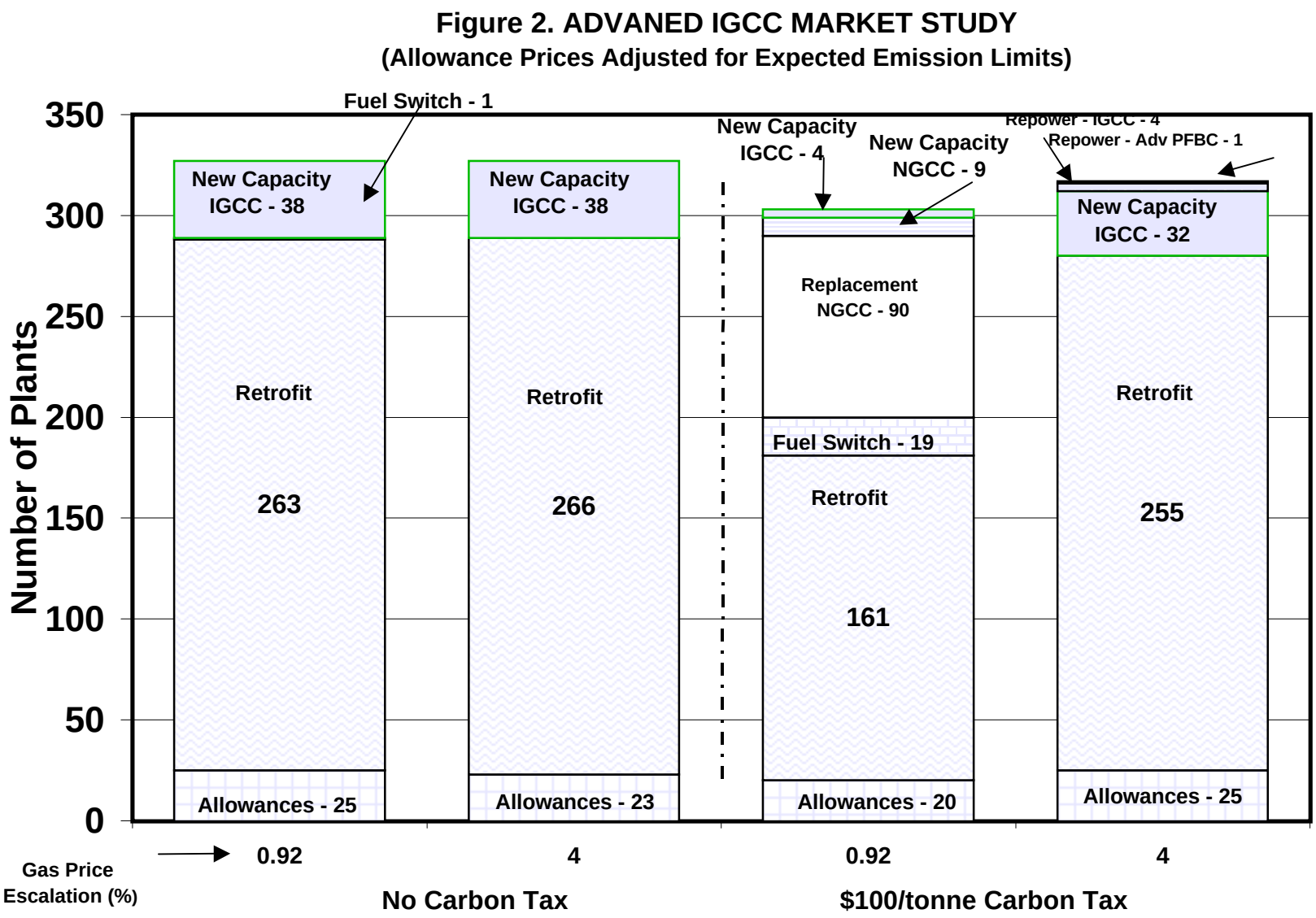


Figure 2. ADVANED IGCC MARKET STUDY
(Allowance Prices Adjusted for Expected Emission Limits)
Number of Plants
350
300
250
200
150
100
50
0
Fuel Switch - 1
New Capacity IGCC - 38
Retrofit
263
Allowances - 25
New Capacity IGCC - 38
Retrofit
266
Allowances - 23
New Capacity IGCC - 4
New Capacity NGCC - 9
Replacement NGCC - 90
Fuel Switch - 19
Retrofit
161
Allowances - 20
Repower - IGCC - 4
Repower - Adv PFBC - 1
New Capacity IGCC - 32
Retrofit
255
Allowances - 25
Gas Price Escalation (%)
0.92
4
0.92
4
No Carbon Tax
$100/tonne Carbon Tax

Figure 3. ADVANCED IGCC MARKET STUDY

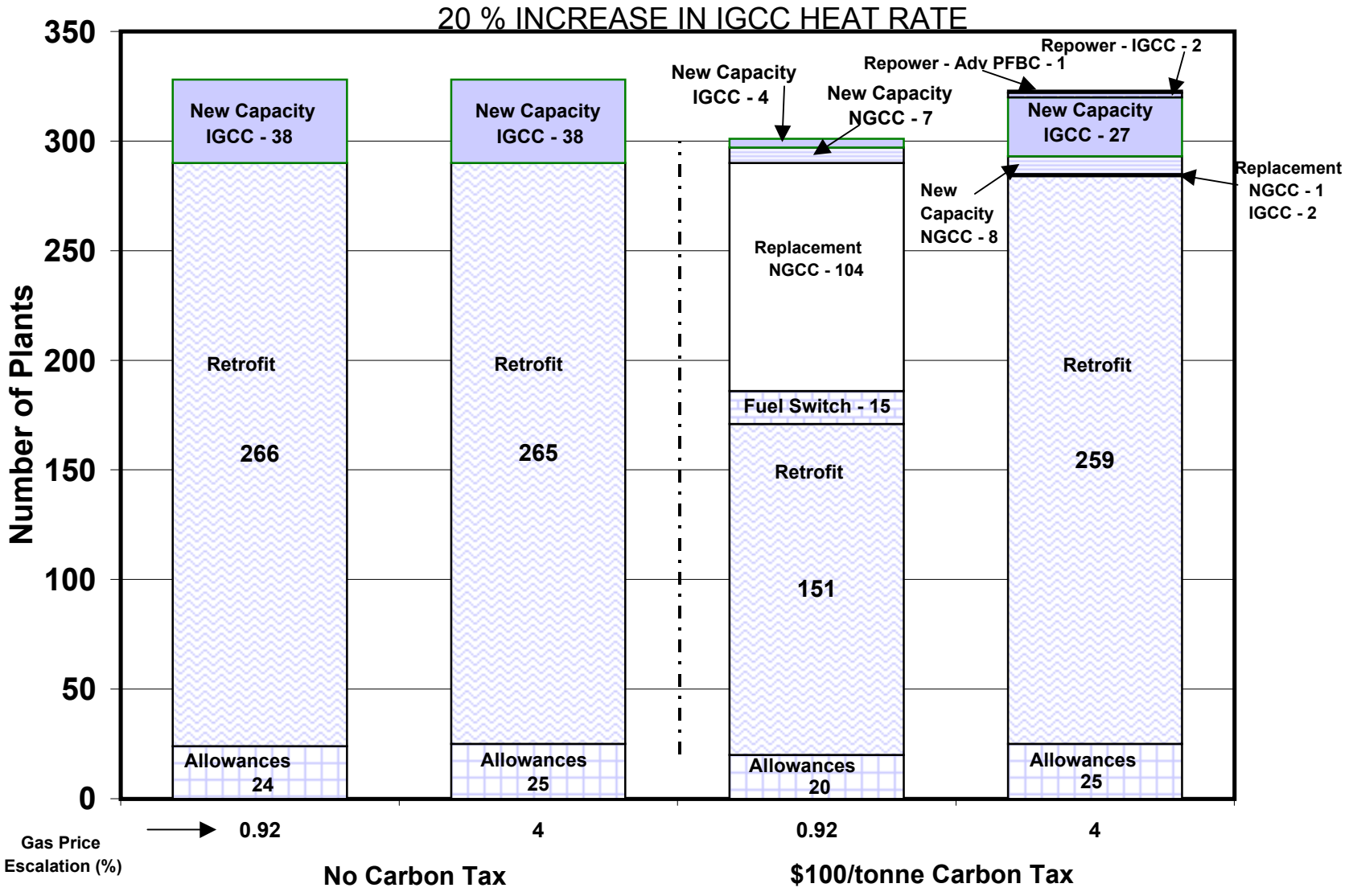


Figure 4. ADVANCED IGCC MARKET STUDY

20 % INCREASE IN CAPITAL COST

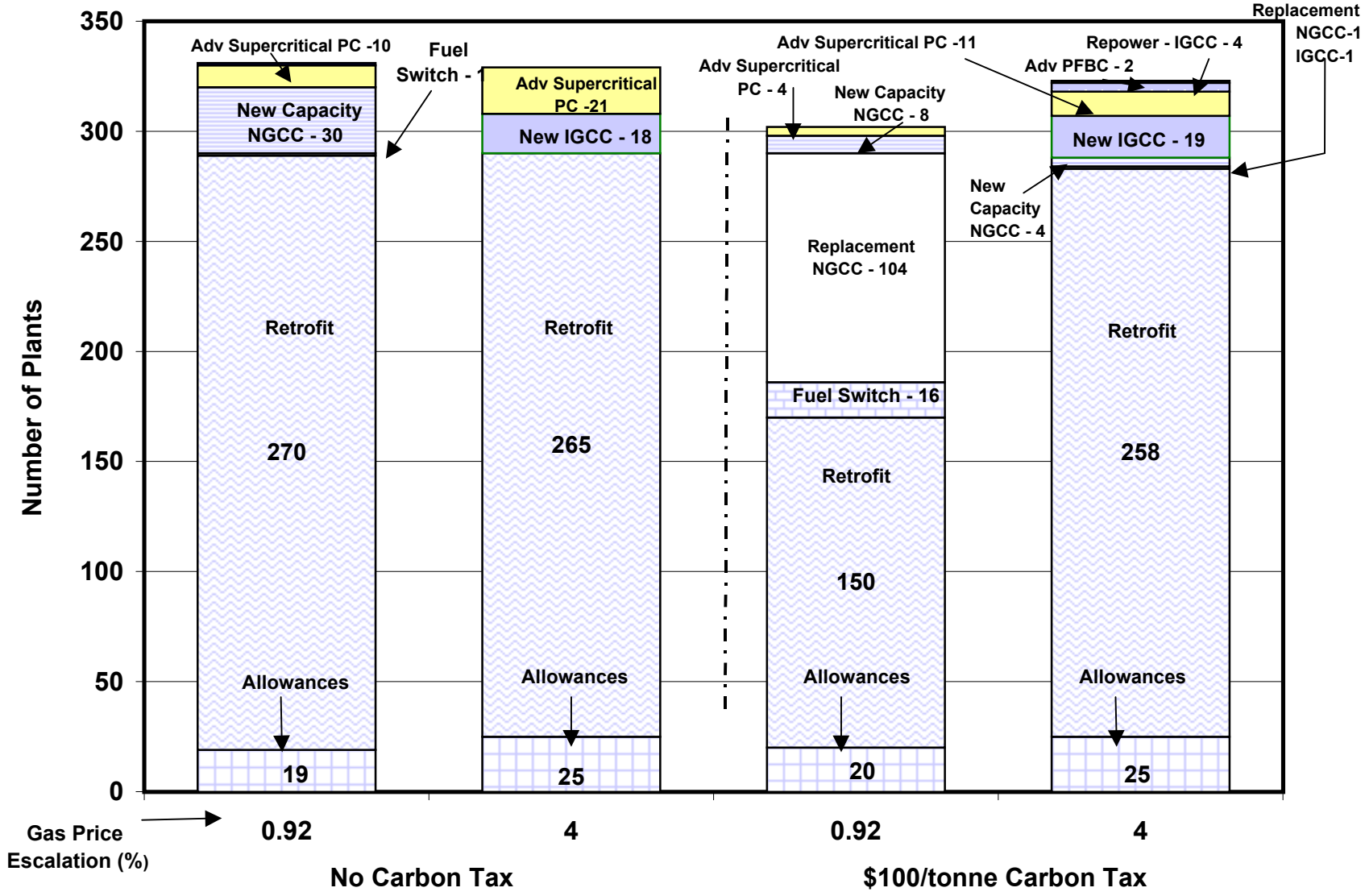


Figure 5. ADVANCED IGCC MARKET STUDY

10 % INCREASE IN CAPITAL & HEAT RATE

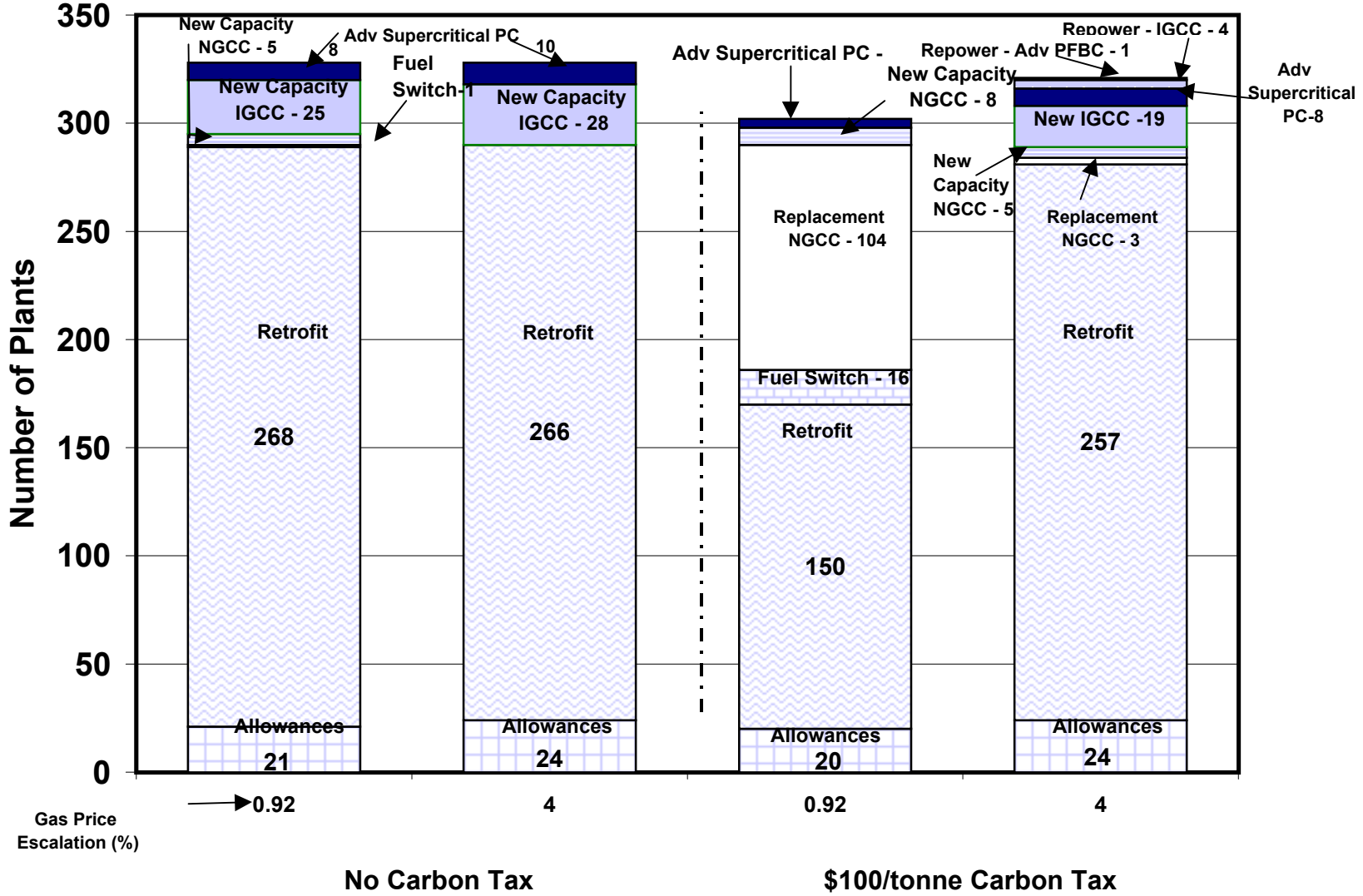


Figure 6. IGCC Market Penetration by Plants

Advanced IGCC Development
($1723/ton Ozone season and $259/ton Non-Ozone Season NOx Allowance Prices, $354/ton SOx Allowance Price)

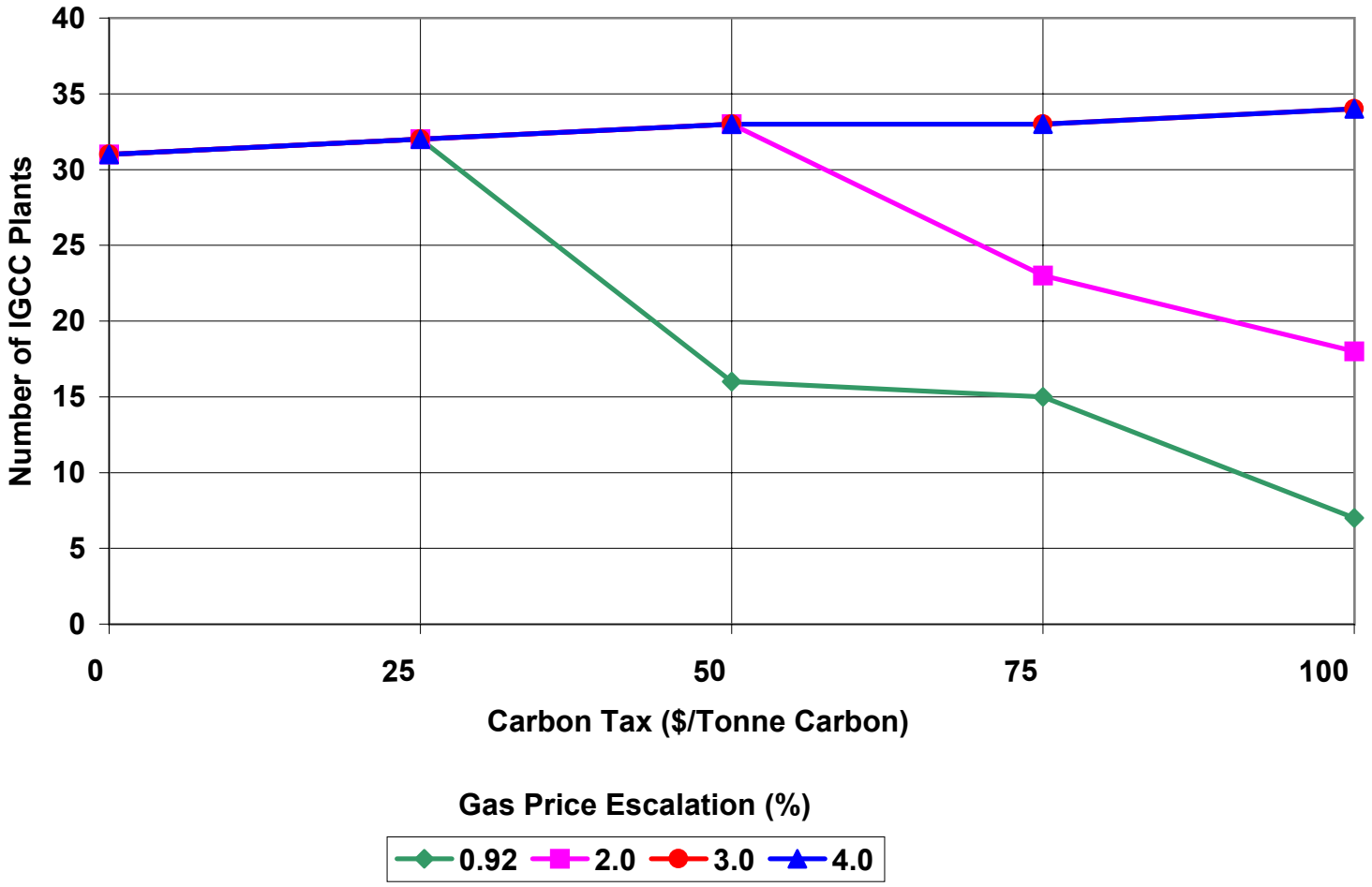


Figure 7. IGCC Installed Capacity

Advanced IGCC Development
($1723/ton Ozone season and $259/ton Non-Ozone Season NOx Allowance Prices, $354/ton SOx Allowance Price)

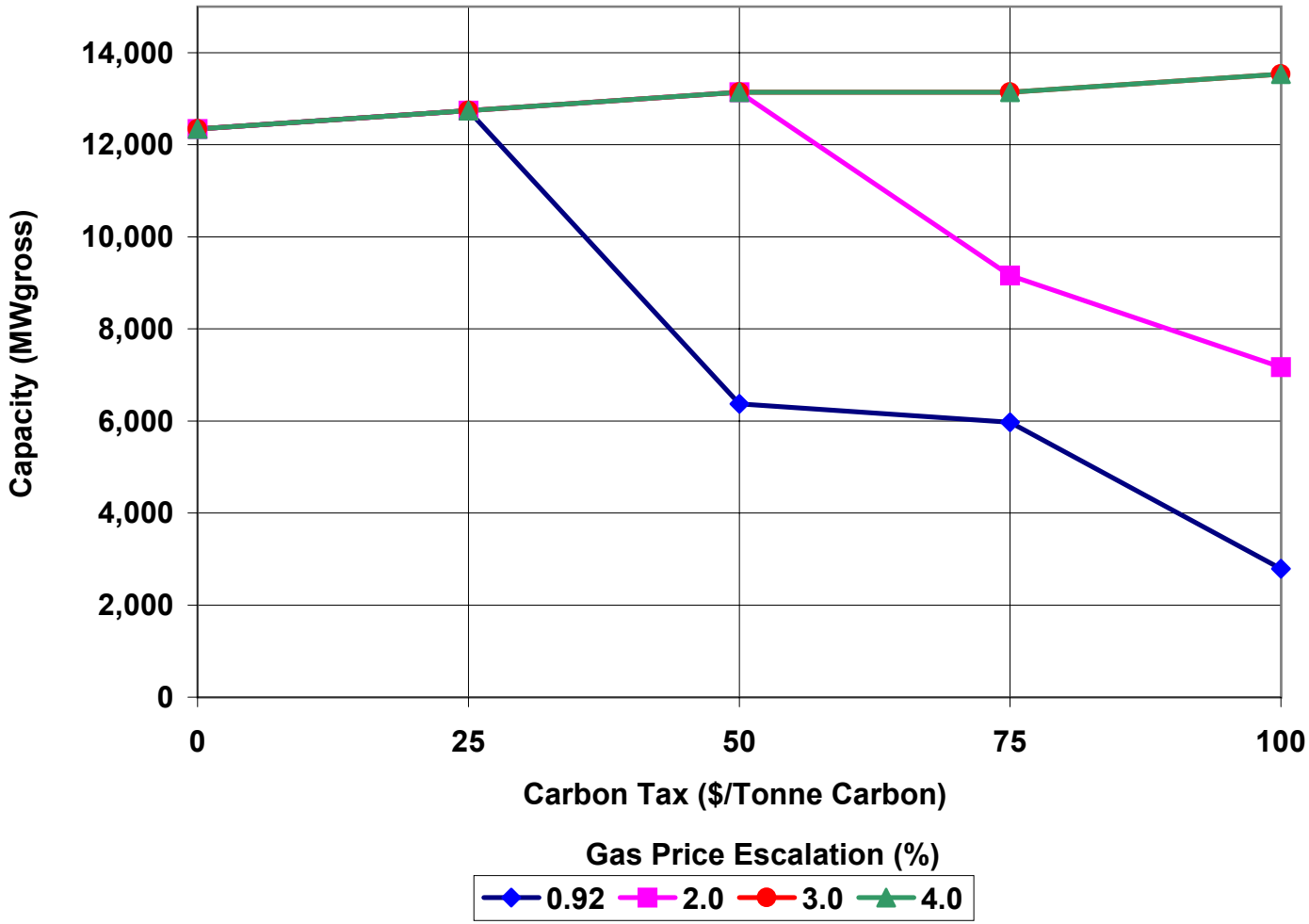


Figure 8. IGCC Market Penetration by Plants

Advanced IGCC Development

($1500/ton NOx Allowance Price (Year-round), $800/ton SOx Allowance Price)

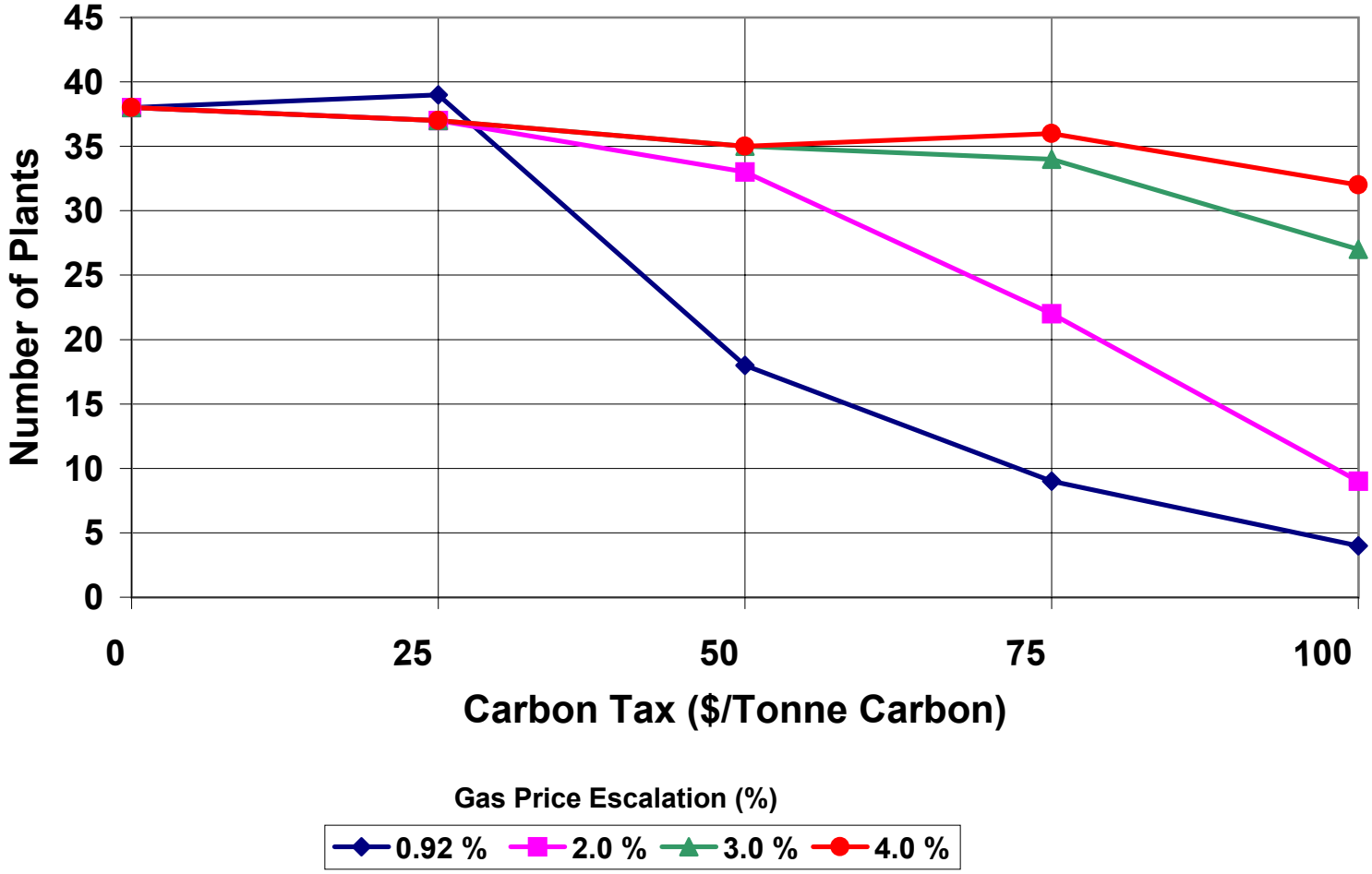


Figure 9. IGCC Installed Capacity

Advanced IGCC Development

($1500/ton NOx Allowance Price (Year-round), $800/ton SOx Allowance Price)

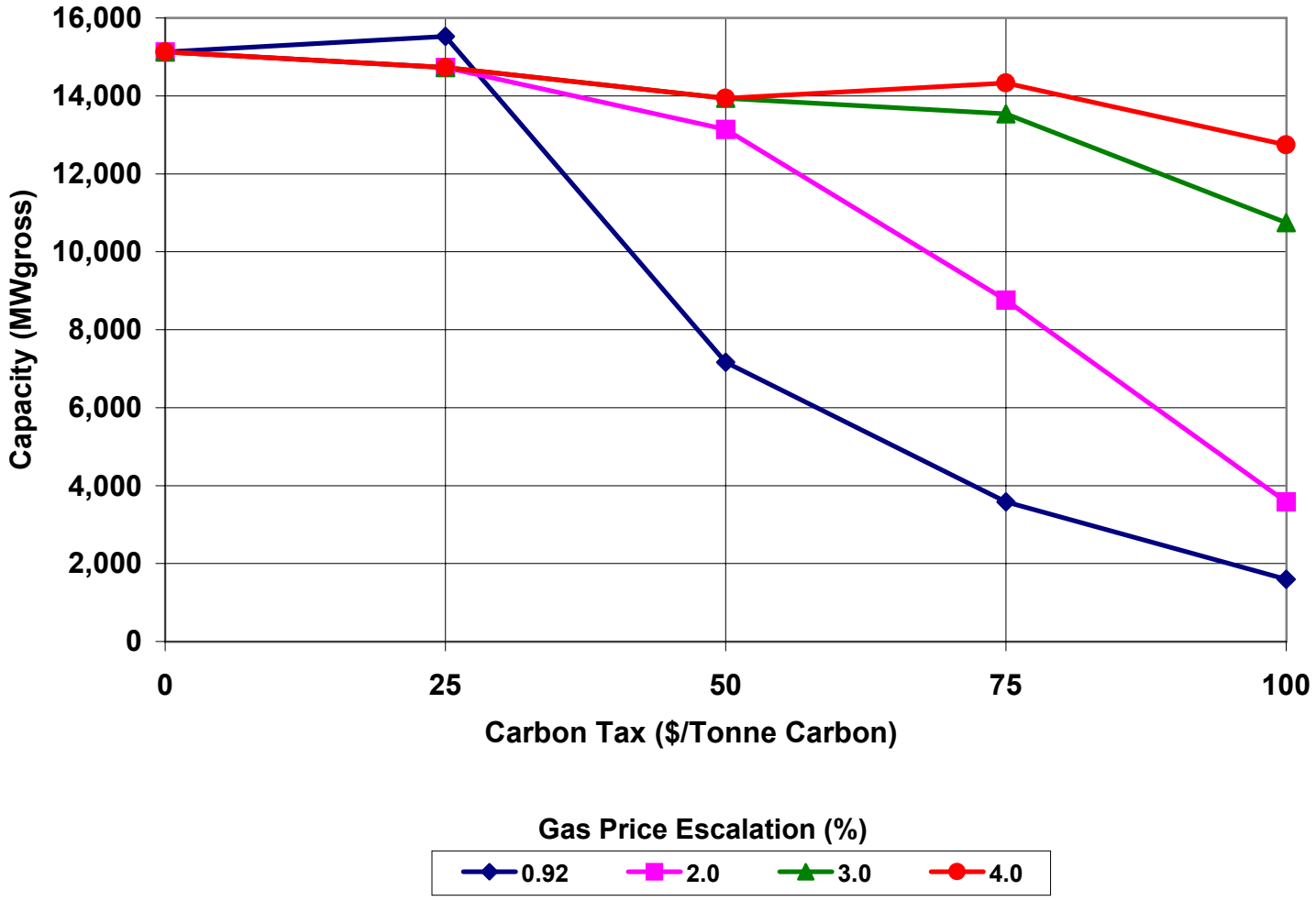


Figure 10. Impact of Allowance Prices on IGCC Market Penetration

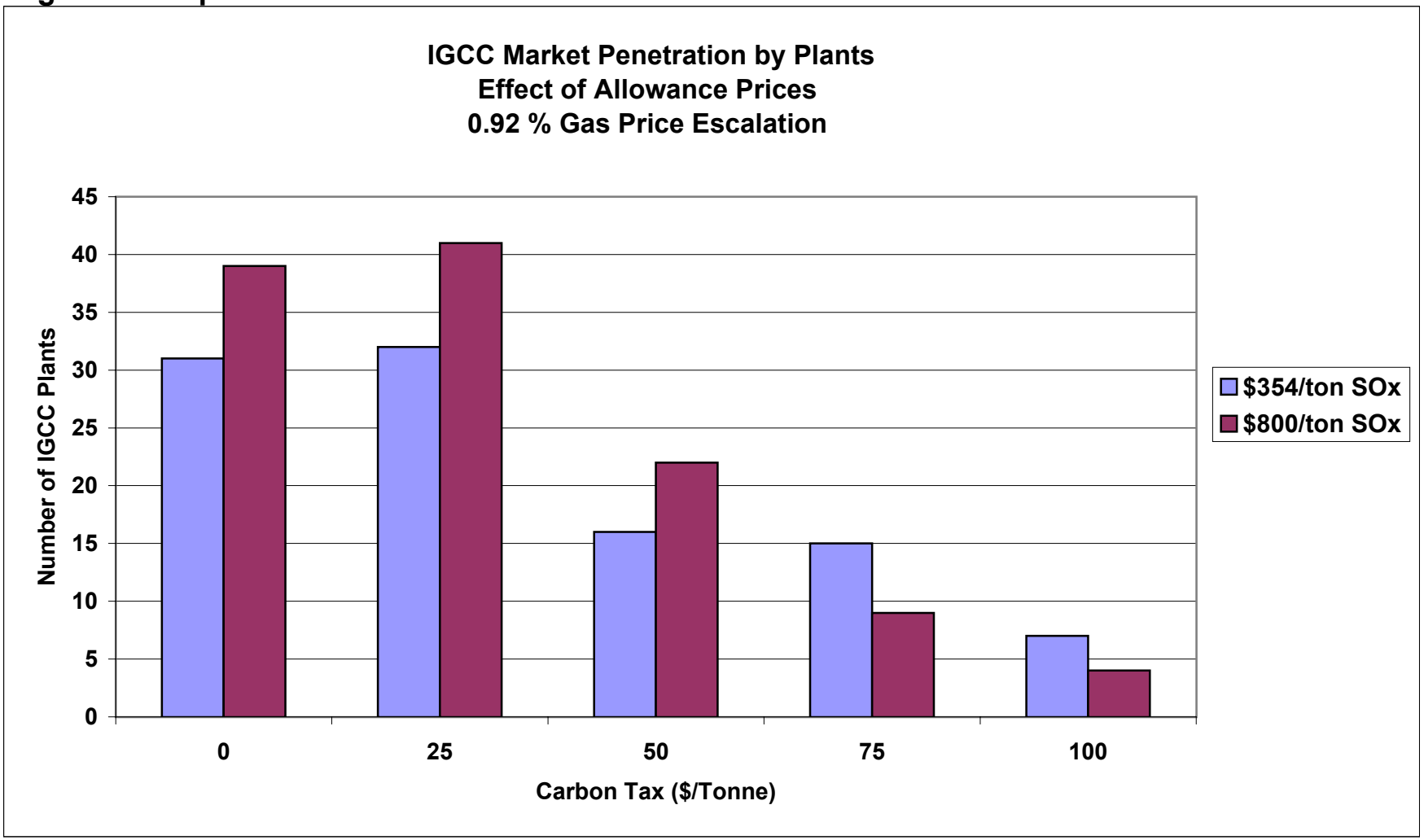


Figure 10. Impact of Allowance Prices on IGCC Market Penetration (Continued)

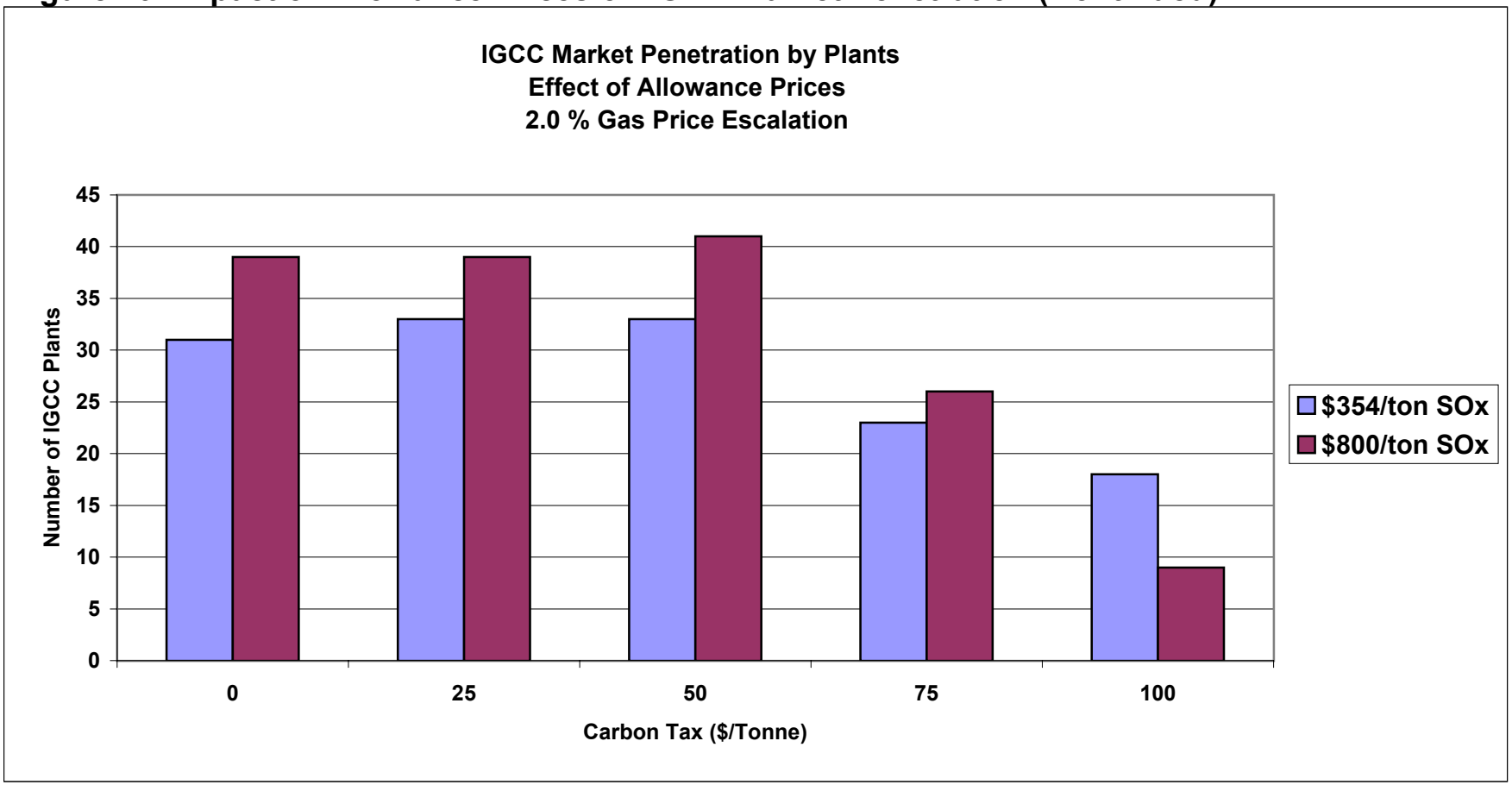


Figure 10. Impact of Allowance Prices on IGCC Market Penetration (Continued)

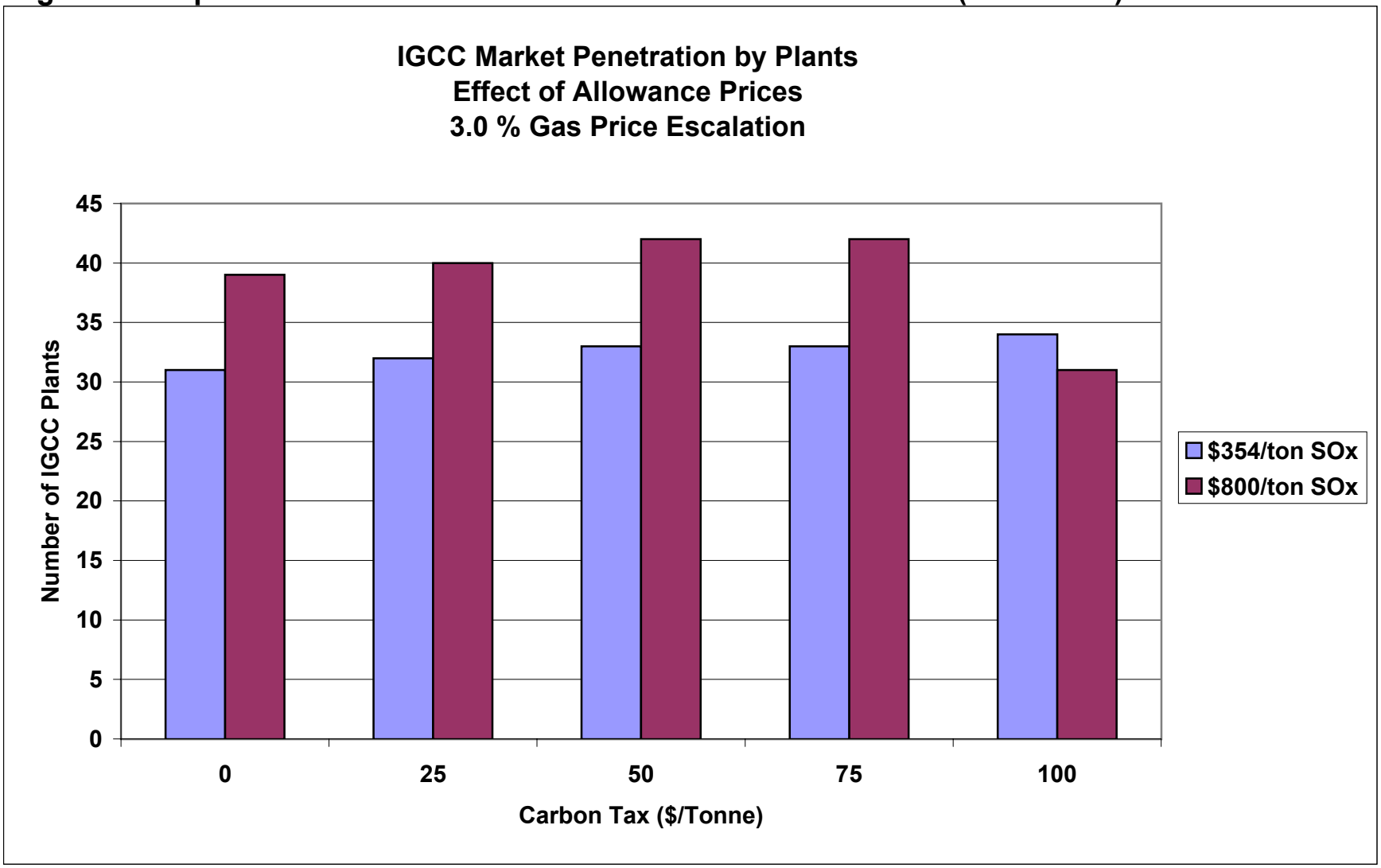


Figure 10. Impact of Allowance Prices on IGCC Market Penetration (Continued)

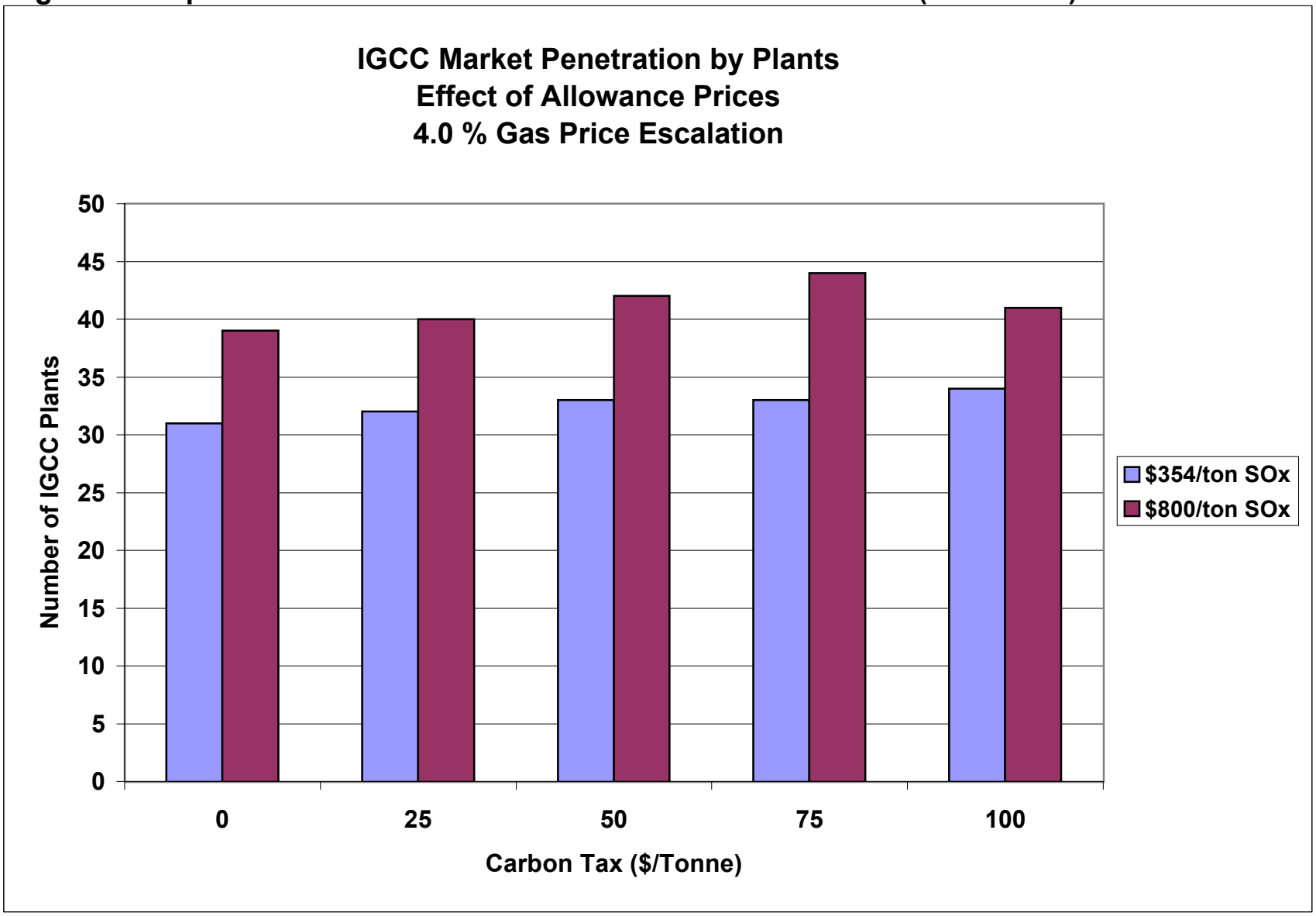


Table 11. Impact of Increased IGCC Heat on IGCC Market Penetration

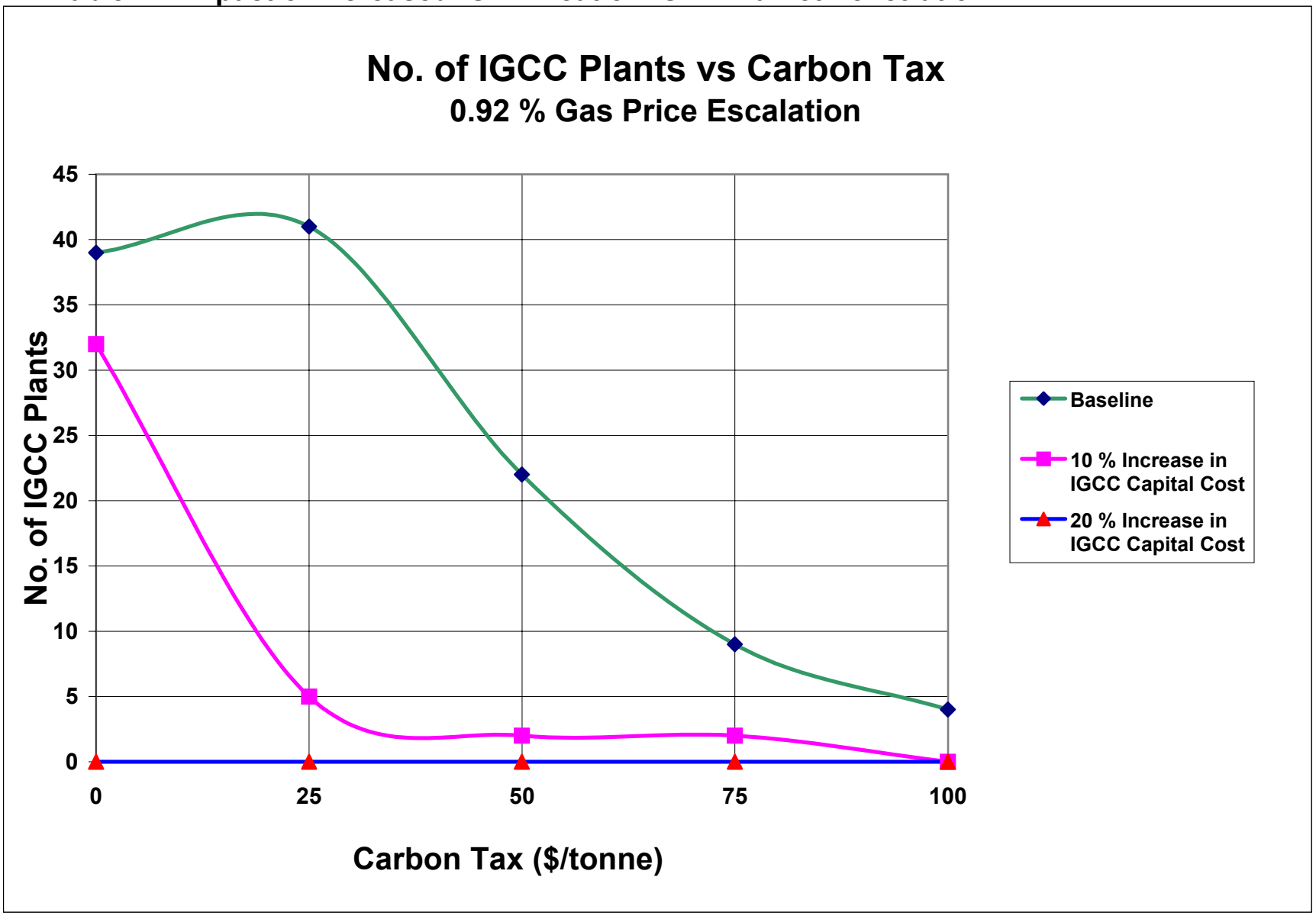


Table 11. Impact of Increased IGCC Heat on IGCC Market Penetration (Continued)

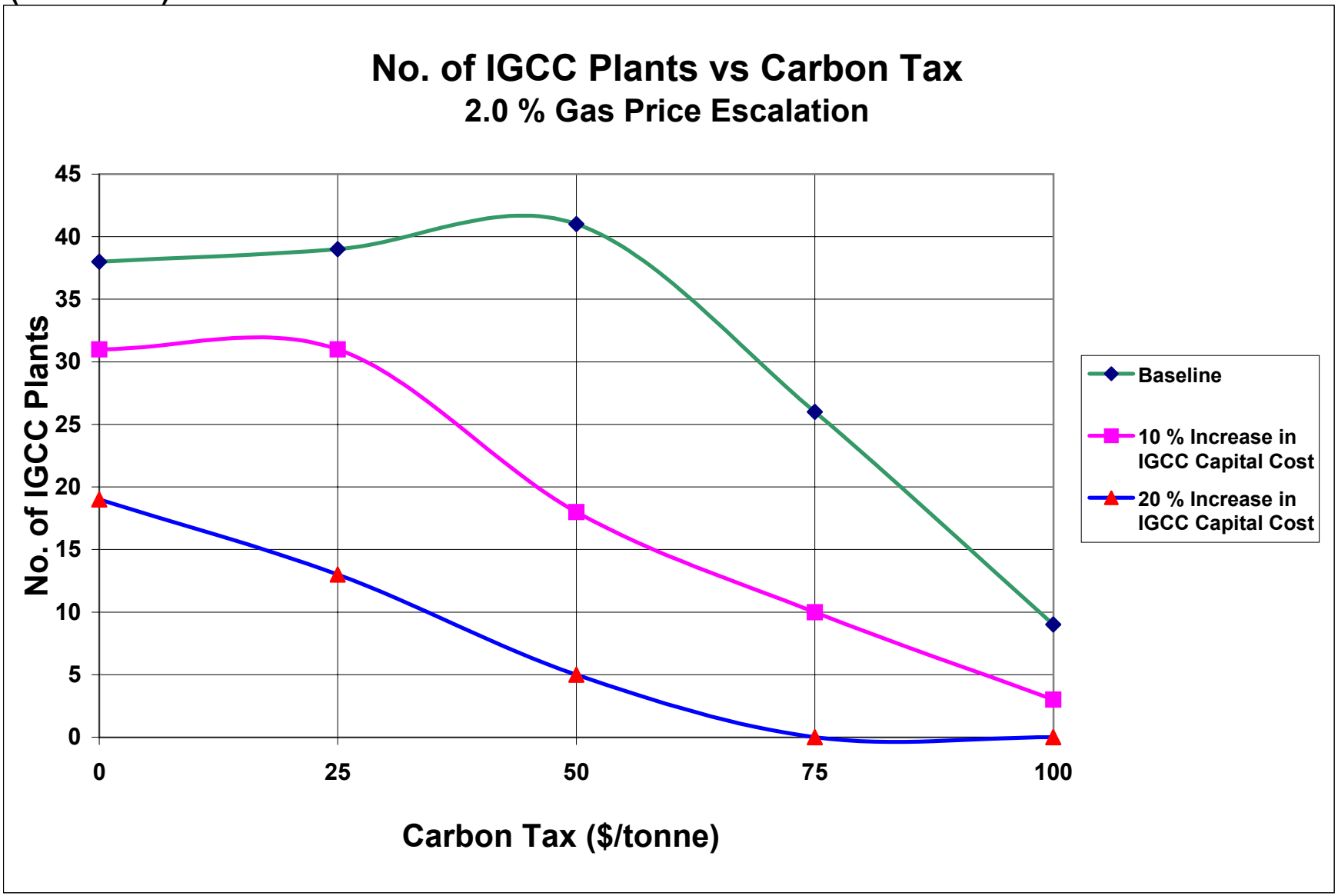


Table 11. Impact of Increased IGCC Heat on IGCC Market Penetration (Continued)

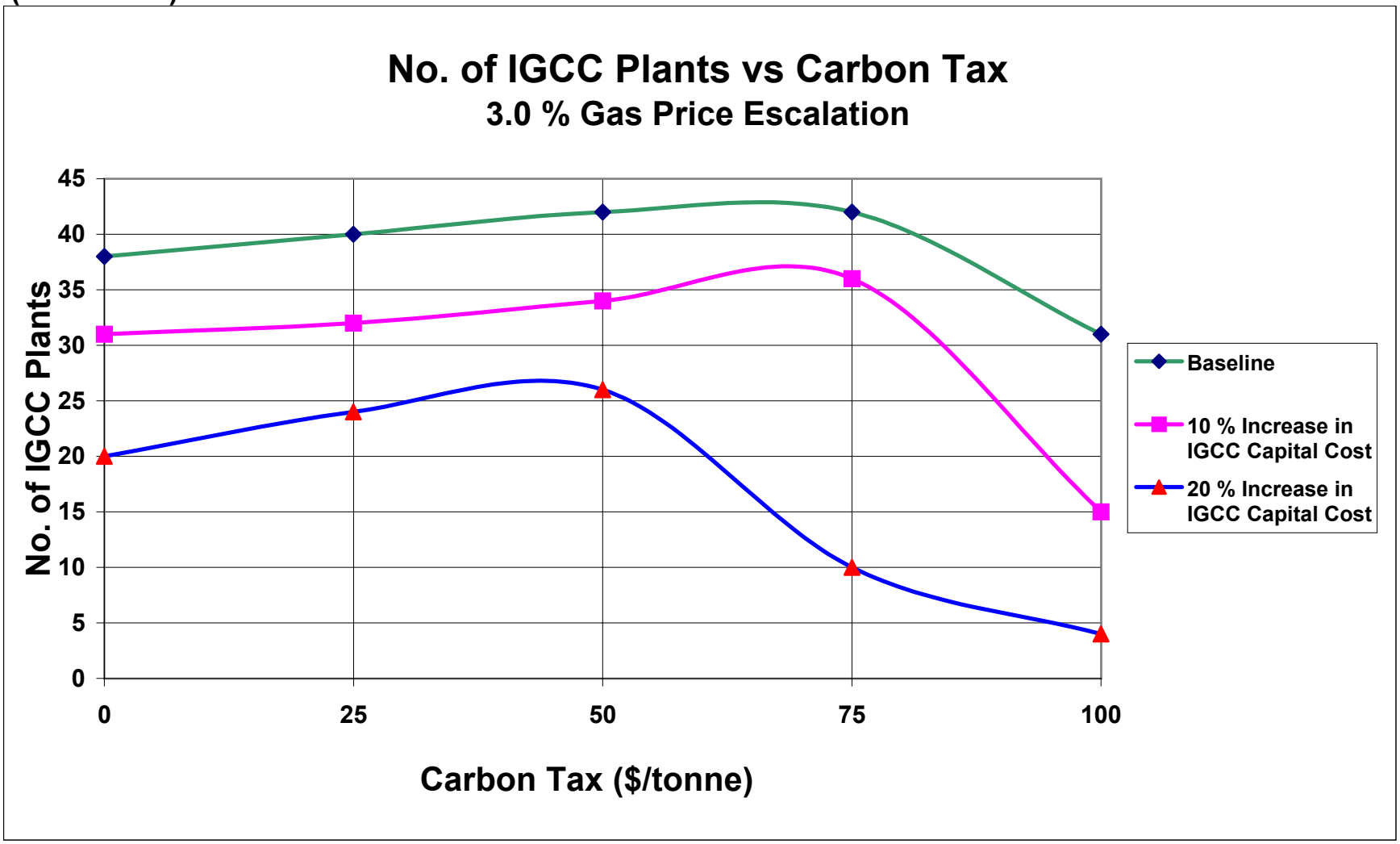


Table 11. Impact of Increased IGCC Heat on IGCC Market Penetration (Continued)

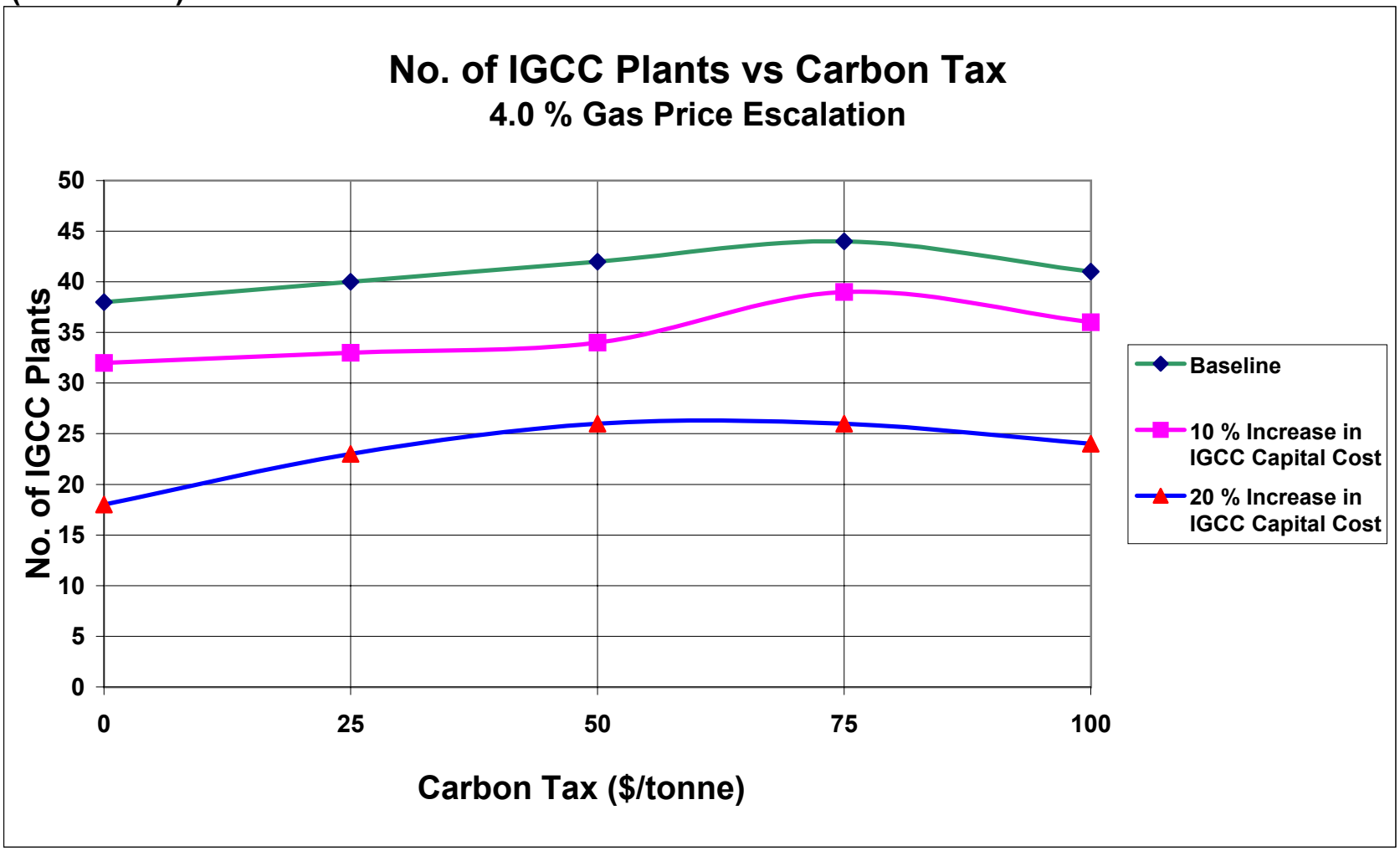


Figure 12

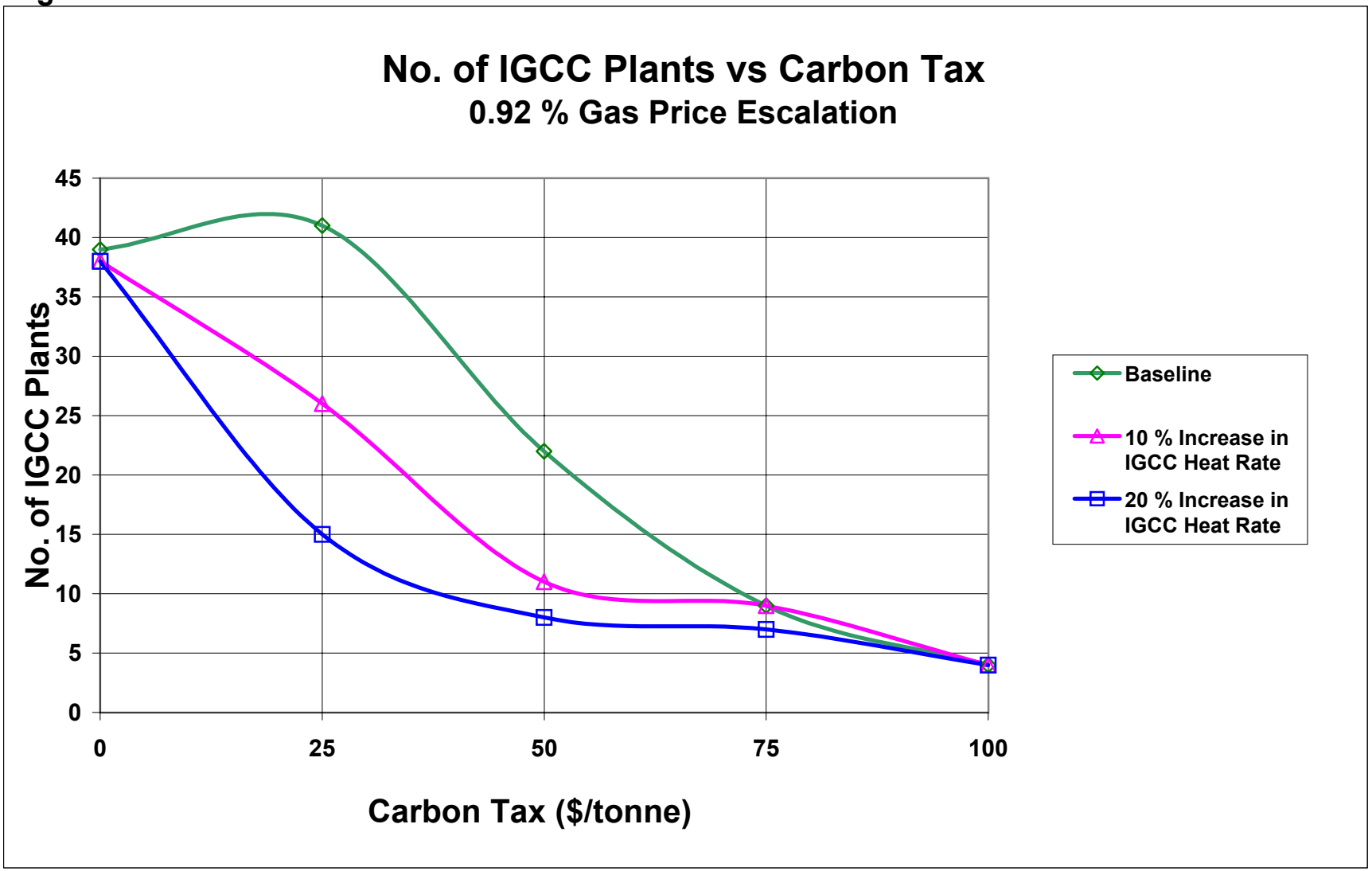

No. of IGCC Plants vs Carbon Tax
0.92 % Gas Price Escalation
No. of IGCC Plants
45
40
35
30
25
20
15
10
5
0
0
25
50
75
100
Carbon Tax ($/tonne)
Baseline
10 % Increase in IGCC Heat Rate
20 % Increase in IGCC Heat Rate

Figure 12 (Continued)

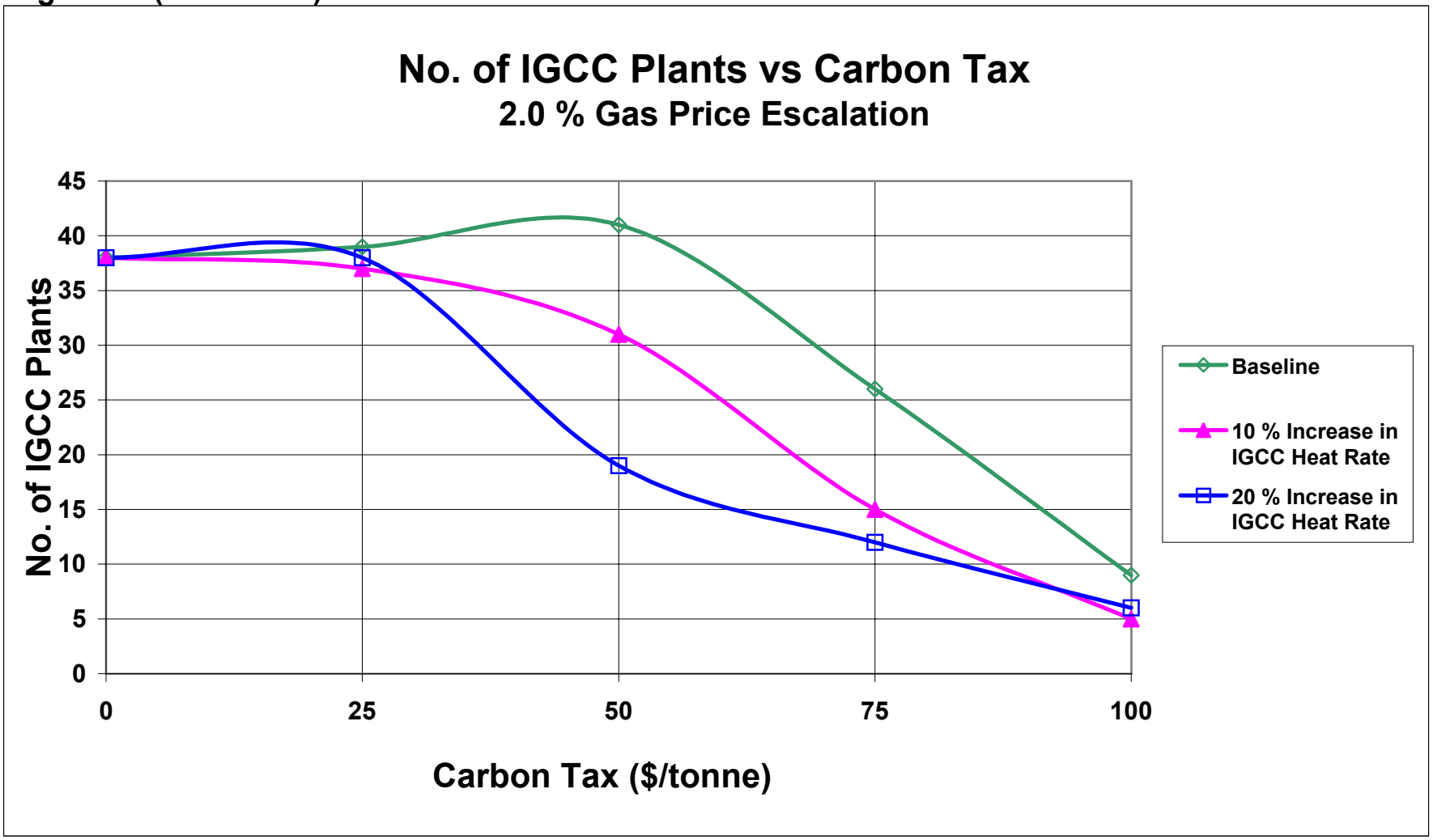


Figure 12 (Continued)

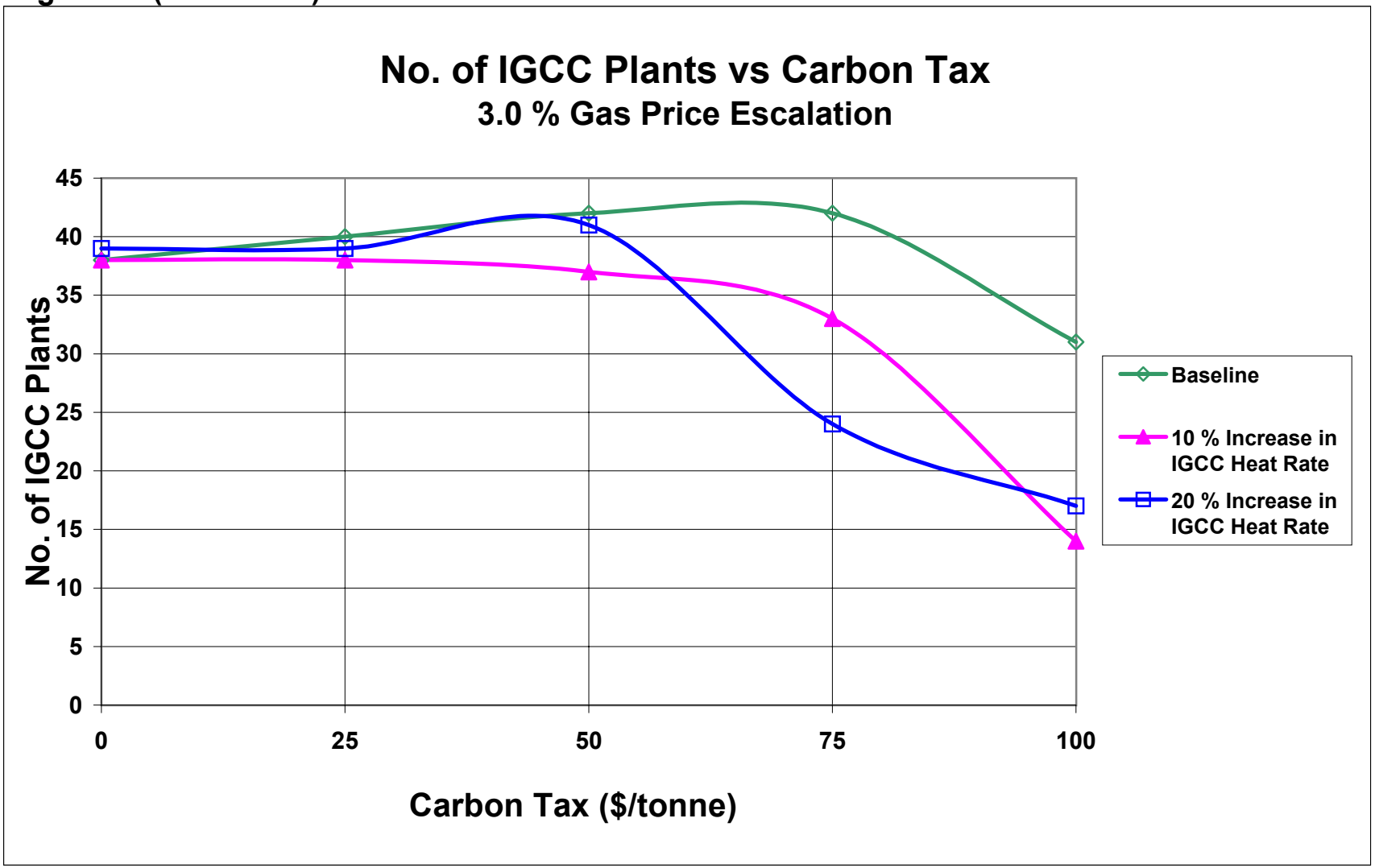


Figure 12 (Continued)

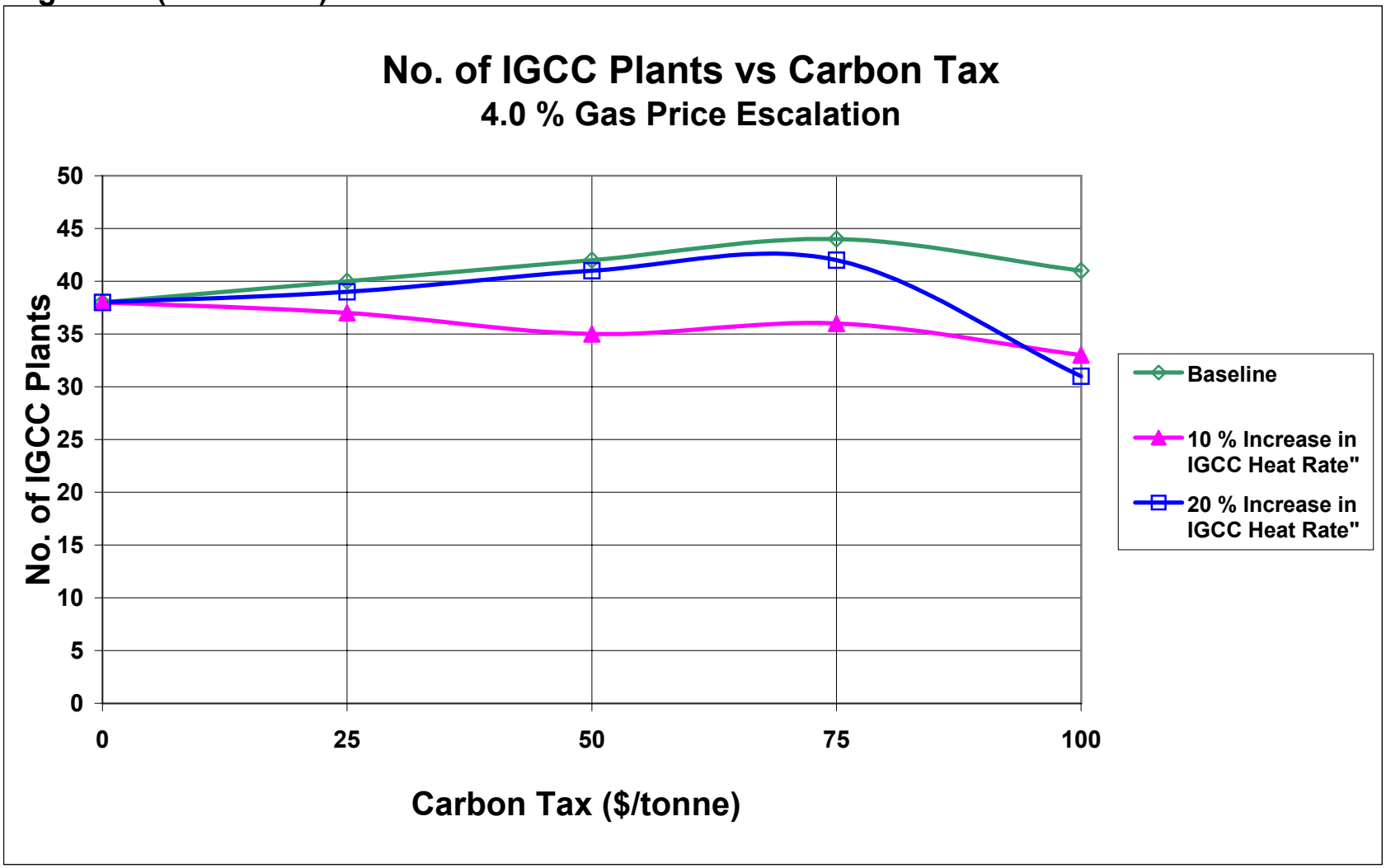


Table 13.

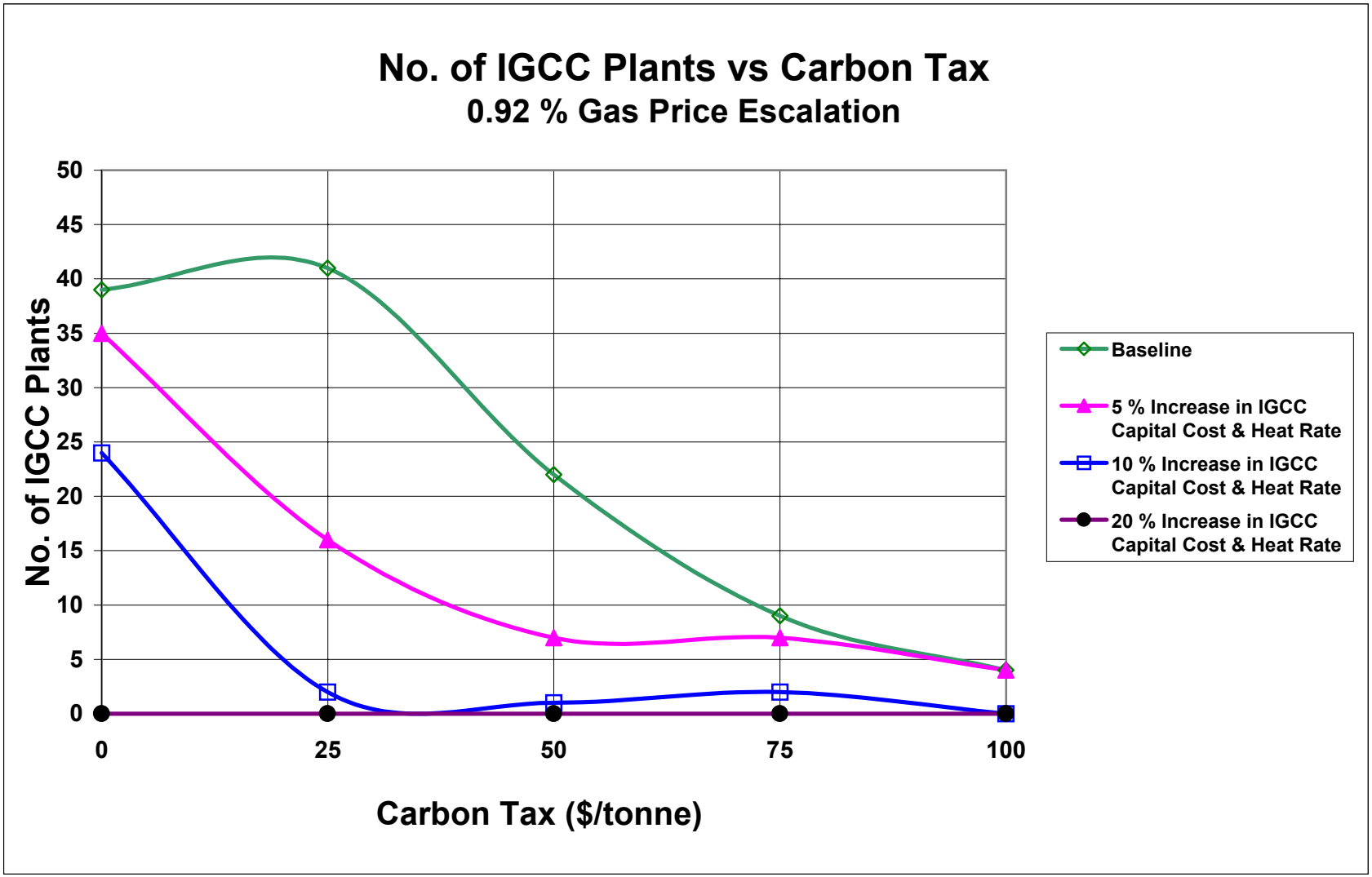

No. of IGCC Plants vs Carbon Tax
0.92 % Gas Price Escalation
No. of IGCC Plants
50
45
40
35
30
25
20
15
10
5
0
0
25
50
75
100
Carbon Tax ($/tonne)
Baseline
5 % Increase in IGCC Capital Cost & Heat Rate
10 % Increase in IGCC Capital Cost & Heat Rate
20 % Increase in IGCC Capital Cost & Heat Rate

Table 13. (Continued)

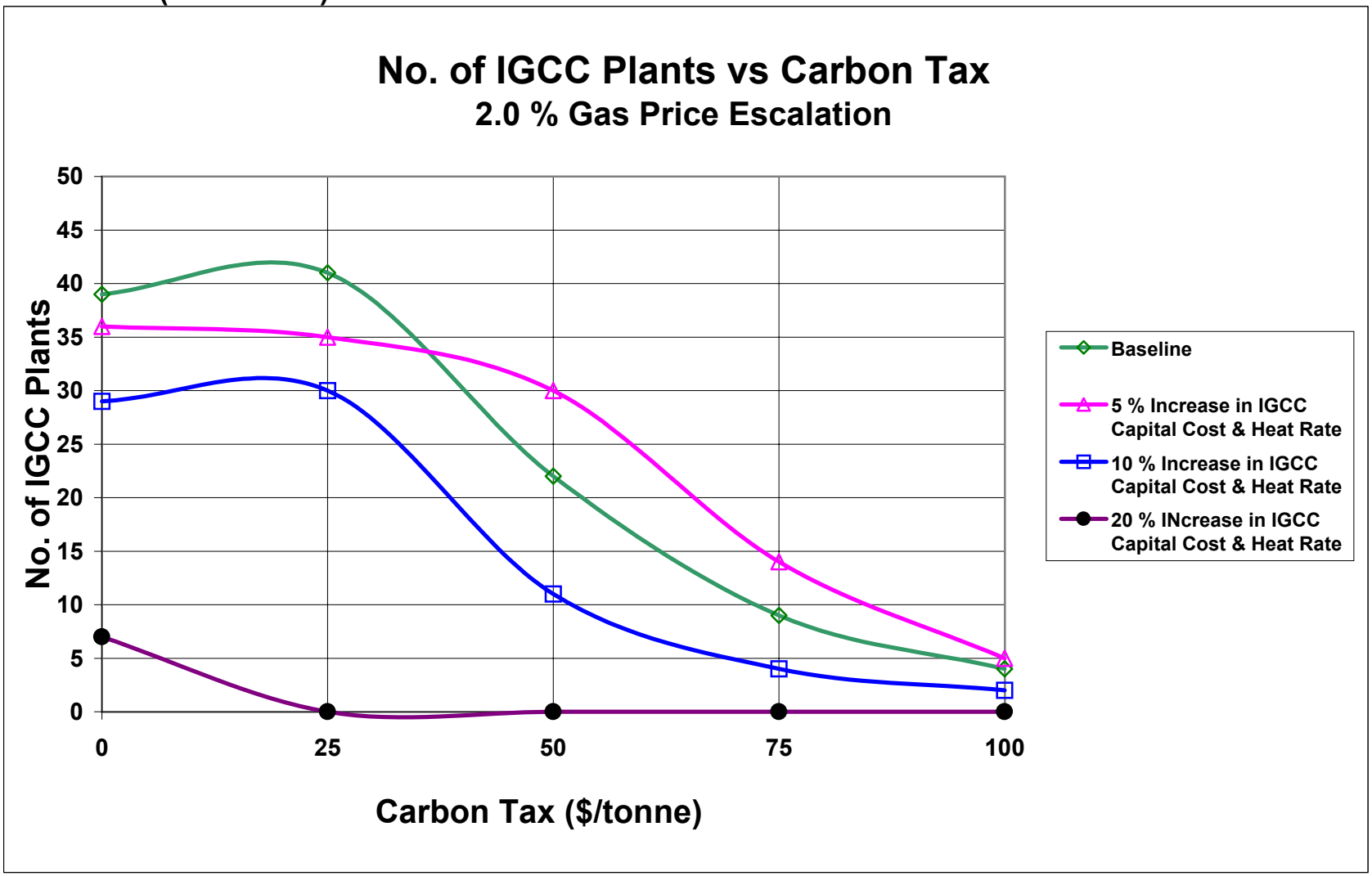


Table 13. (Continued)

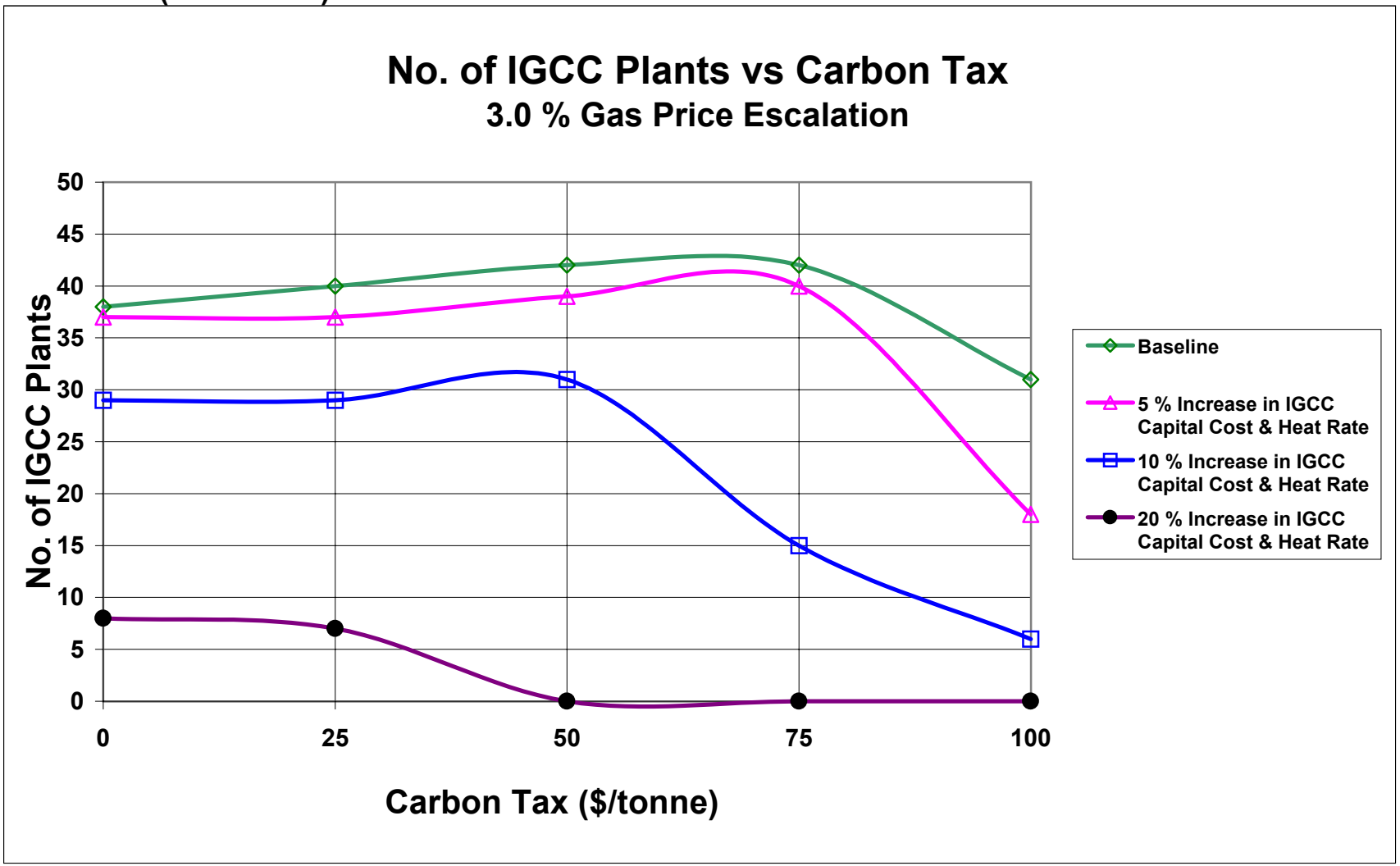


Table 13. (Continued)

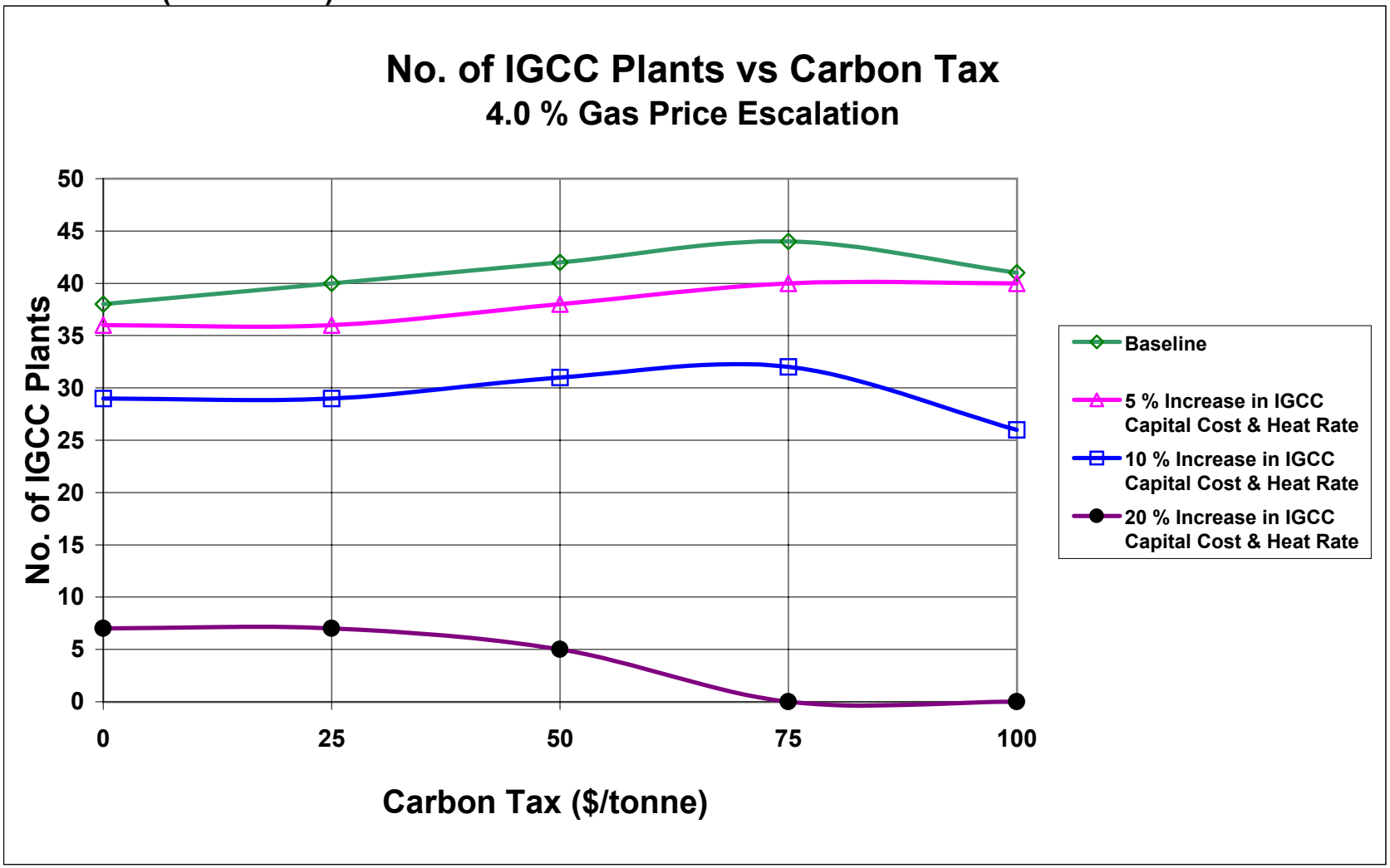


Figure 14. IGCC Market Penetration by Plants

Advanced IGCC Development
($1723/ton Ozone Season and $259/ton Non-Ozone Season NOx Allowance Prices, $354/ton SOx Allowance Price)

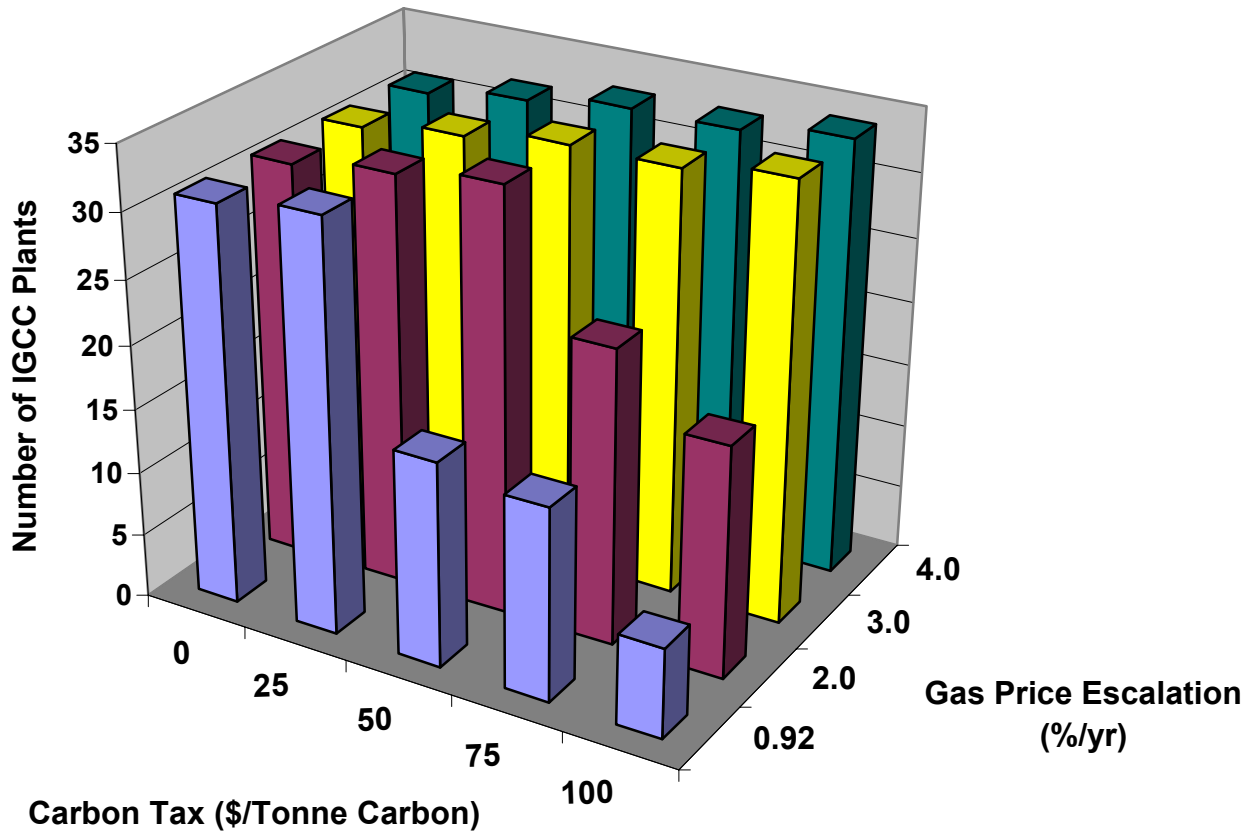


Figure 15. IGCC Installed Capacity
Advanced IGCC Development
($1723/ton Ozone Season and $259/ton Non-Ozone Season NOx Allowance Prices,
$354/ton SOx Allowance Price)

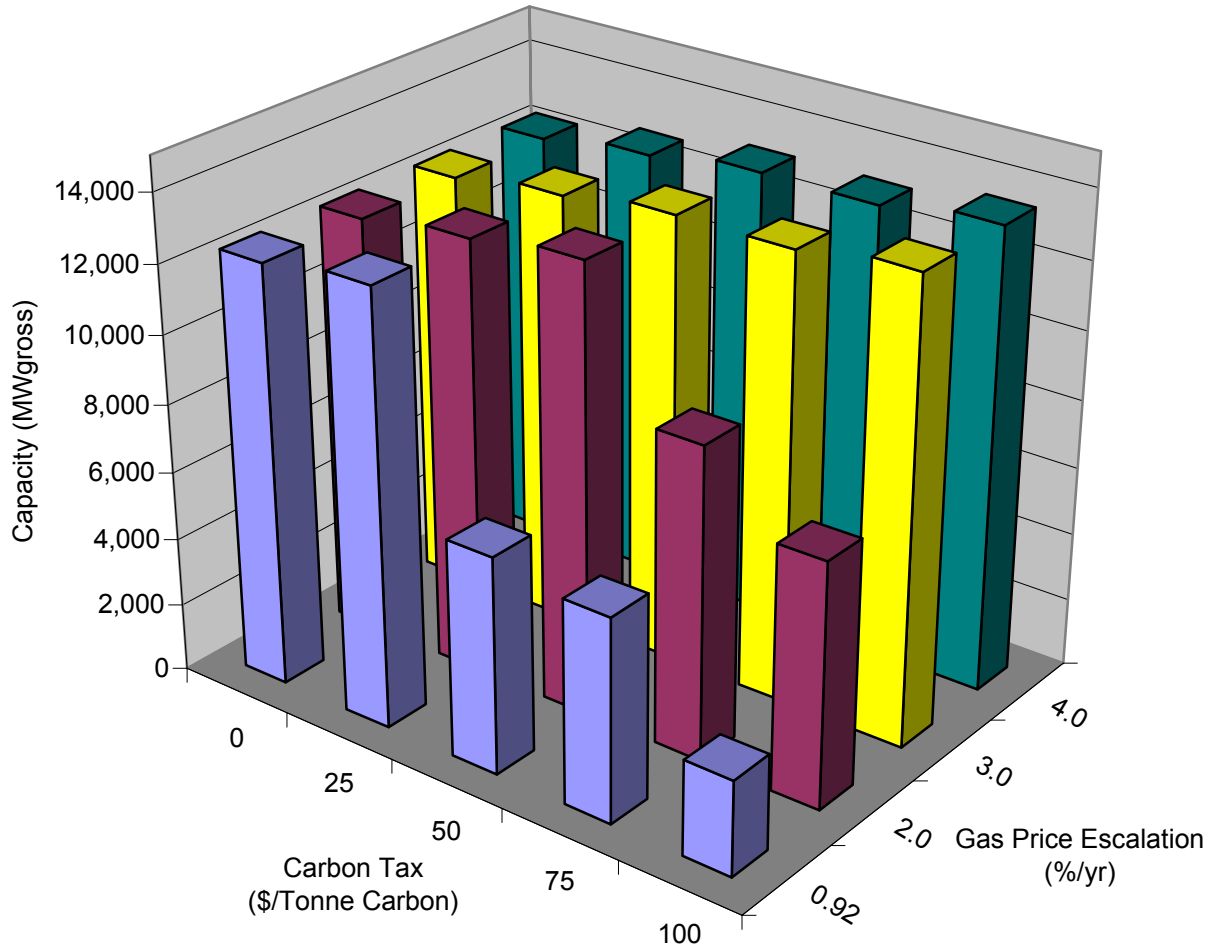
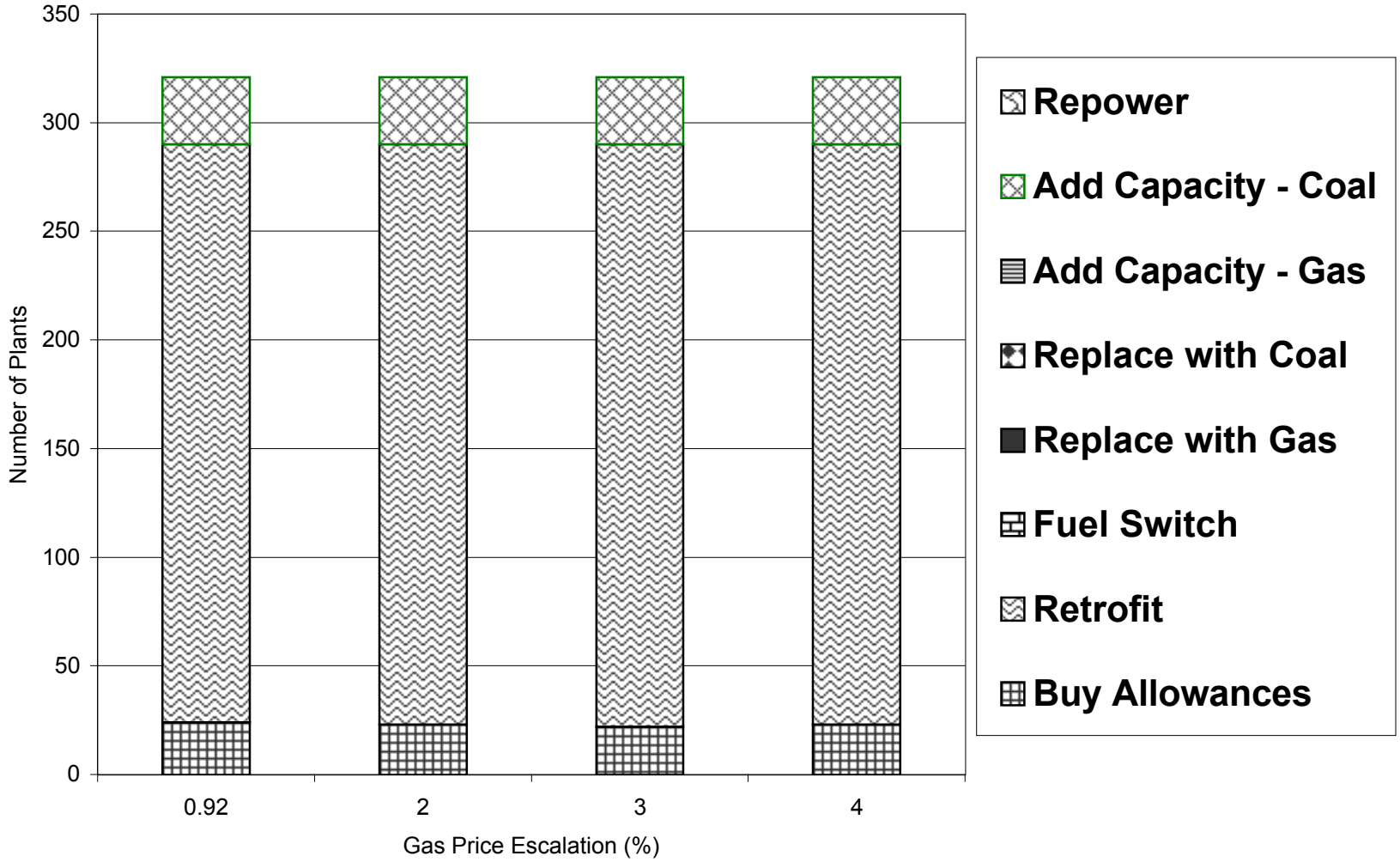


Figure 16. Baseload Fossil Power Plants
(Advanced IGCC, No Carbon Tax)



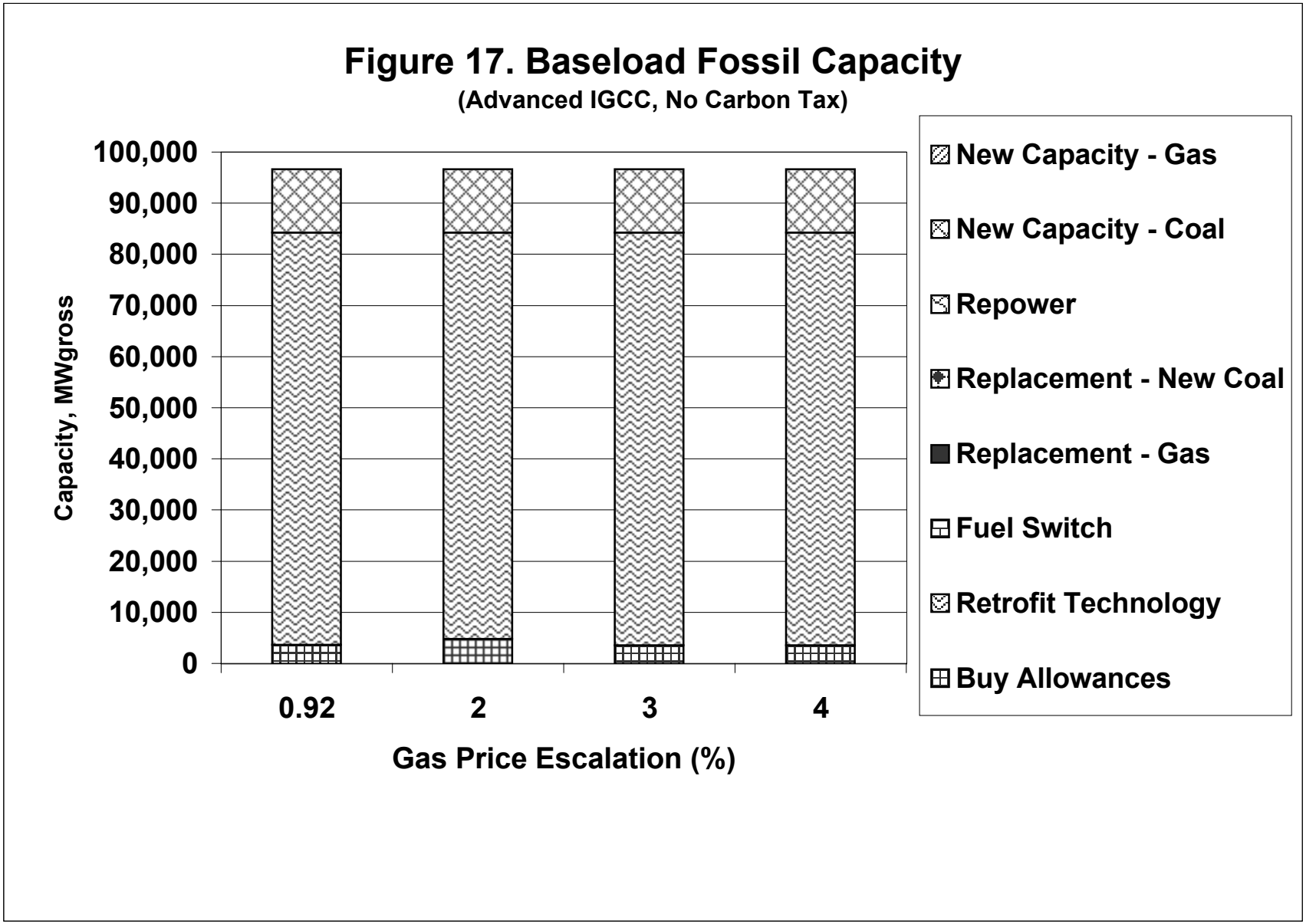


Figure 17. Baseload Fossil Capacity
(Advanced IGCC, No Carbon Tax)
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Capacity, MWgross
0.92
2
3
4
Gas Price Escalation (%)
New Capacity - Gas
New Capacity - Coal
Repower
Replacement - New Coal
Replacement - Gas
Fuel Switch
Retrofit Technology
Buy Allowances

Figure 18. New Baseload Capacity Technologies
(Advanced IGCC, No Carbon Tax)

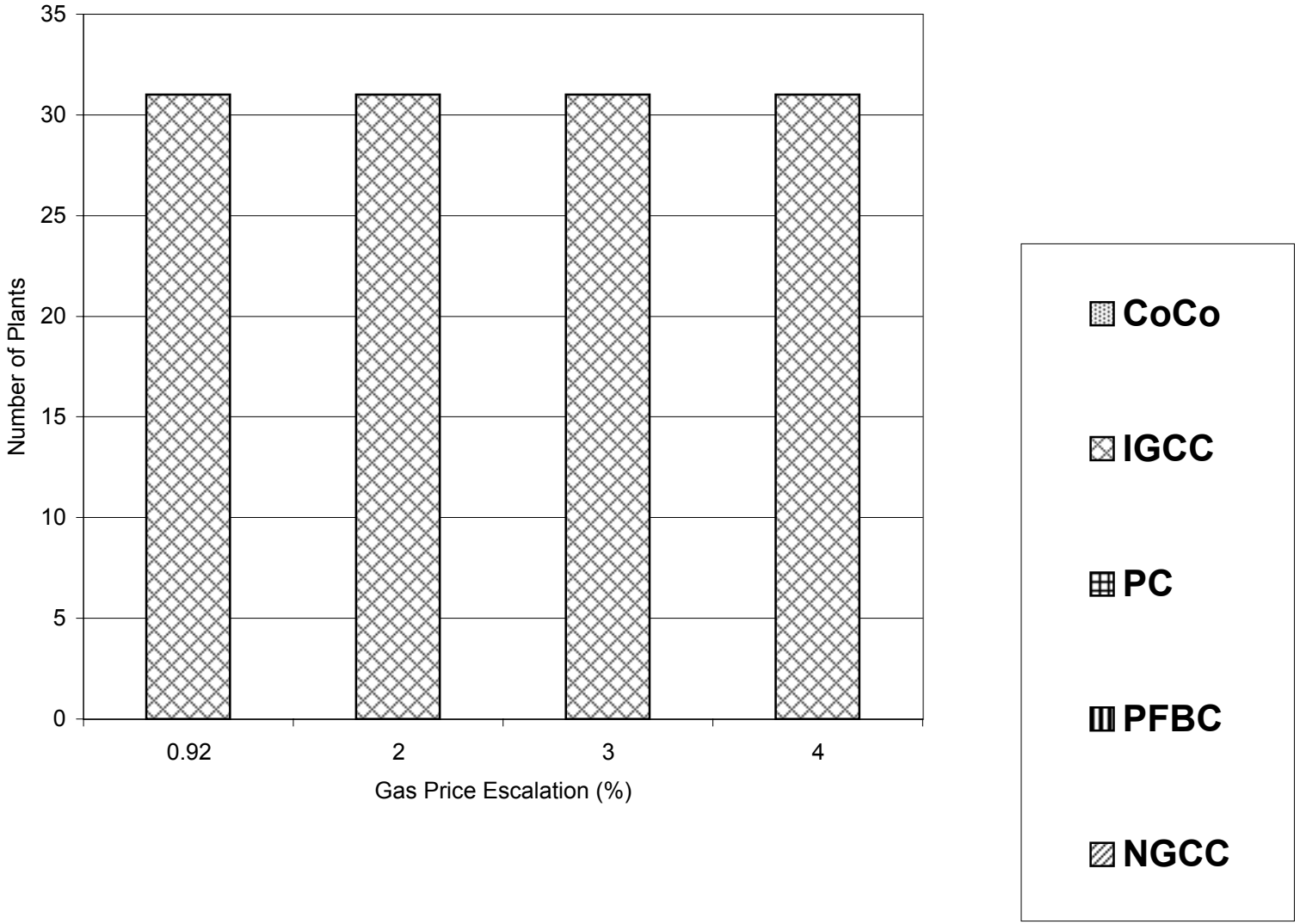
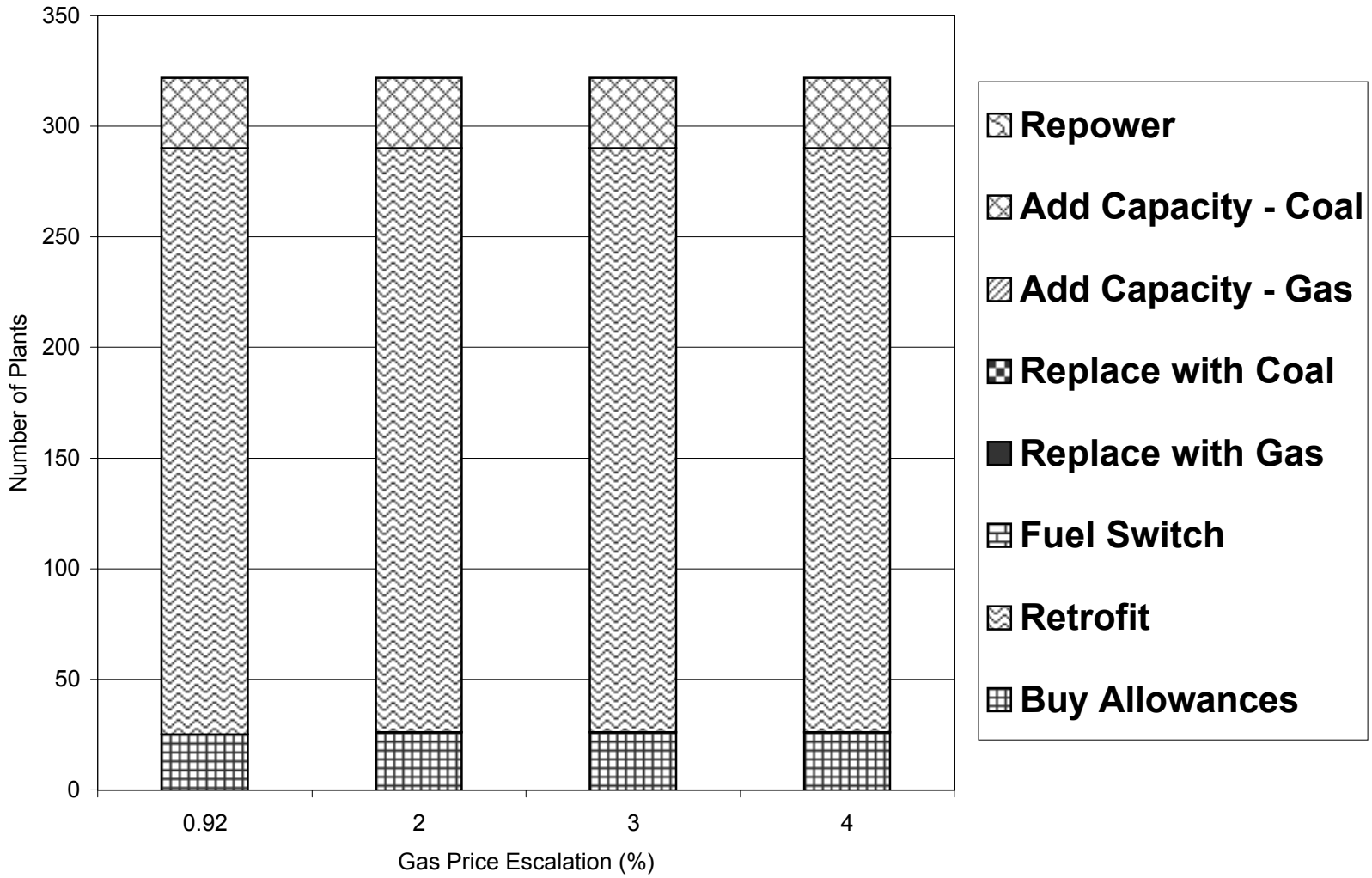


Figure 19. Baseload Fossil Power Plants
(Advanced IGCC, $25/Tonne Carbon Tax)



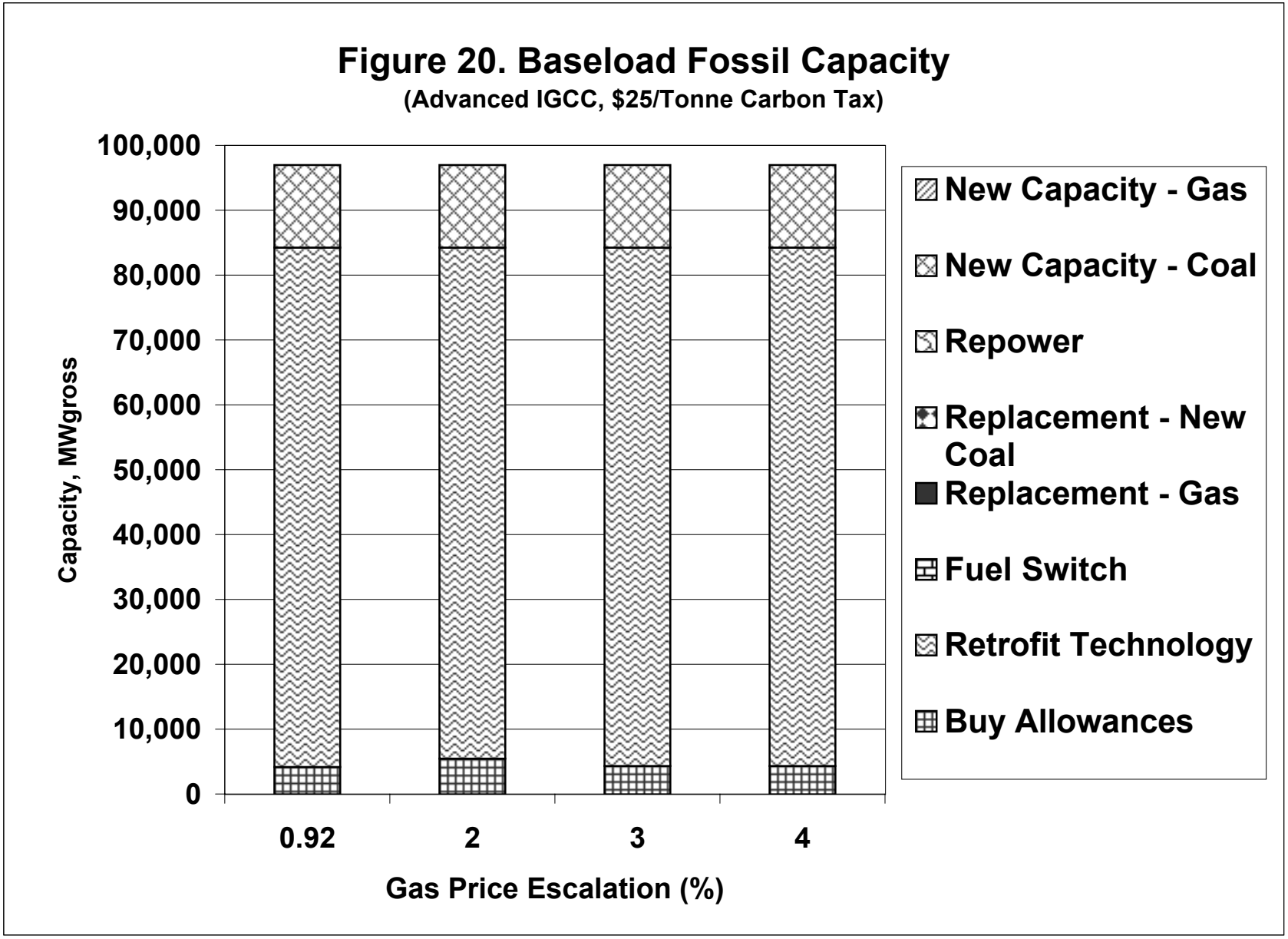


Figure 20. Baseload Fossil Capacity
(Advanced IGCC, $25/Tonne Carbon Tax)
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Capacity, MWgross
0.92
2
3
4
Gas Price Escalation (%)
New Capacity - Gas
New Capacity - Coal
Repower
Replacement - New Coal
Replacement - Gas
Fuel Switch
Retrofit Technology
Buy Allowances

Figure 21. New Baseload Capacity Technologies
(Advanced IGCC, $25/Tonne Carbon Tax)

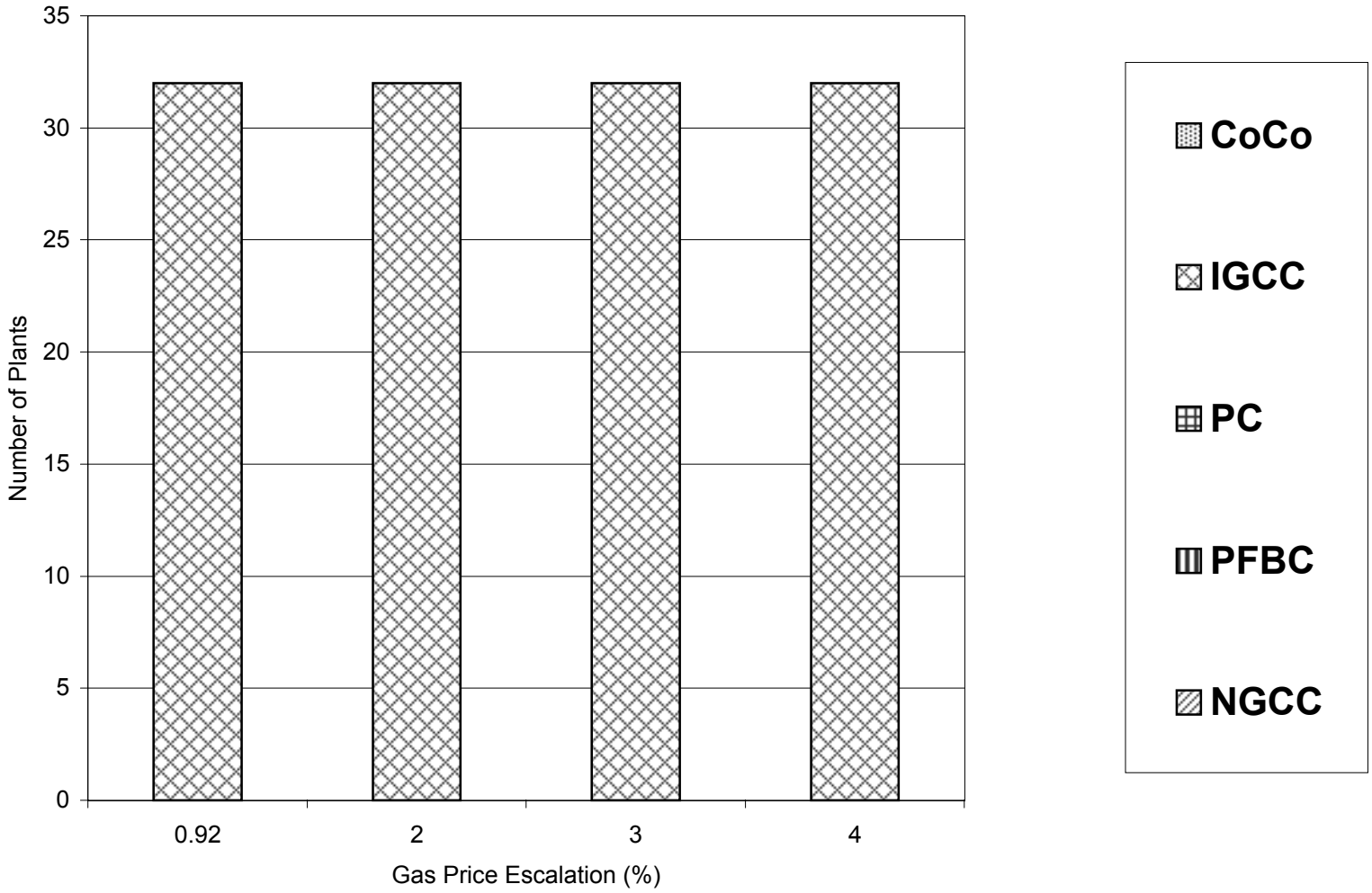
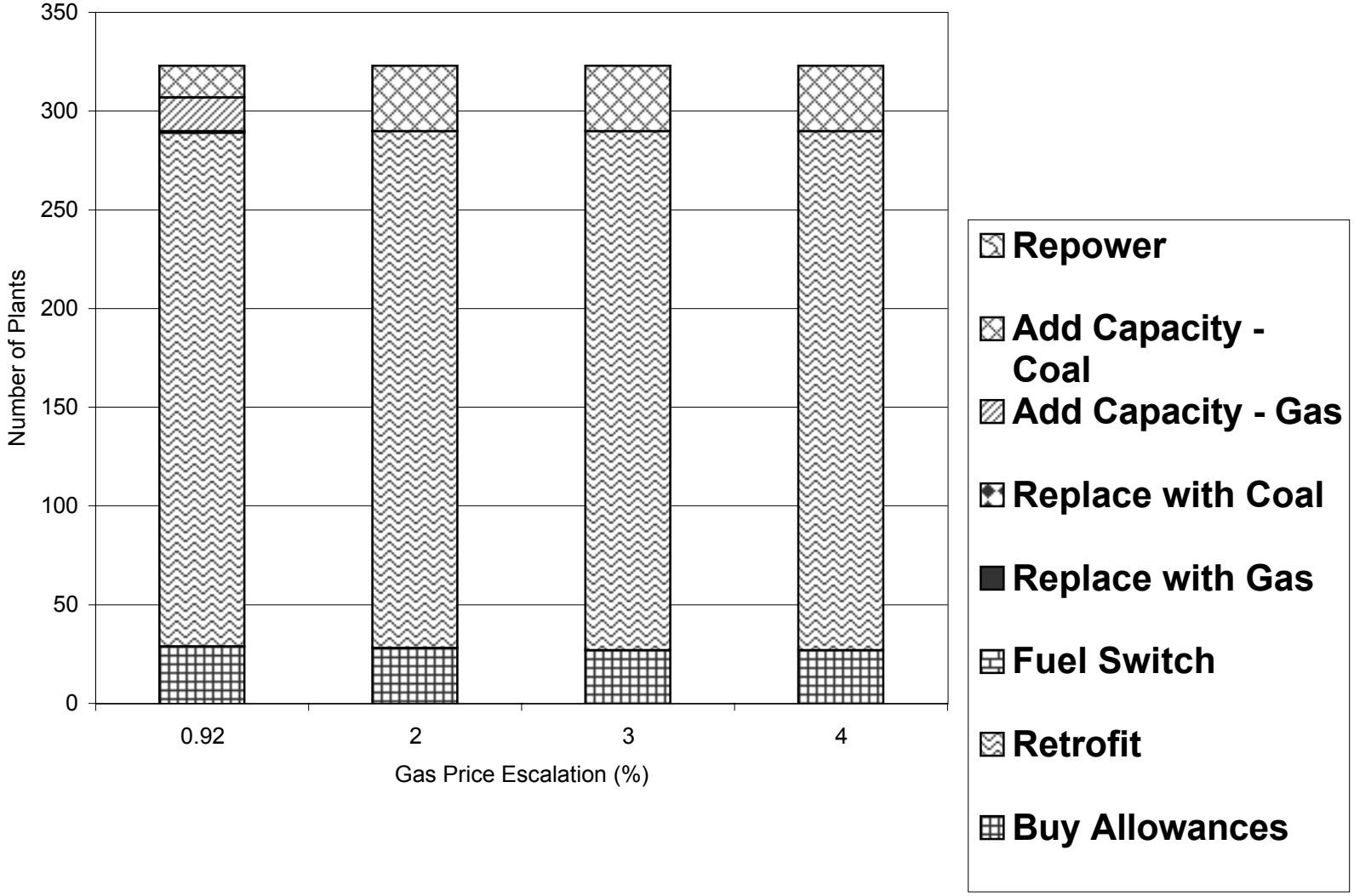


Figure 22. Baseload Fossil Power Plants
(Advanced IGCC, $50/Tonne Carbon Tax)



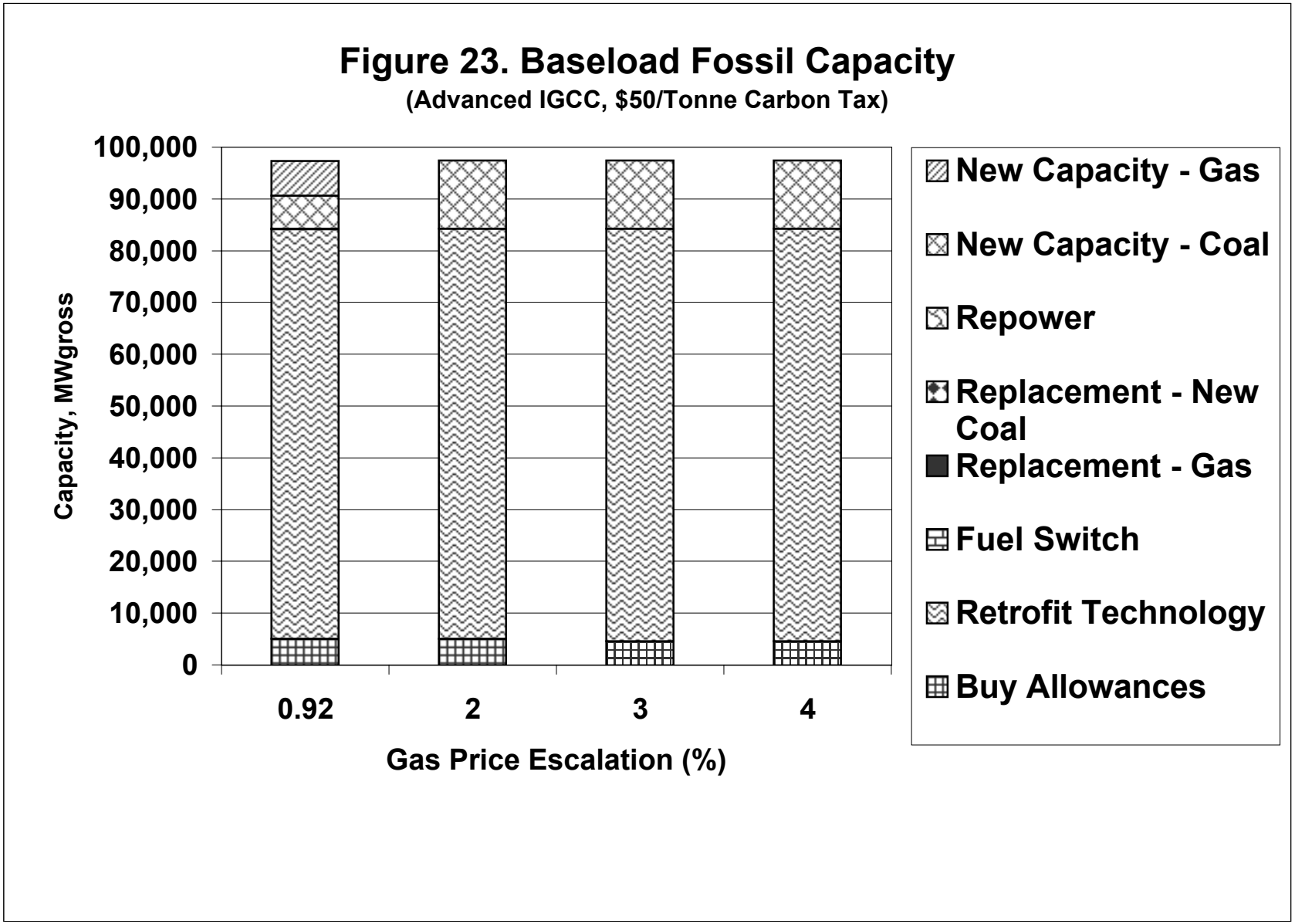


Figure 23. Baseload Fossil Capacity
(Advanced IGCC, $50/Tonne Carbon Tax)
Capacity, MWgross
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
0.92
2
3
4
Gas Price Escalation (%)
New Capacity - Gas
New Capacity - Coal
Repower
Replacement - New Coal
Replacement - Gas
Fuel Switch
Retrofit Technology
Buy Allowances

Figure 24. New Baseload Capacity Technologies
(Advanced IGCC, $50/Tonne Carbon Tax)

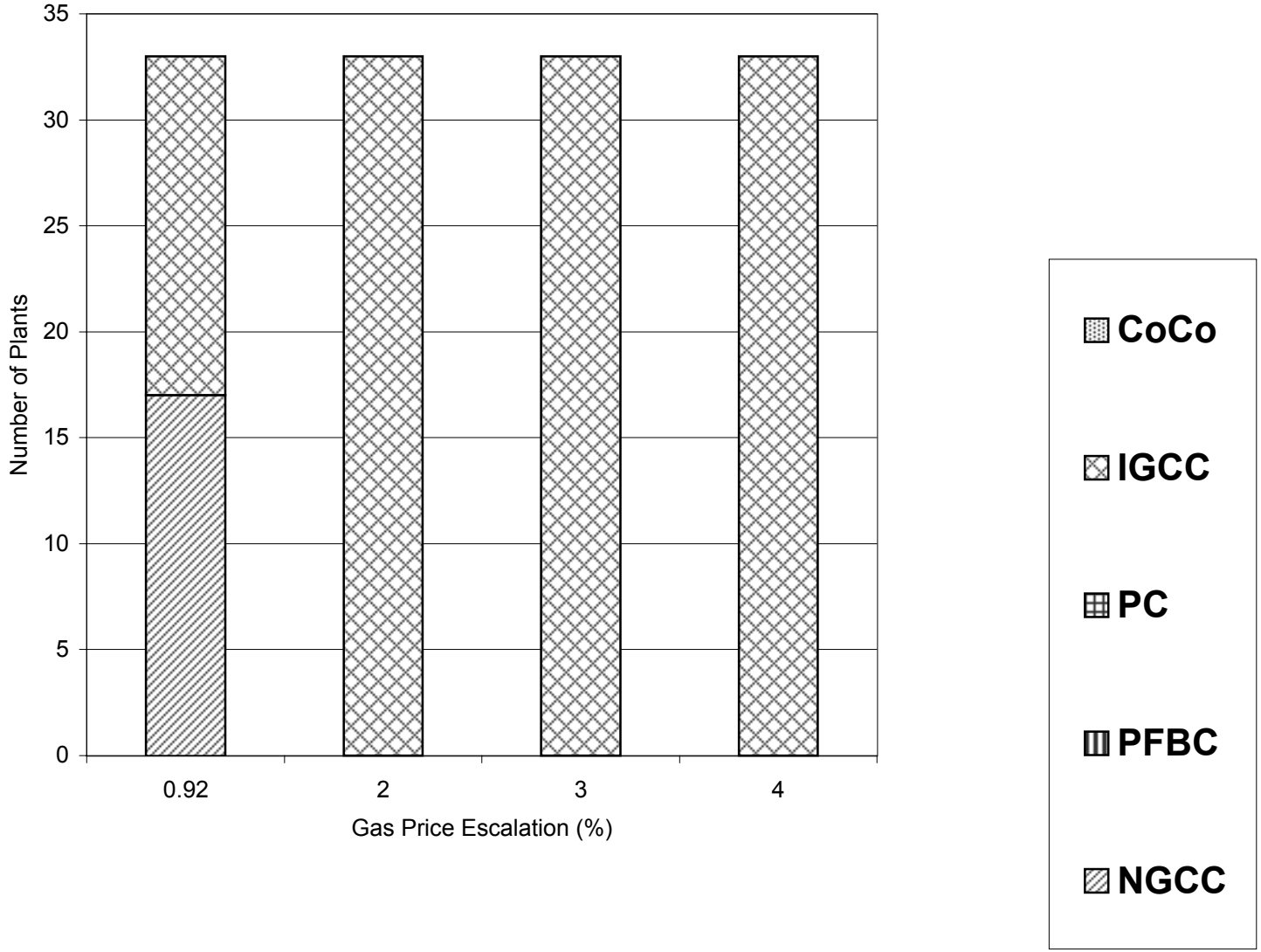


Figure 25. Baseload Fossil Power Plants
(Advanced IGCC, $75/Tonne Carbon Tax)

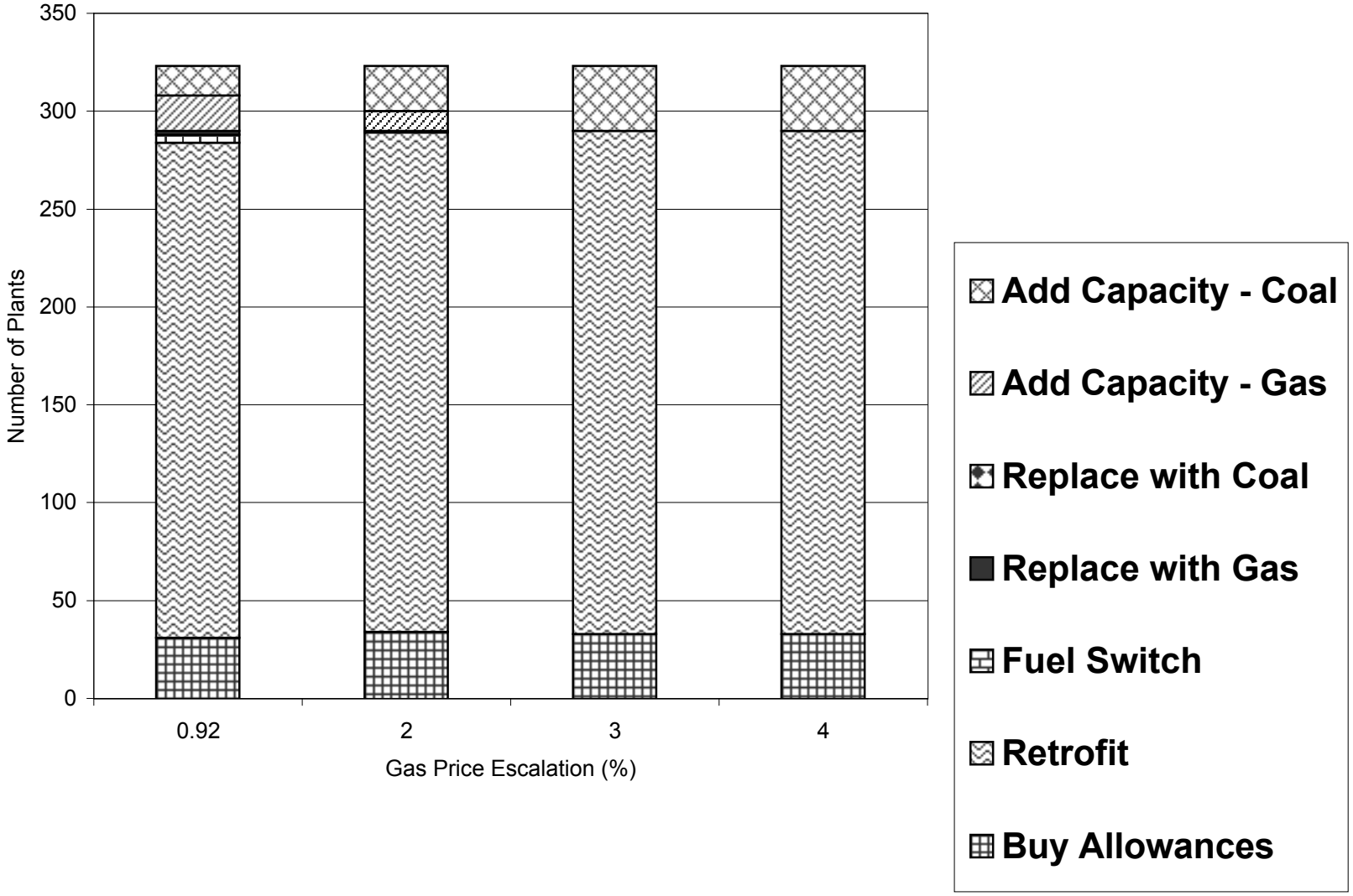


Figure 26. Baseload Fossil Capacity
(Advanced IGCC, $75/Tonne Carbon Tax)

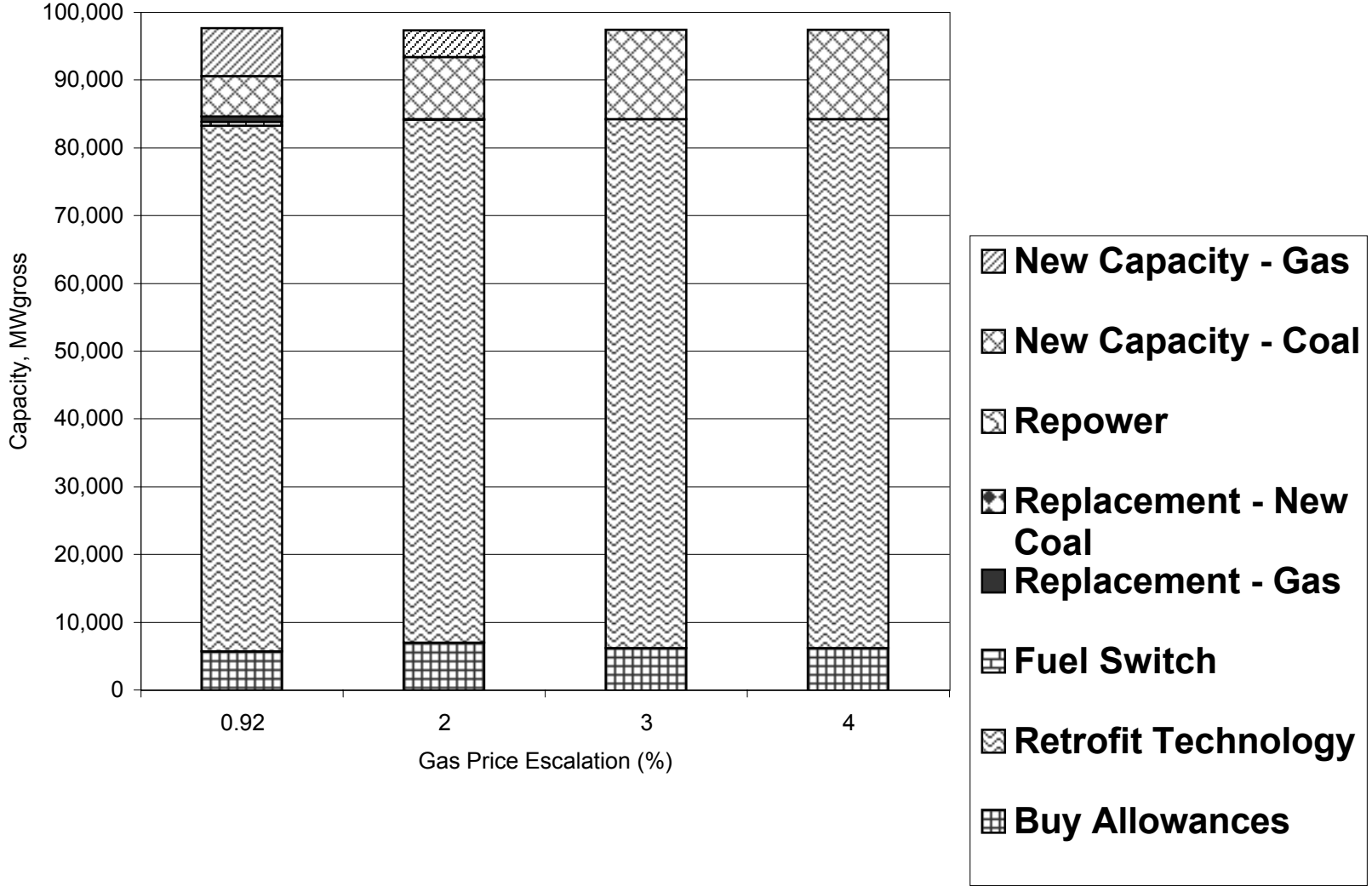


Figure 27. New Baseload Capacity Technologies
(Advanced IGCC, $75/Tonne Carbon Tax)

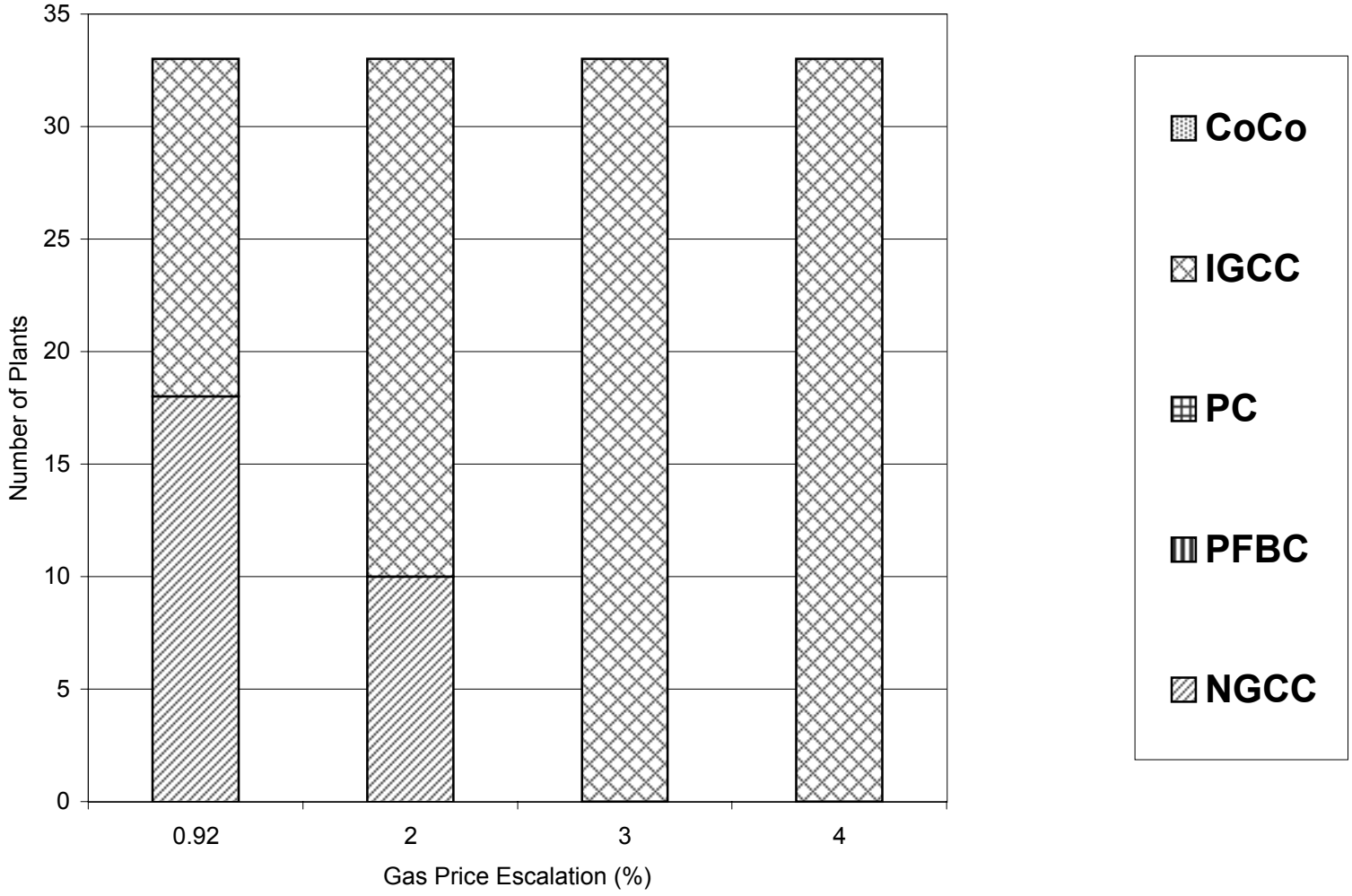


Figure 28. Baseload Fossil Power Plants
(Advanced IGCC, $100/Tonne Carbon Tax)

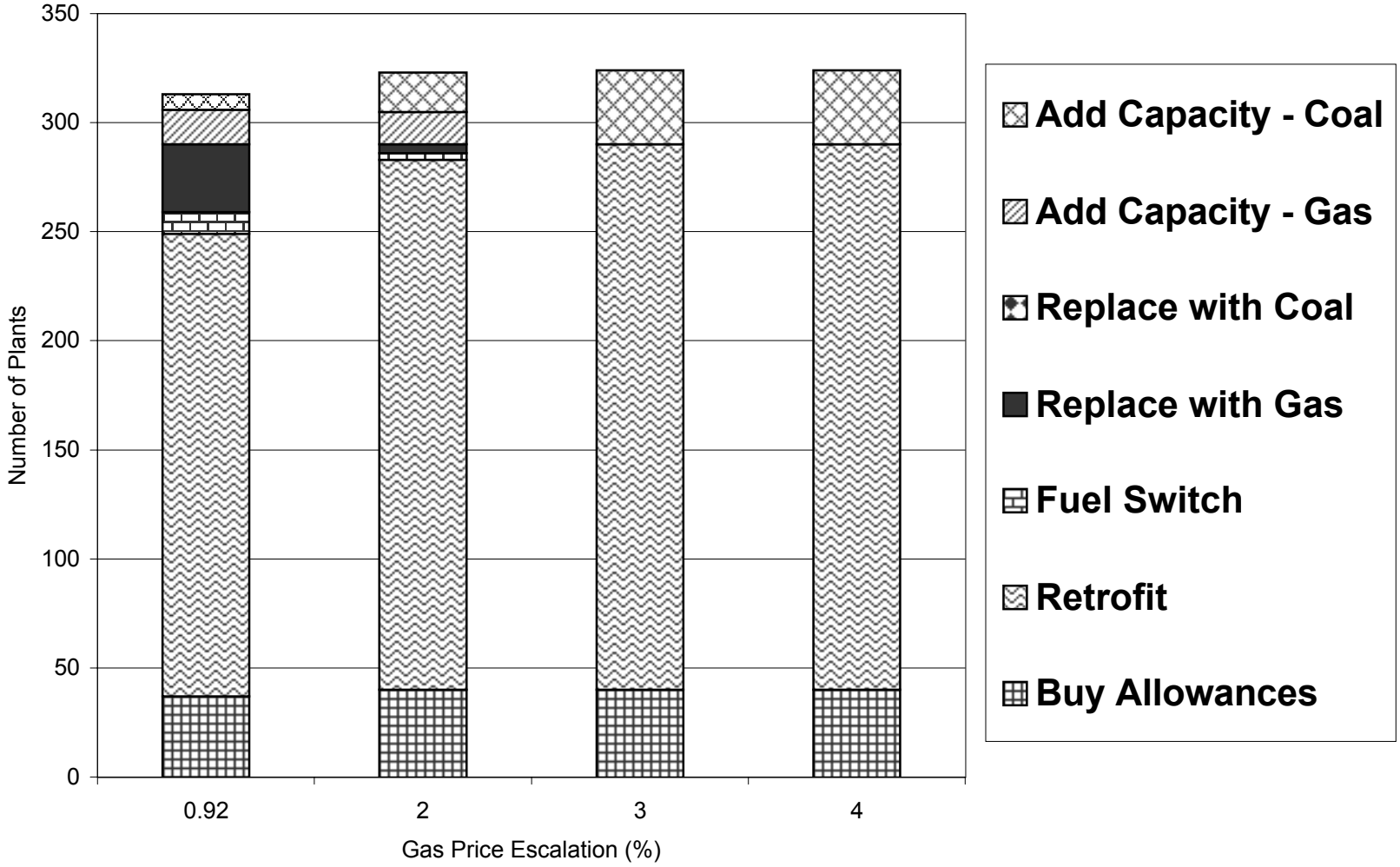


Figure 29. Baseload Fossil Capacity
(Advanced IGCC, $100/Tonne Carbon Tax)

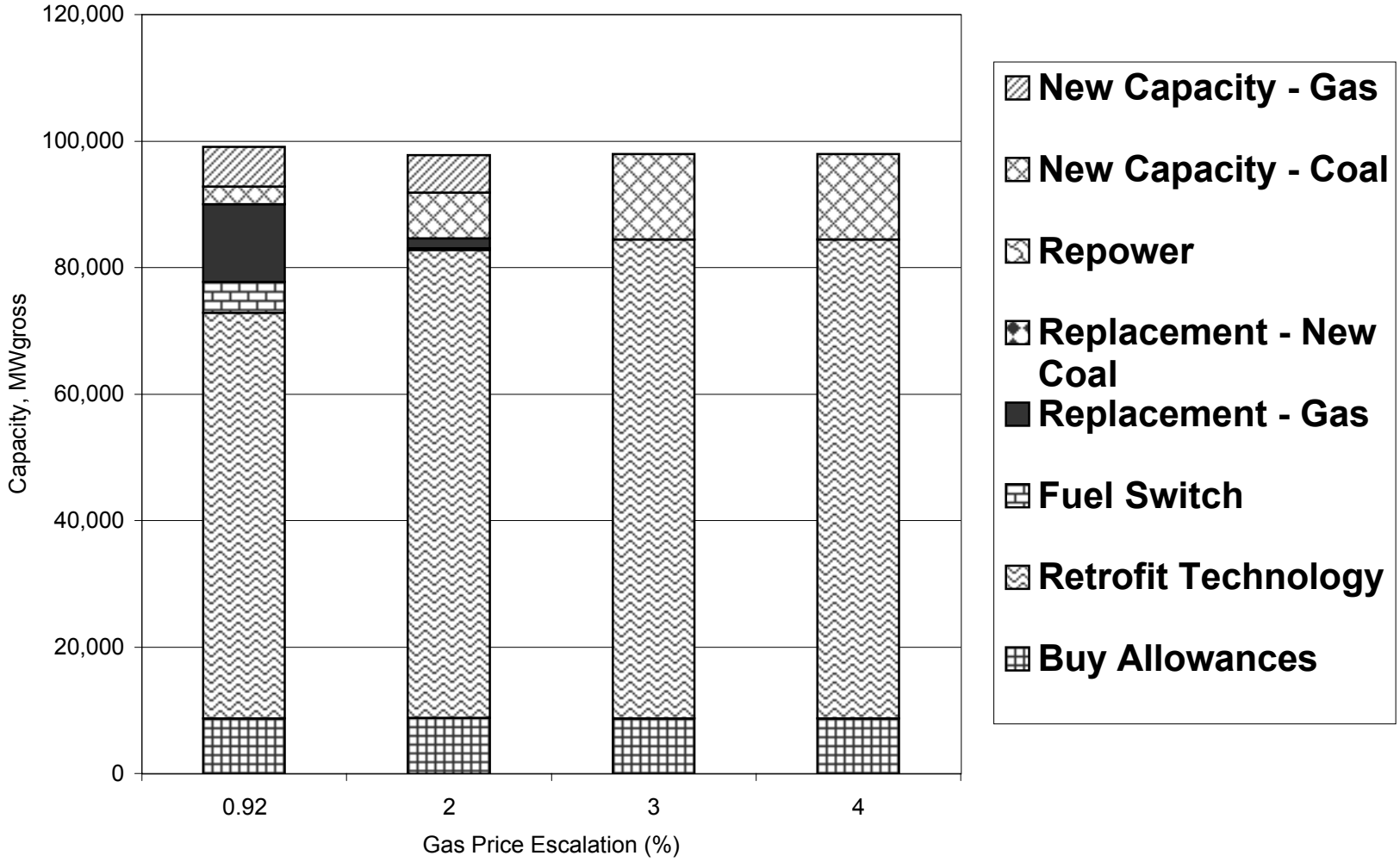
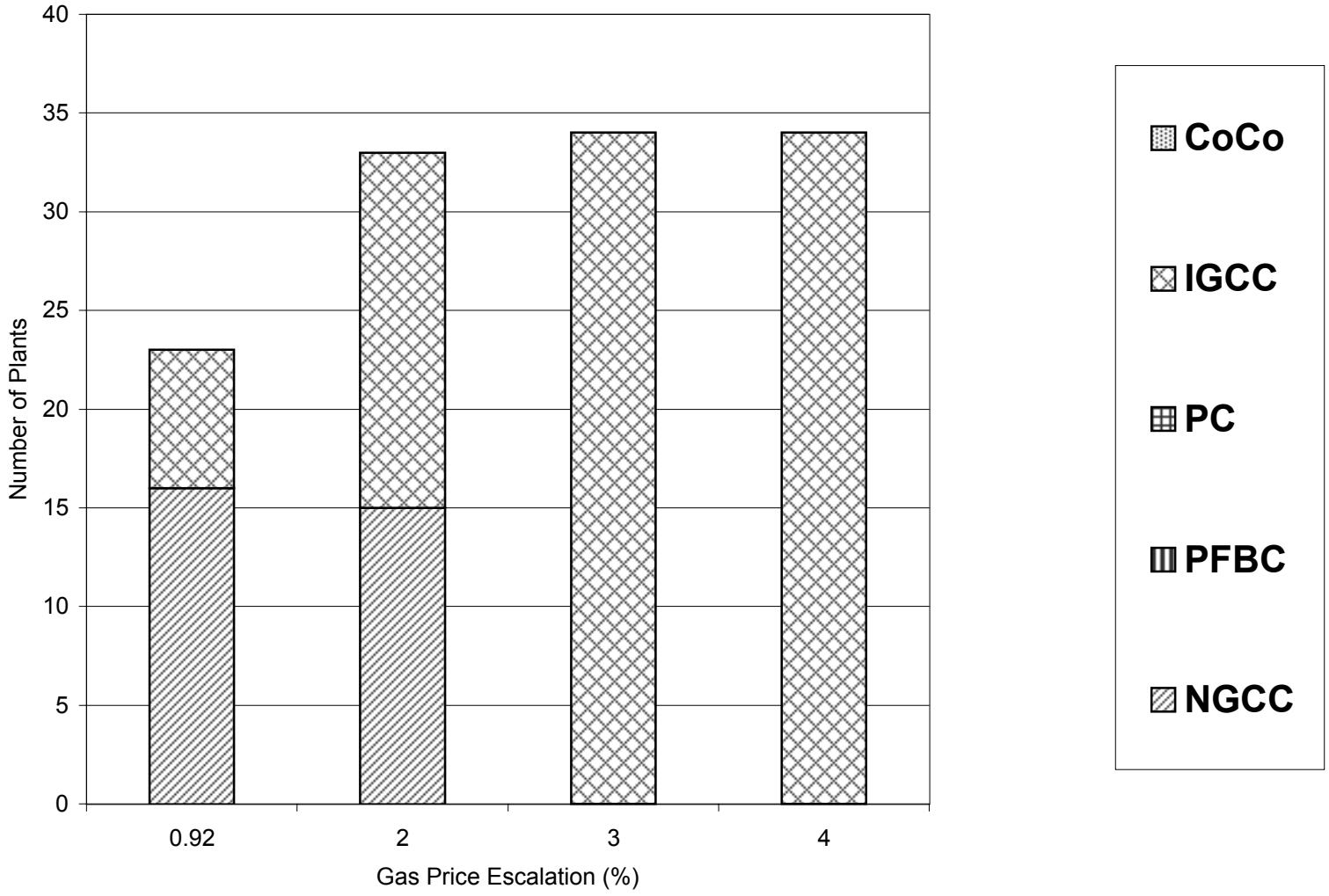


Figure 30. New Baseload Capacity Technologies
(Advanced IGCC, $100/Tonne Carbon Tax)



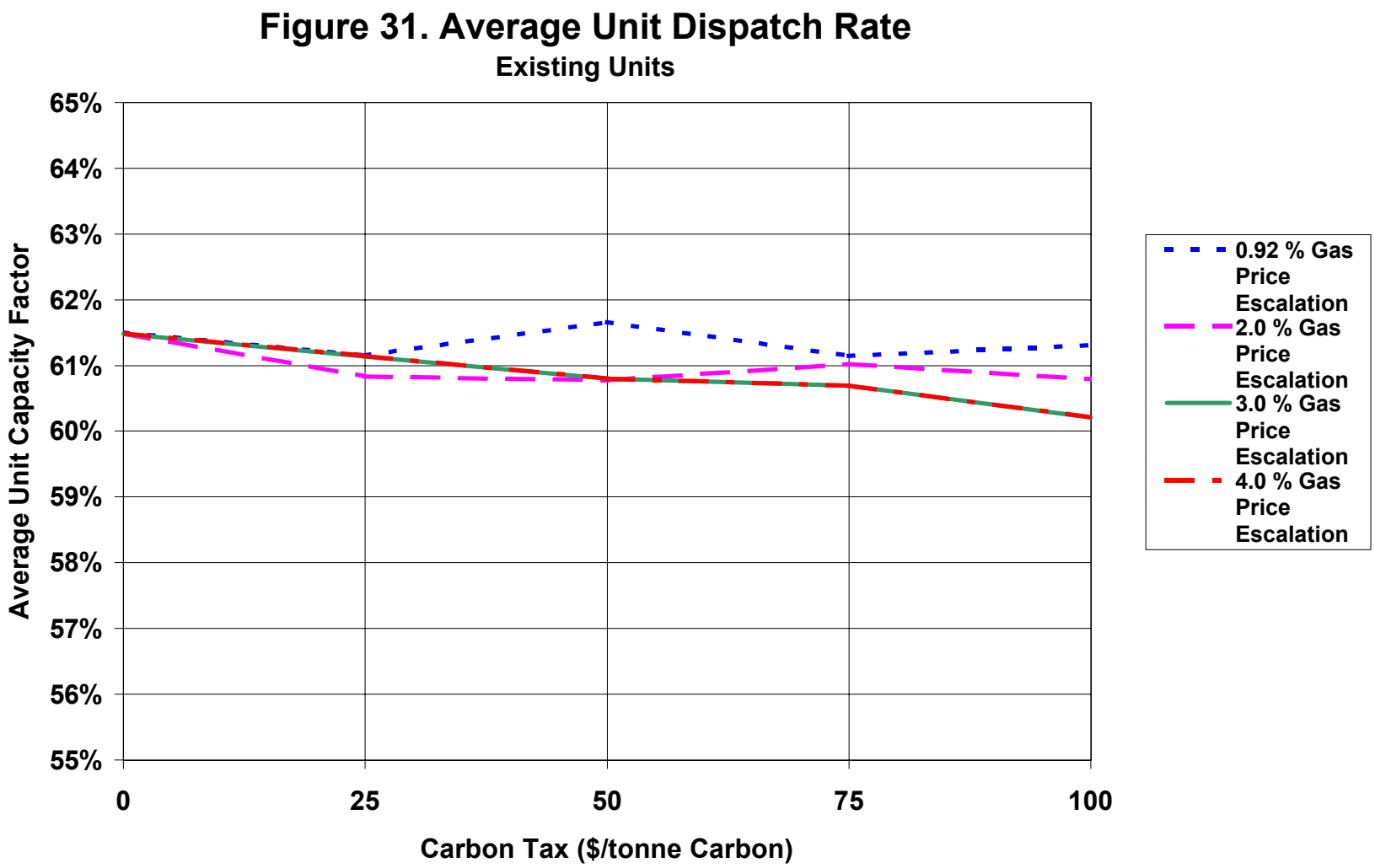


Figure 31. Average Unit Dispatch Rate
Existing Units
65%
64%
63%
62%
61%
60%
59%
58%
57%
56%
55%
Average Unit Capacity Factor
0
25
50
75
100
Carbon Tax ($/tonne Carbon)
0.92 % Gas Price Escalation
2.0 % Gas Price Escalation
3.0 % Gas Price Escalation
4.0 % Gas Price Escalation

Figure 32. Average Unit Dispatch Rate
New Units

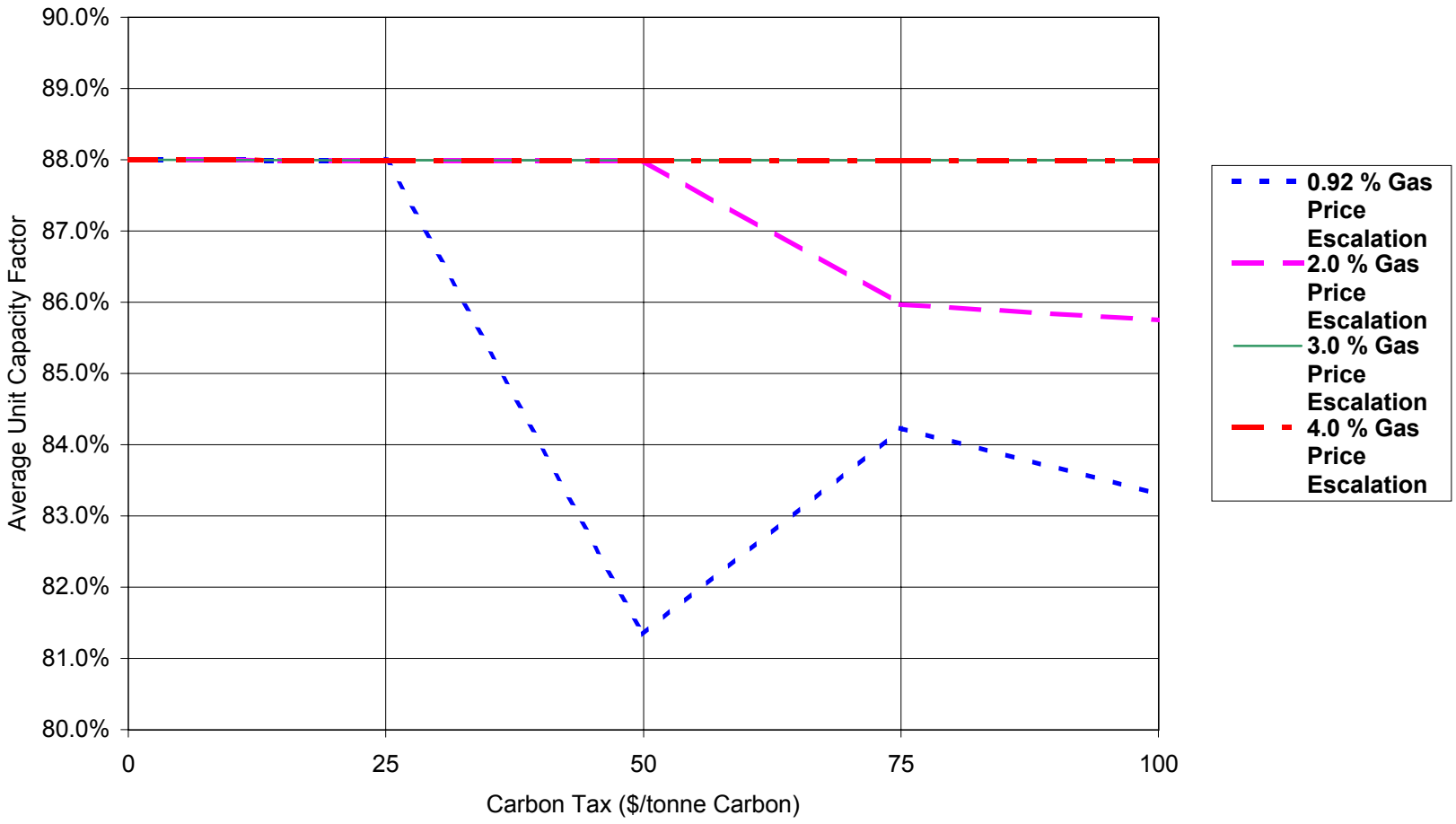


Figure 33. Unit Dispatch at 0.92 % Gas Price Escalation
New Capacity

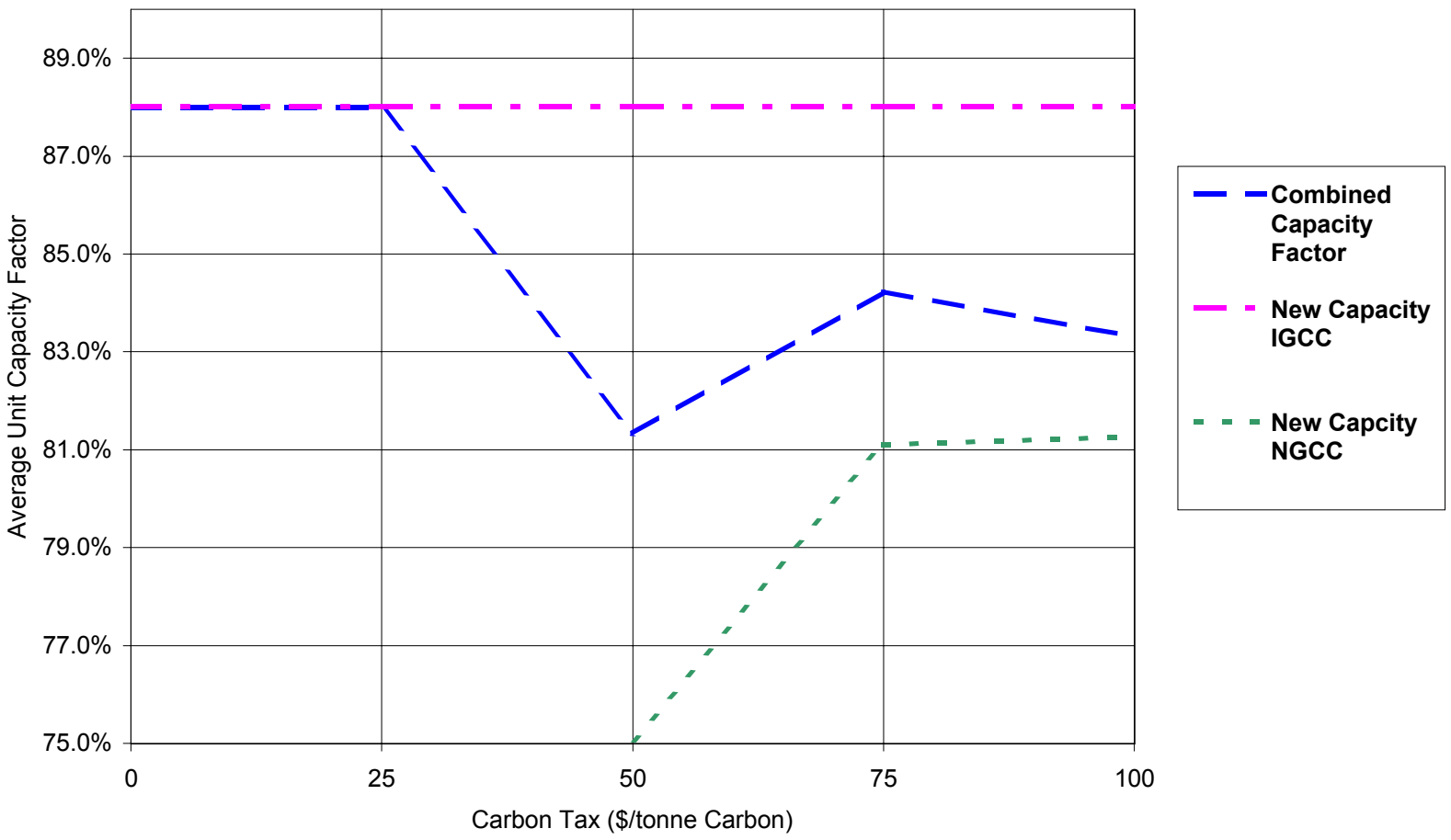


Figure 34. Annual Average Lambda, Fixed Allowance Price, Existing Plants
(Note: The 3%/4% lines coincide)

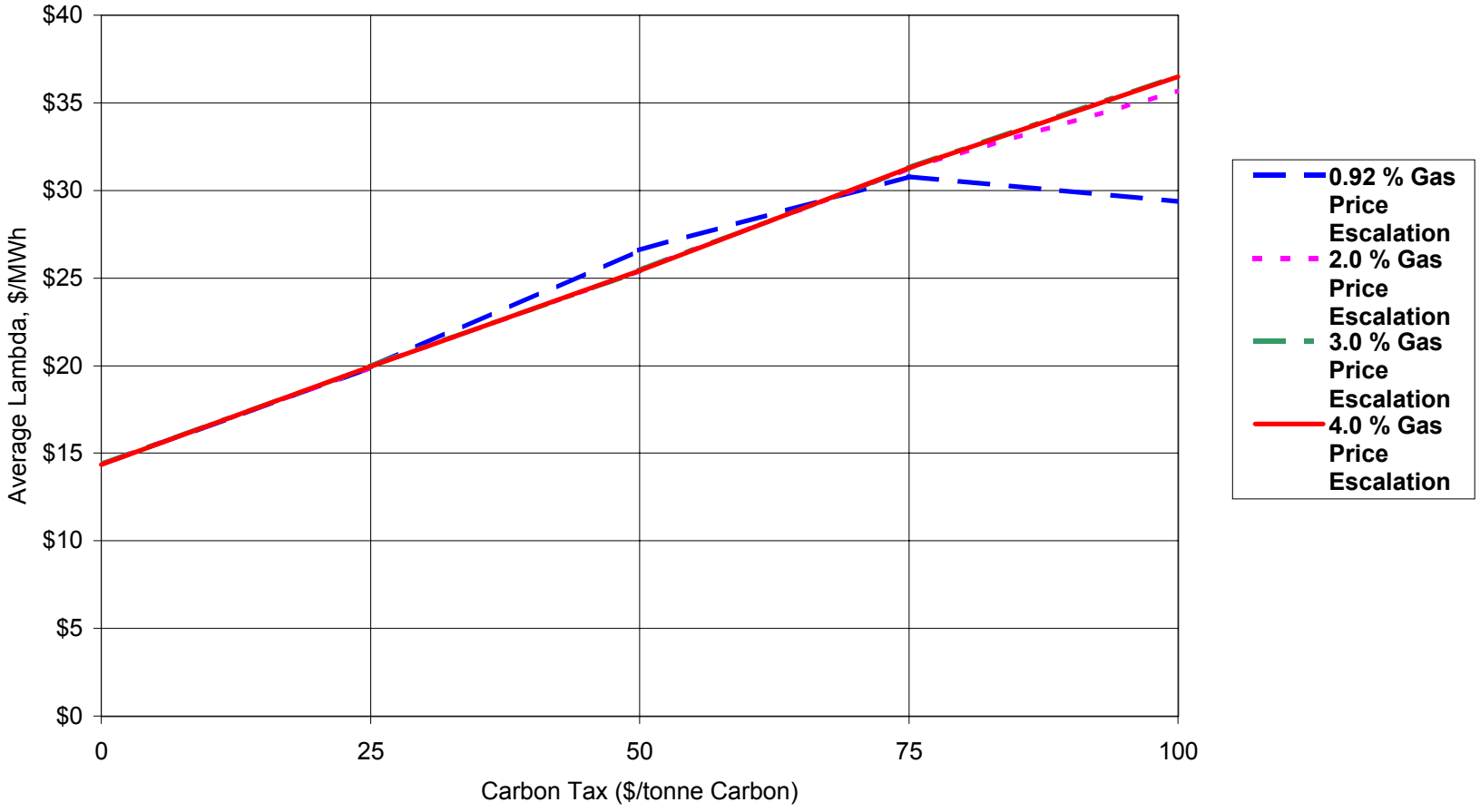


Figure 35. Annual Average Lambda, Fixed Allowance Price,
New Plants
(Note: The 3%/4% lines coincide)

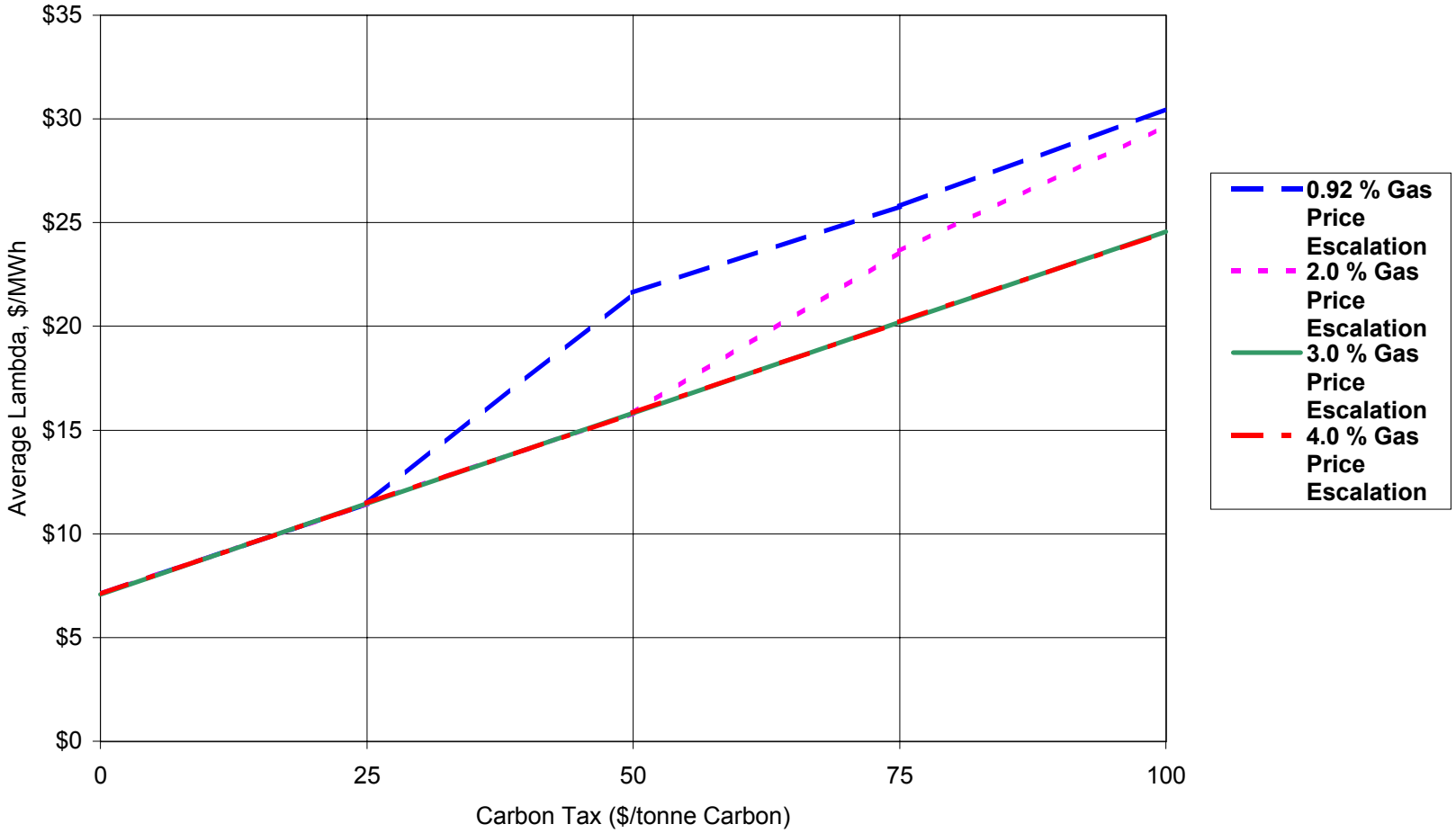


Figure 36. Baseload Fossil Power Plants
(Advanced IGCC, No Carbon Tax)

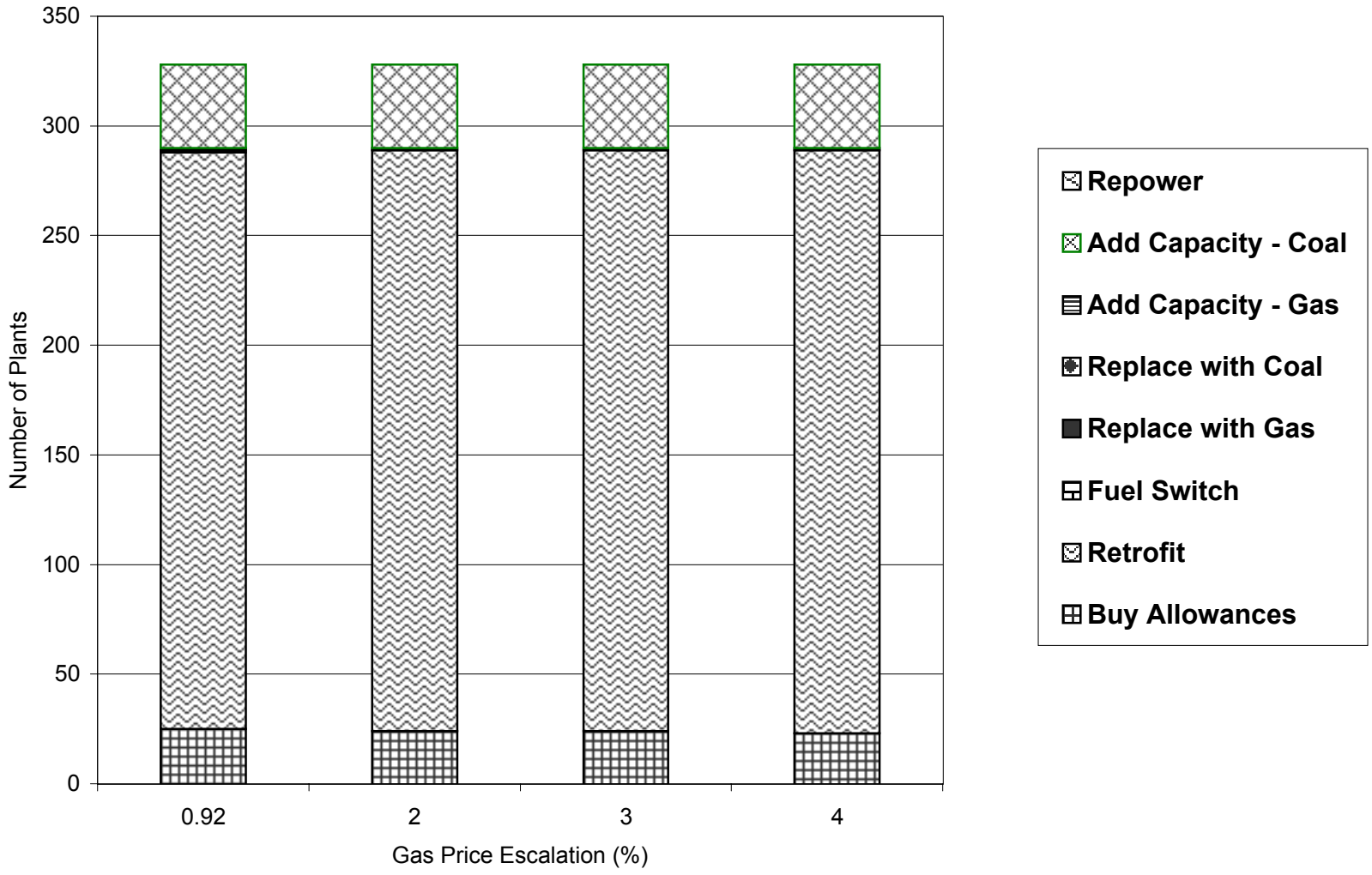


Figure 37. Baseload Fossil Capacity
(Advanced IGCC, No Carbon Tax)

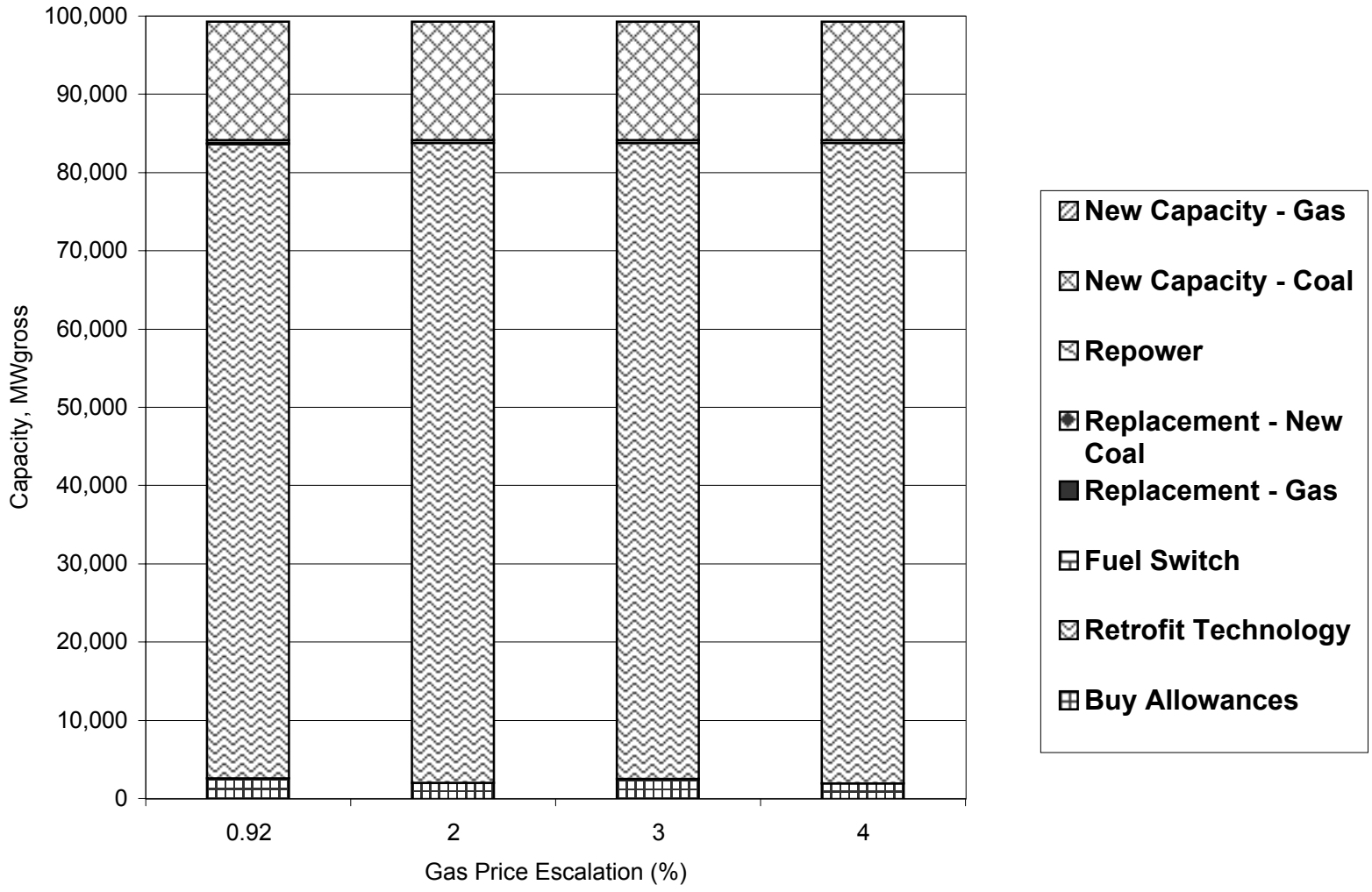


Figure 38. New Baseload Capacity Technologies
(Advanced IGCC, No Carbon Tax)

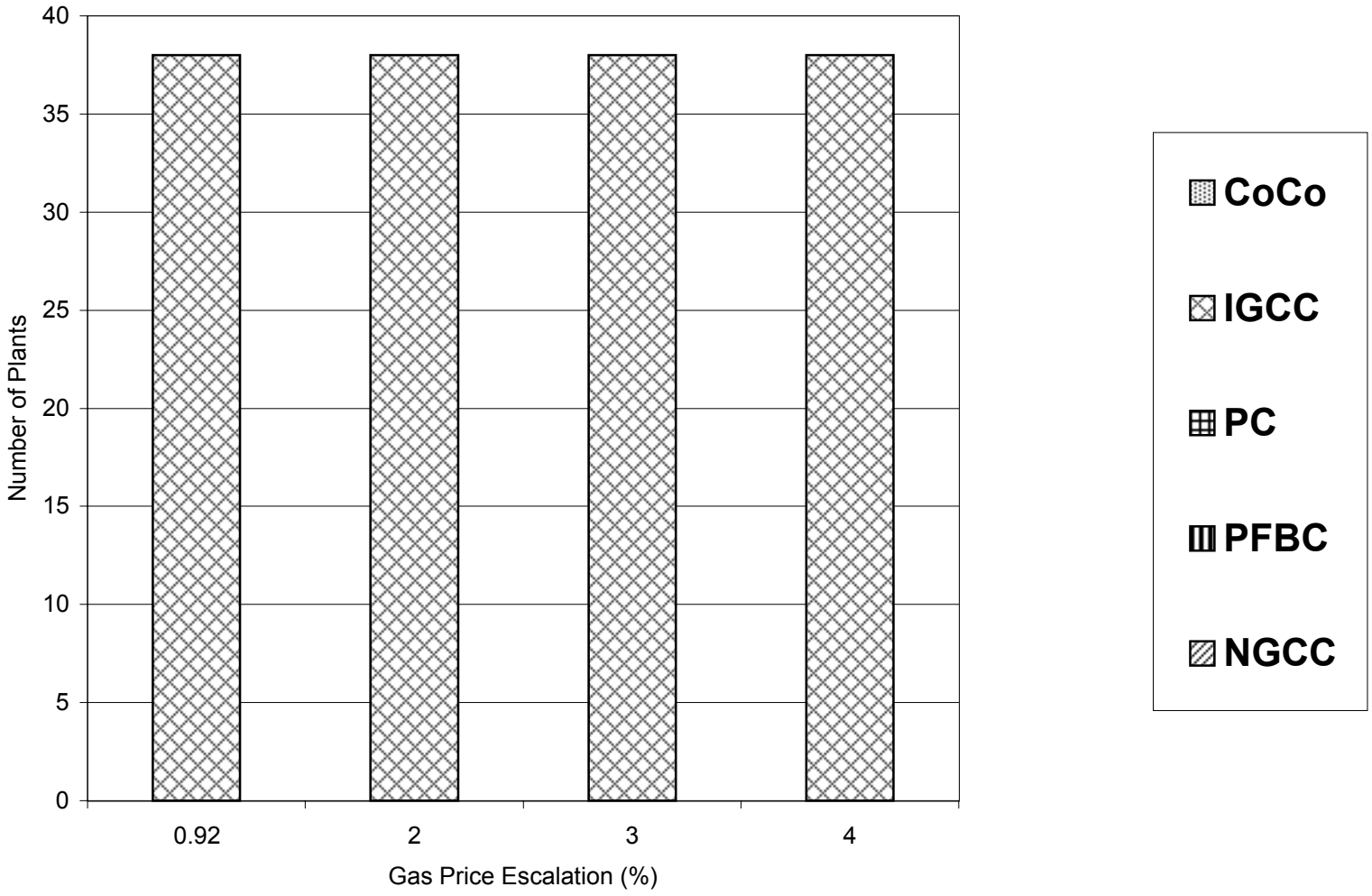


Figure 39. Baseload Fossil Power Plants
(Advanced IGCC, $25/Tonne Carbon Tax)

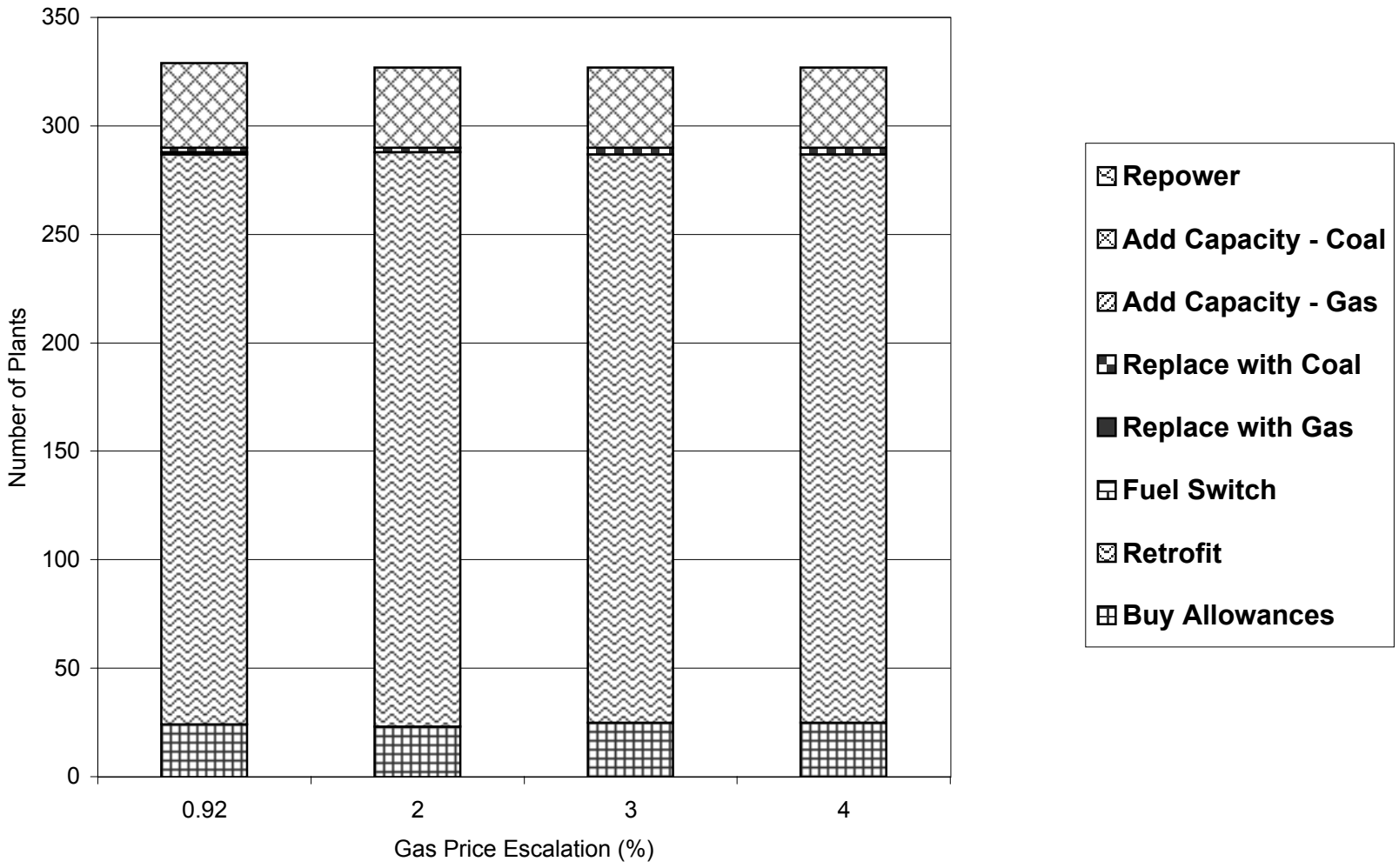


Figure 40. Baseload Fossil Capacity
(Advanced IGCC, $25/Tonne Carbon Tax)

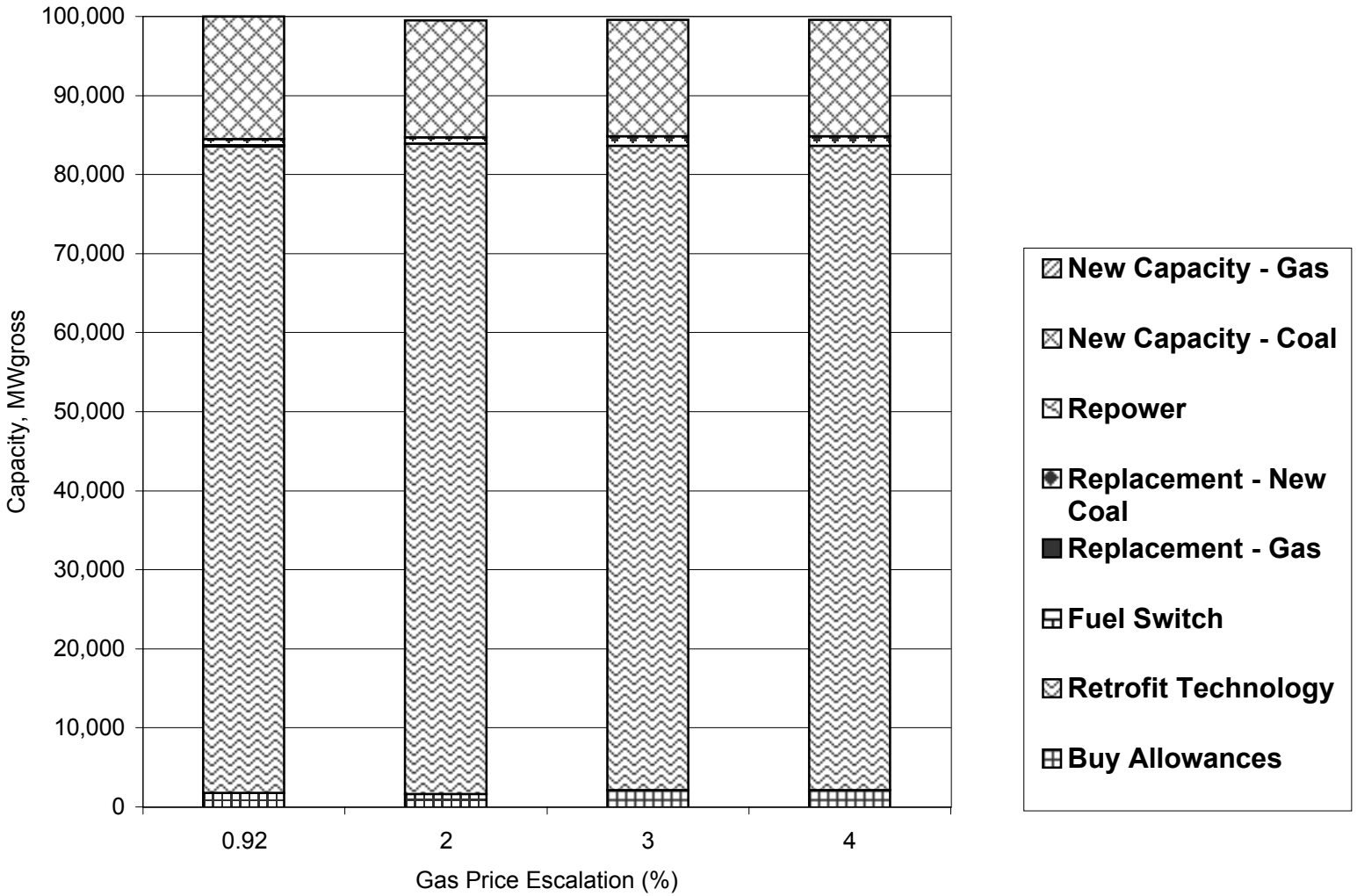


Figure 41. New Baseload Capacity Technologies
(Advanced IGCC, $25/Tonne Carbon Tax)

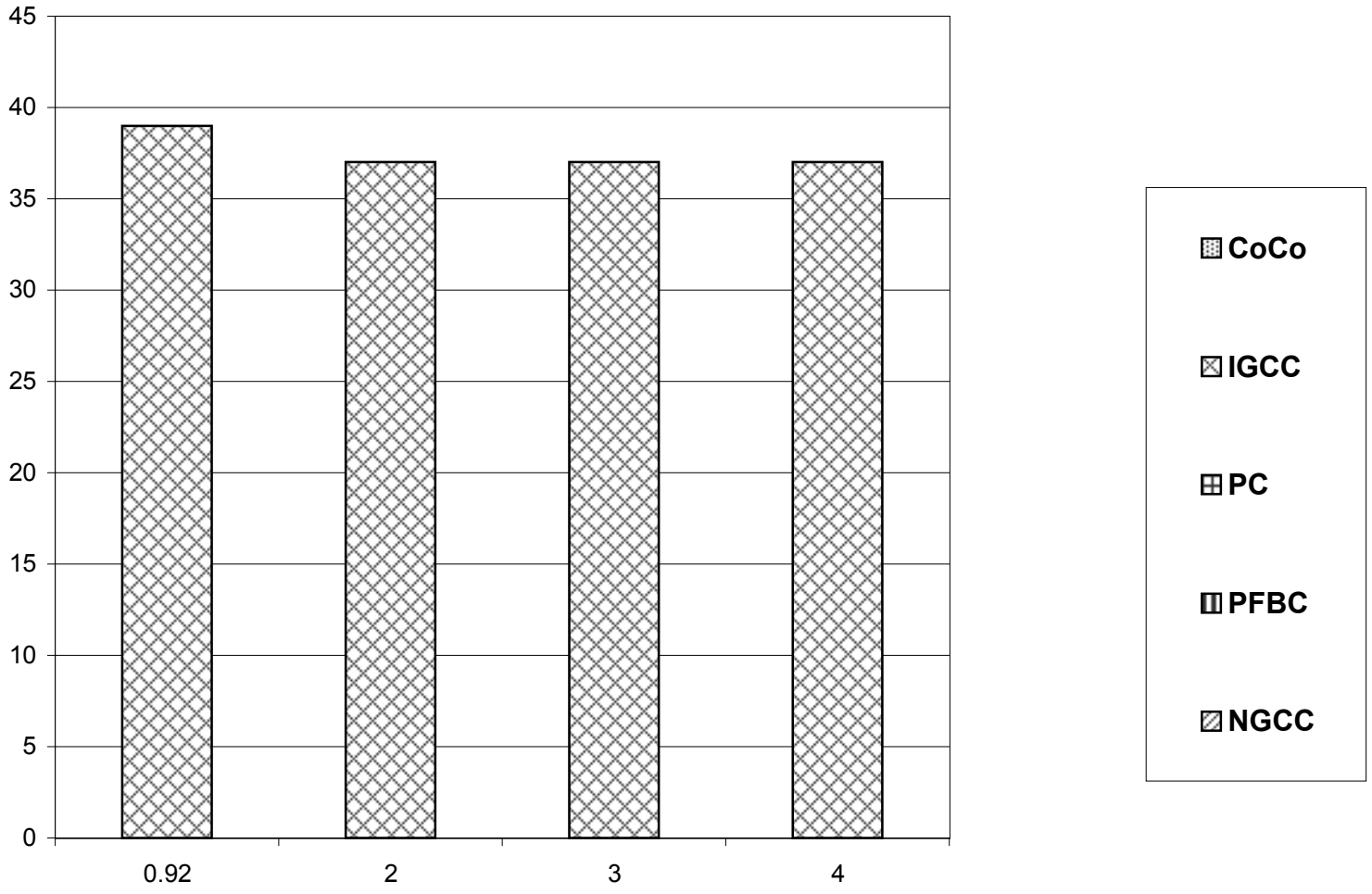


Figure 42. Baseload Fossil Power Plants
(Advanced IGCC, $50/Tonne Carbon Tax)

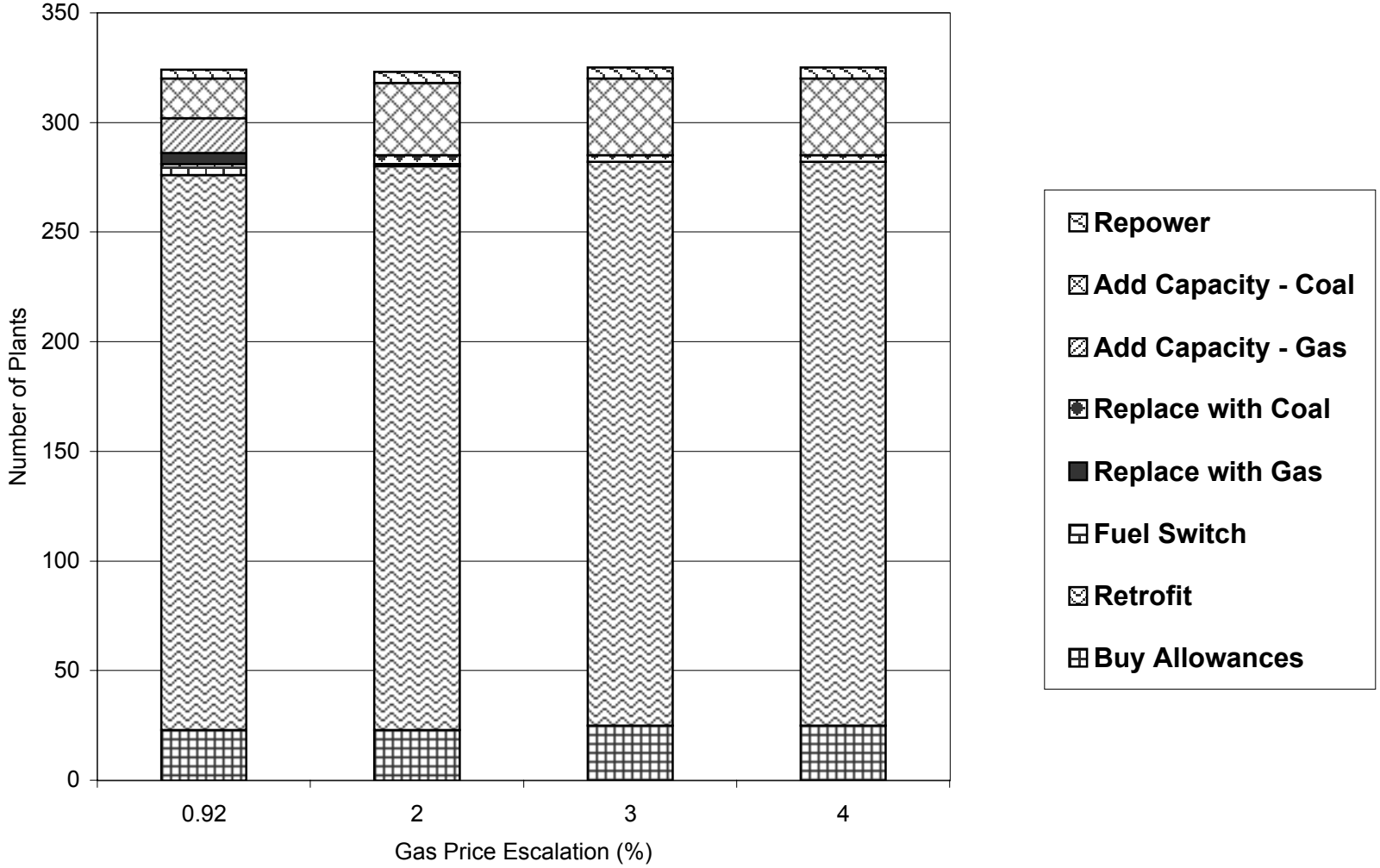


Figure 43. Baseload Fossil Capacity
(Advanced IGCC, $50/Tonne Carbon Tax)

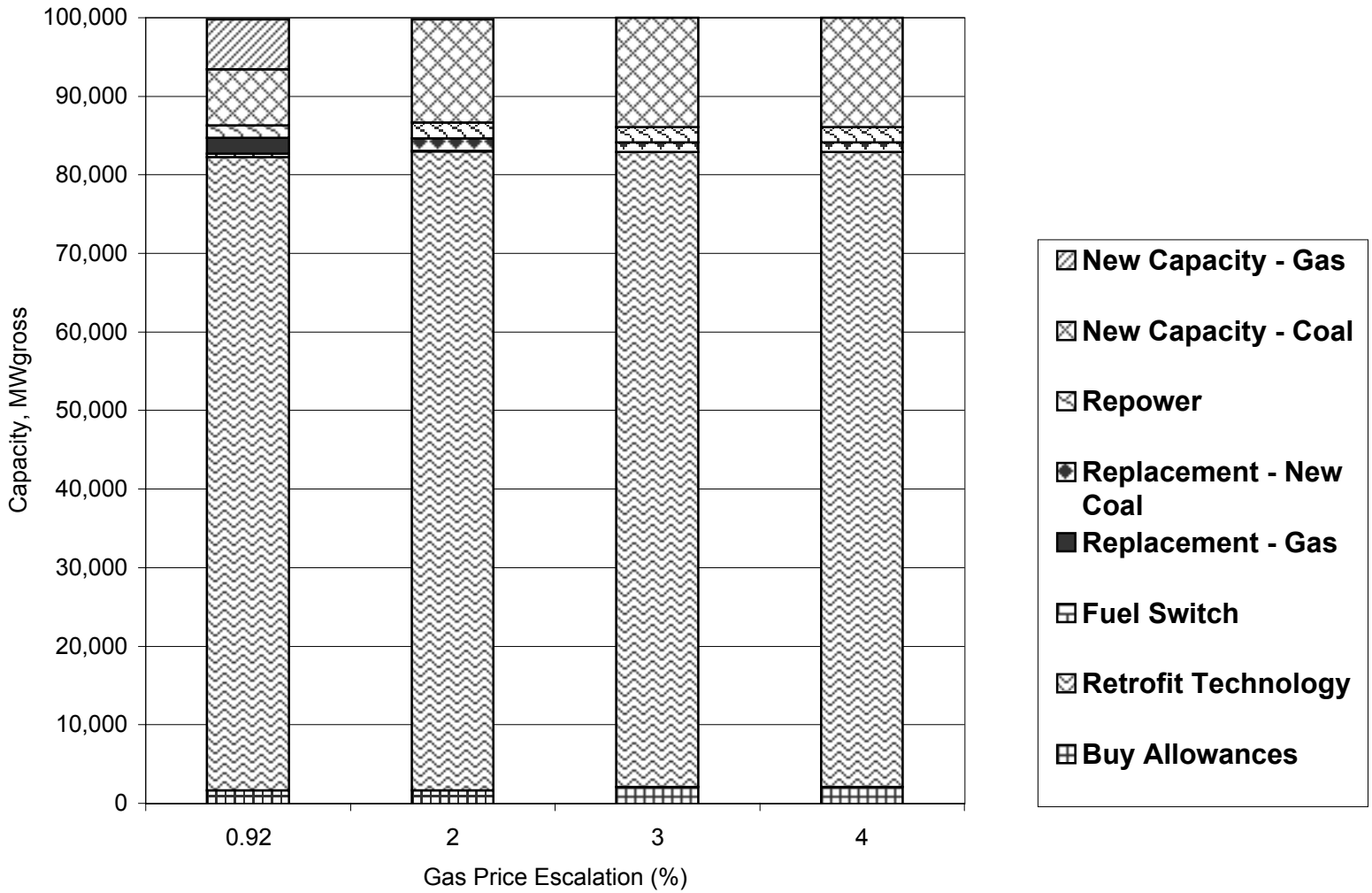


Figure 44. New Baseload Capacity Technologies
(Advanced IGCC, $50/Tonne Carbon Tax)

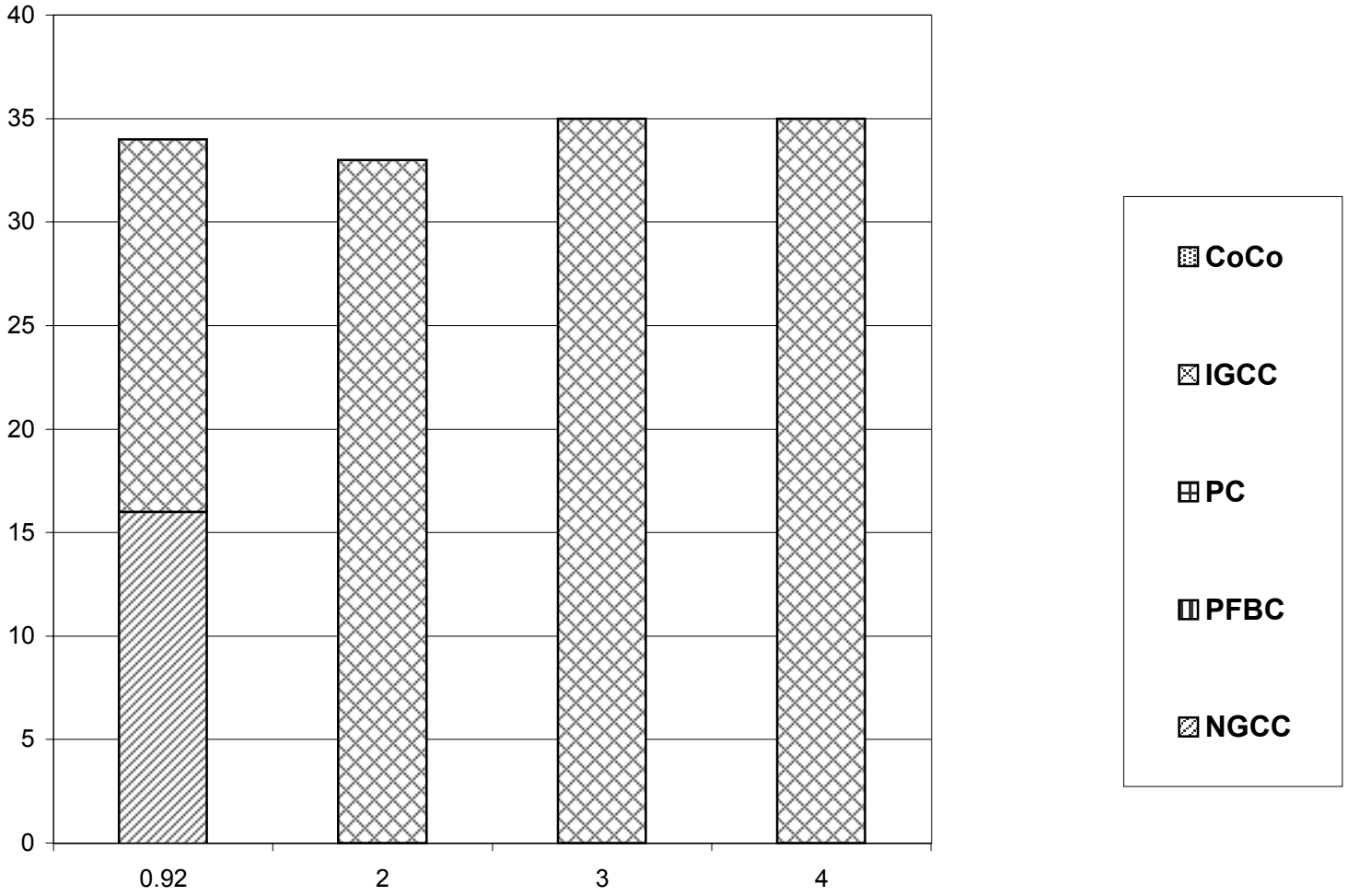


Figure 45. Baseload Fossil Power Plants
(Advanced IGCC, $75/Tonne Carbon Tax)

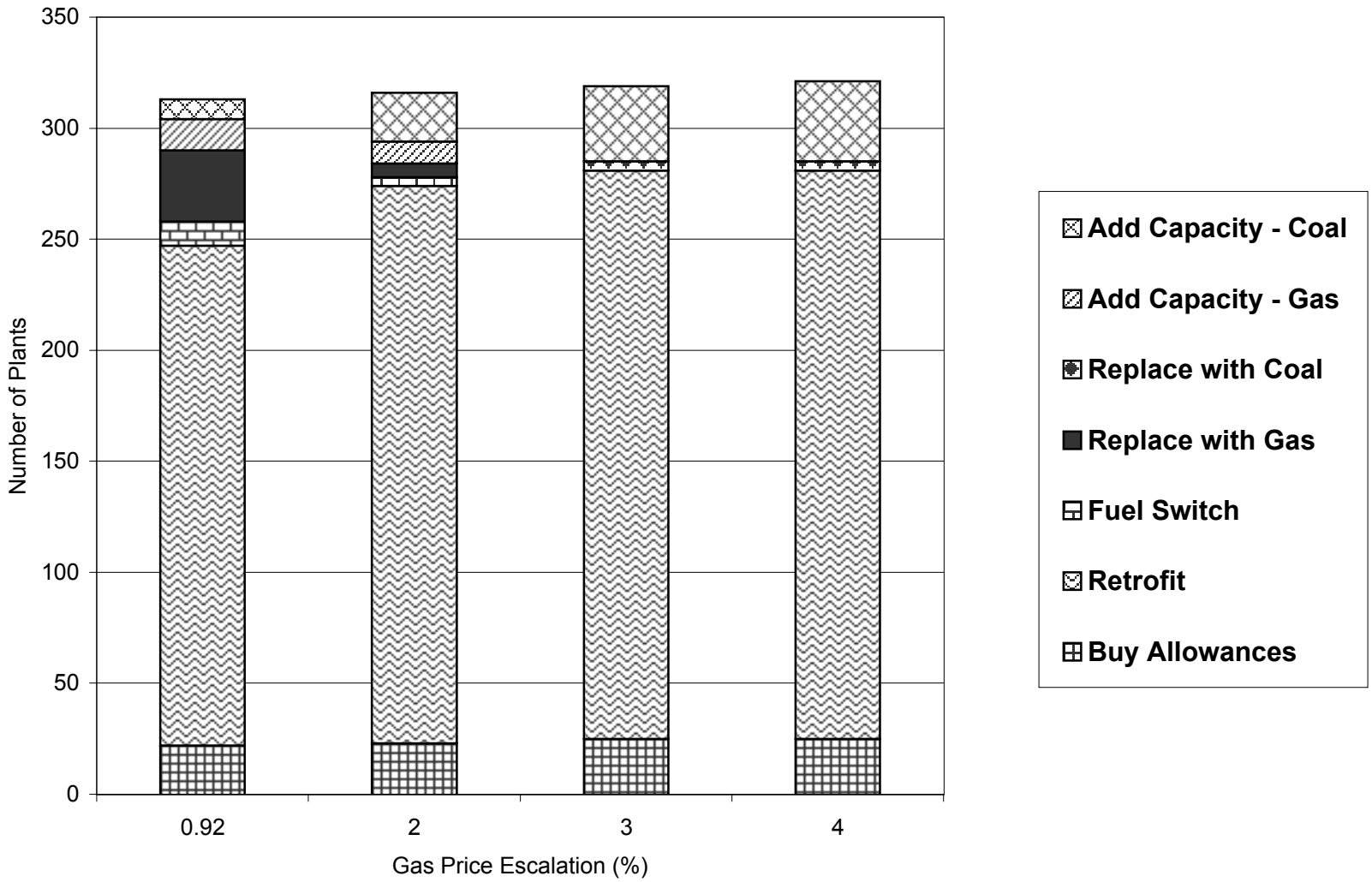


Figure 46. Baseload Fossil Capacity
(Advanced IGCC, $75/Tonne Carbon Tax)

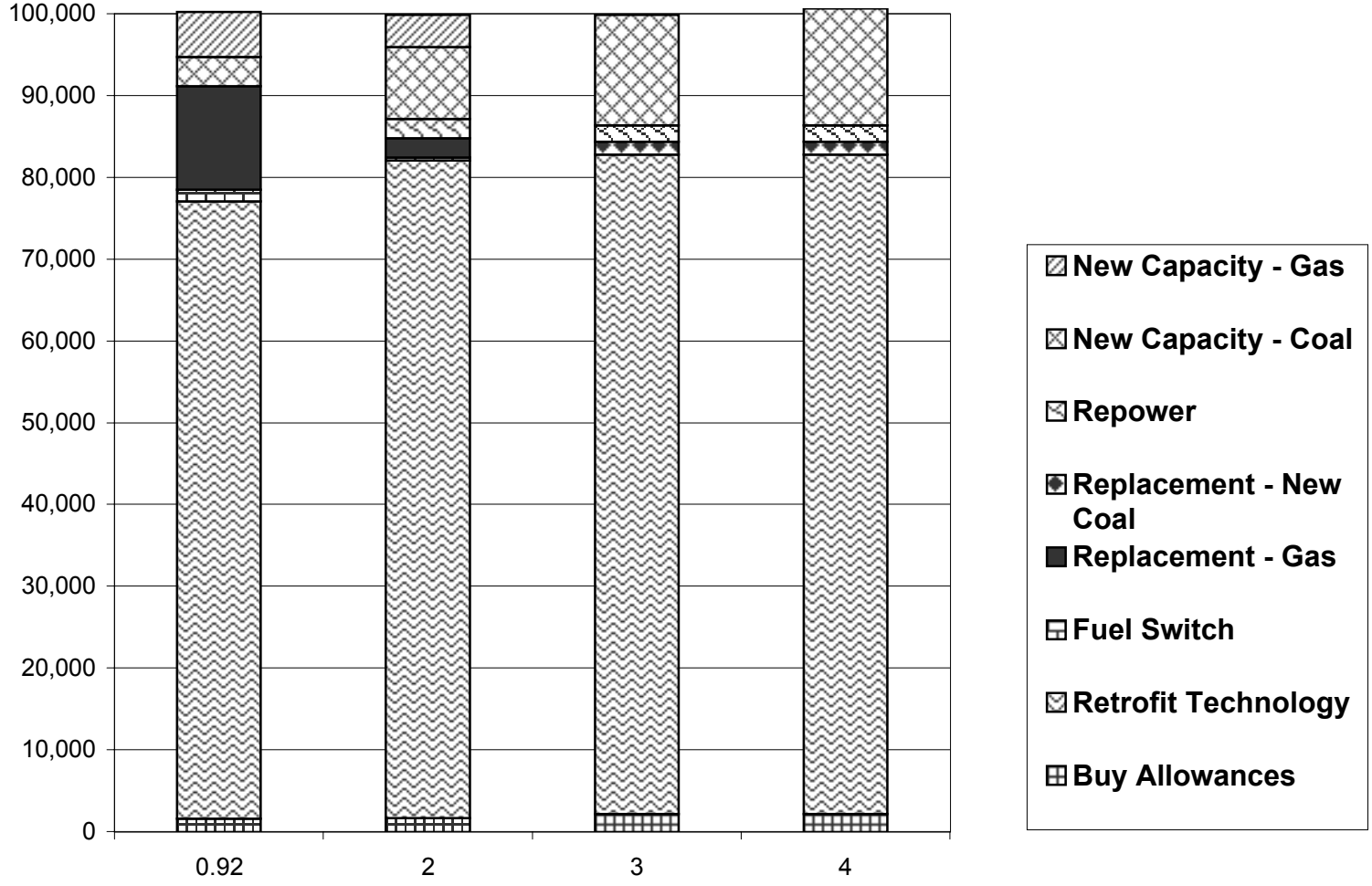


Figure 47. New Baseload Capacity Technologies
(Advanced IGCC, $75/Tonne Carbon Tax)

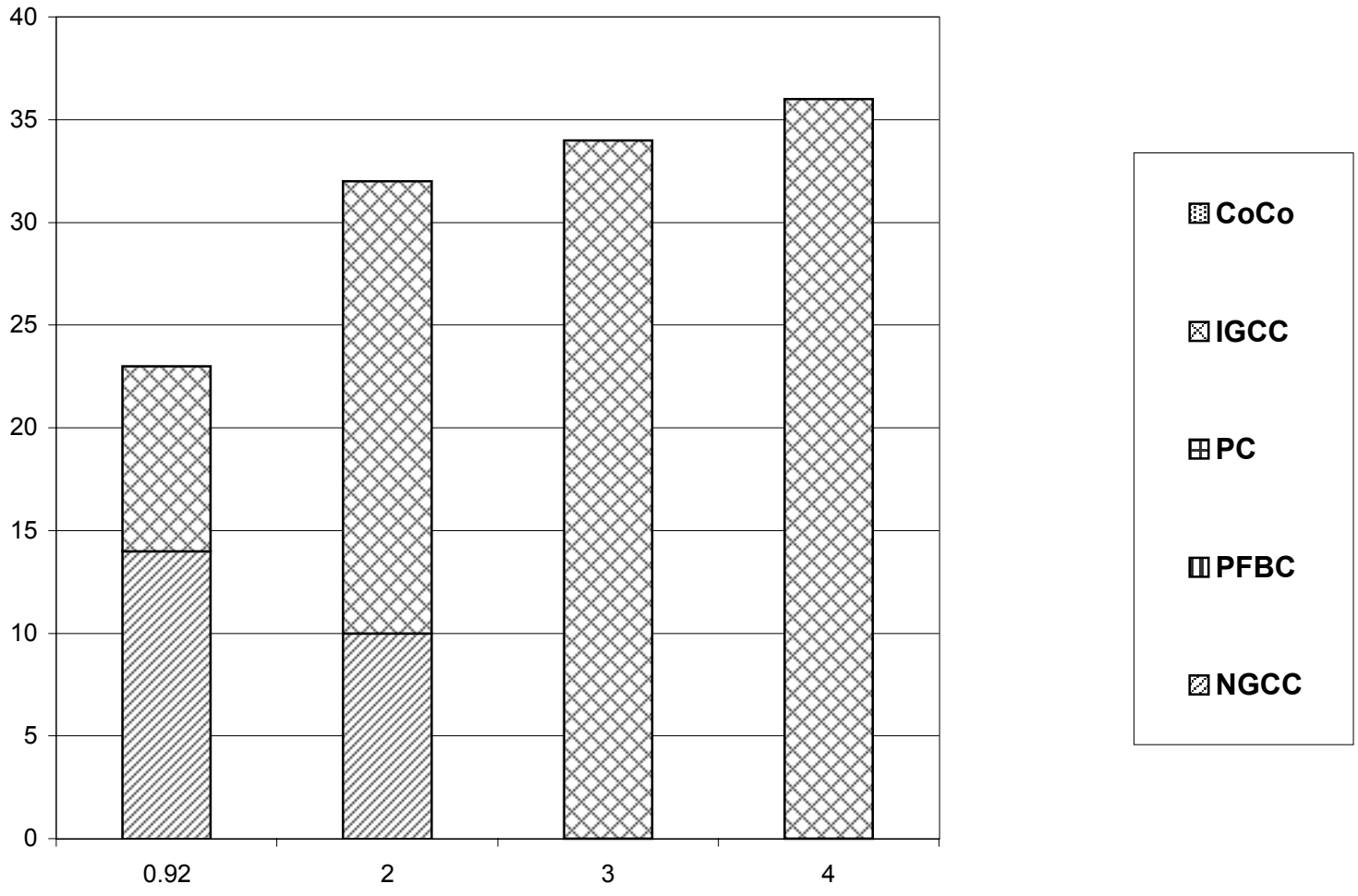


Figure 48. Baseload Fossil Power Plants
(Advanced IGCC, $100/Tonne Carbon Tax)

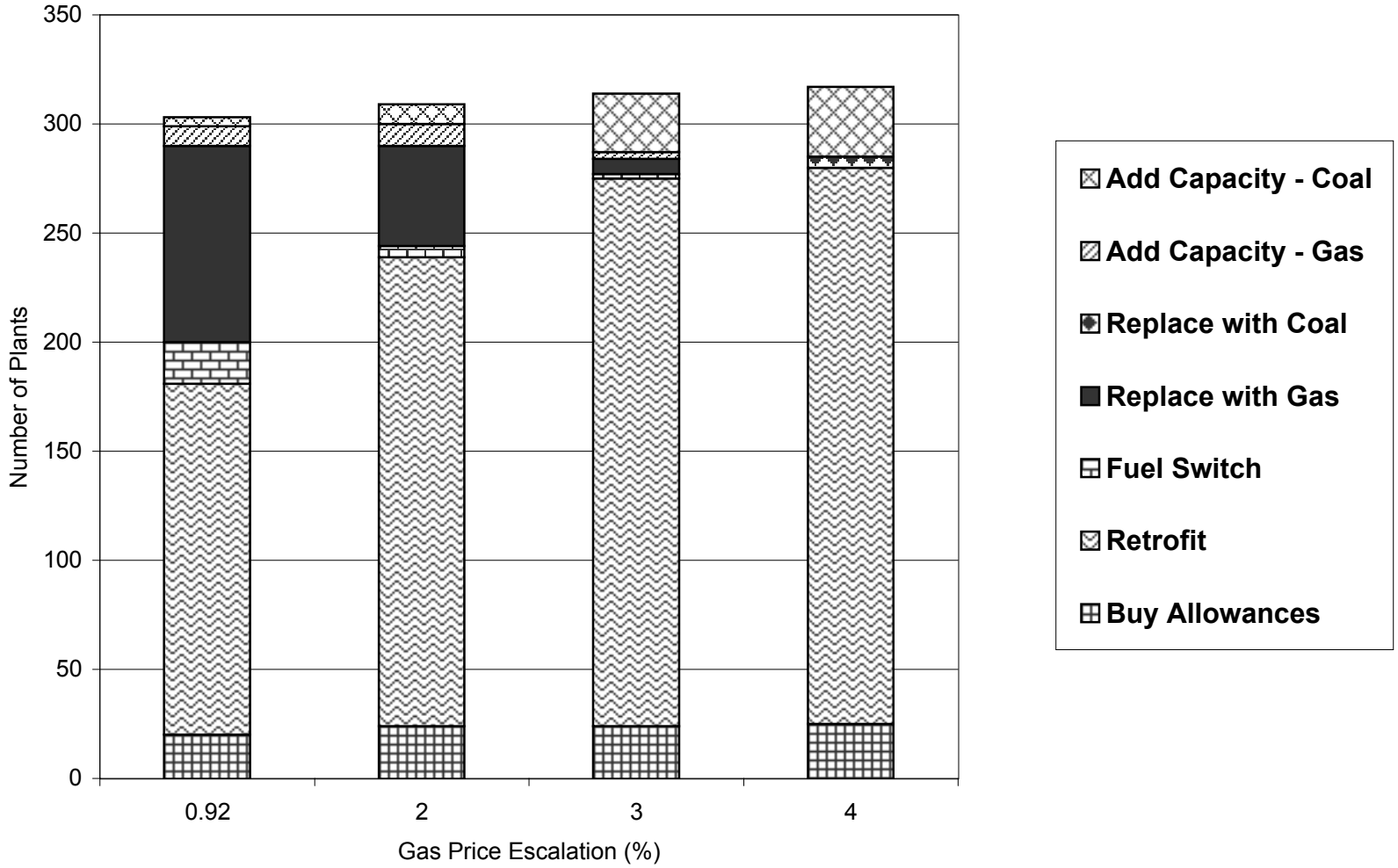


Figure 49. Baseload Fossil Capacity
(Advanced IGCC, $100/Tonne Carbon Tax)

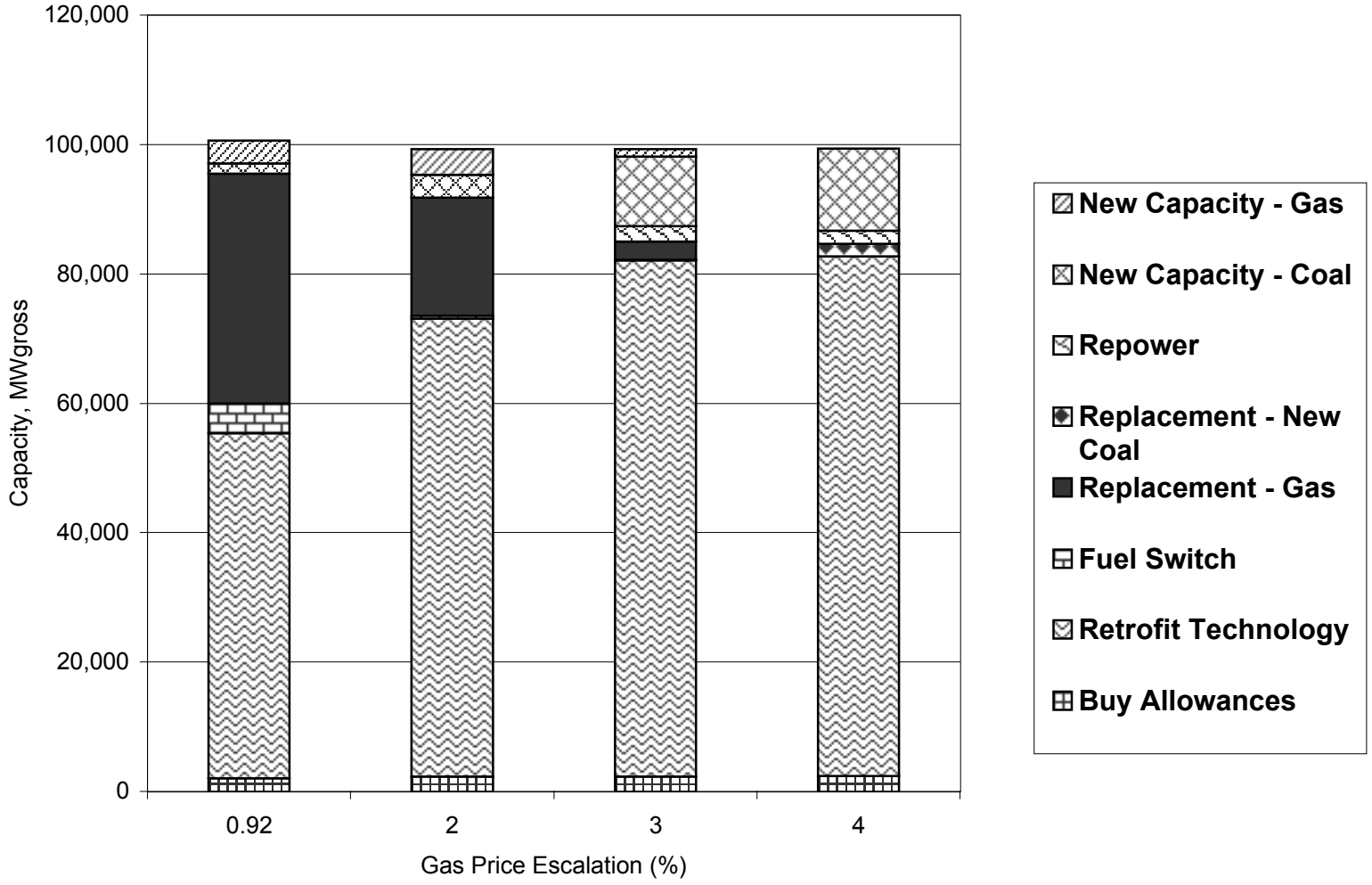


Figure 50. New Baseload Capacity Technologies
(Advanced IGCC, $100/Tonne Carbon Tax)

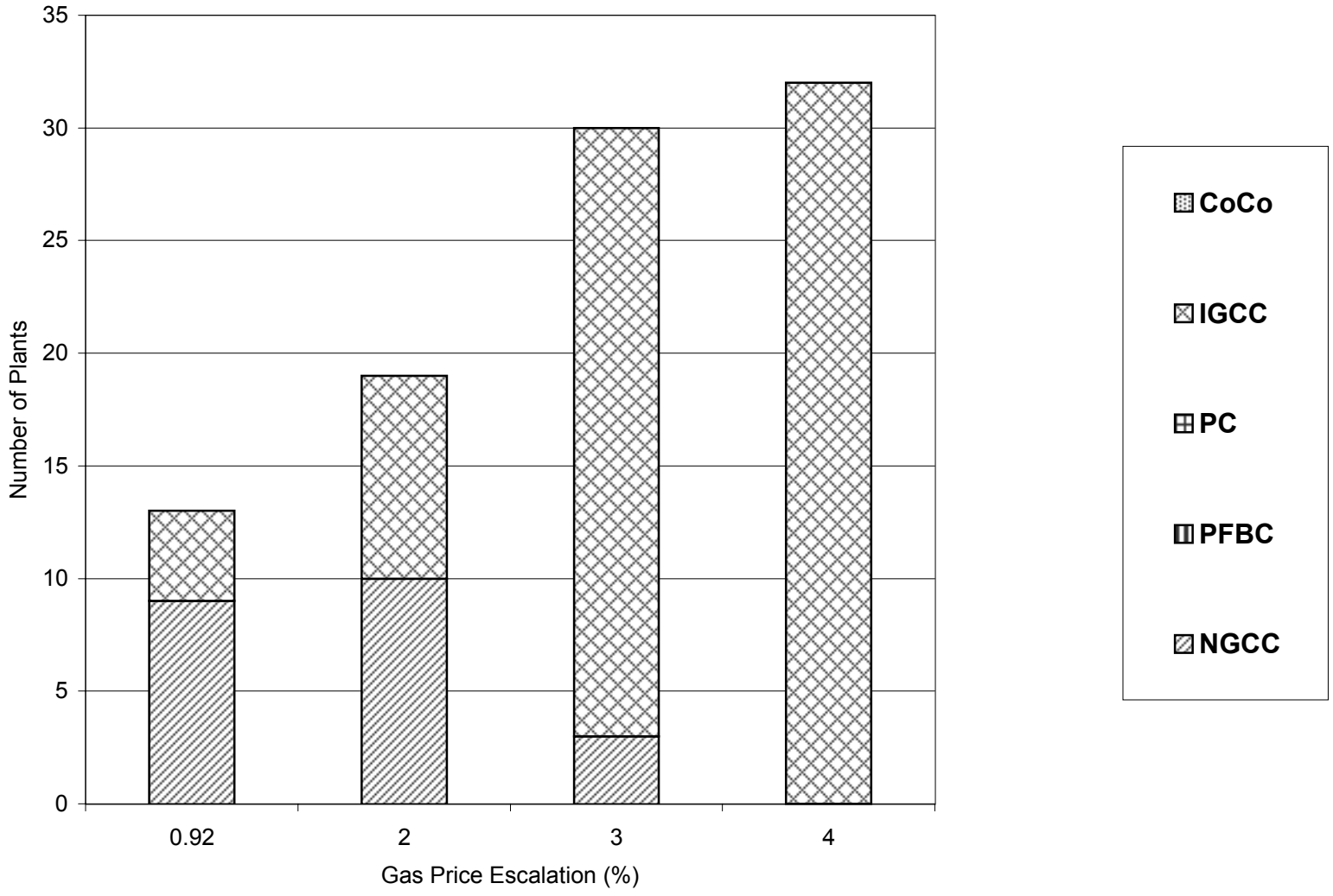
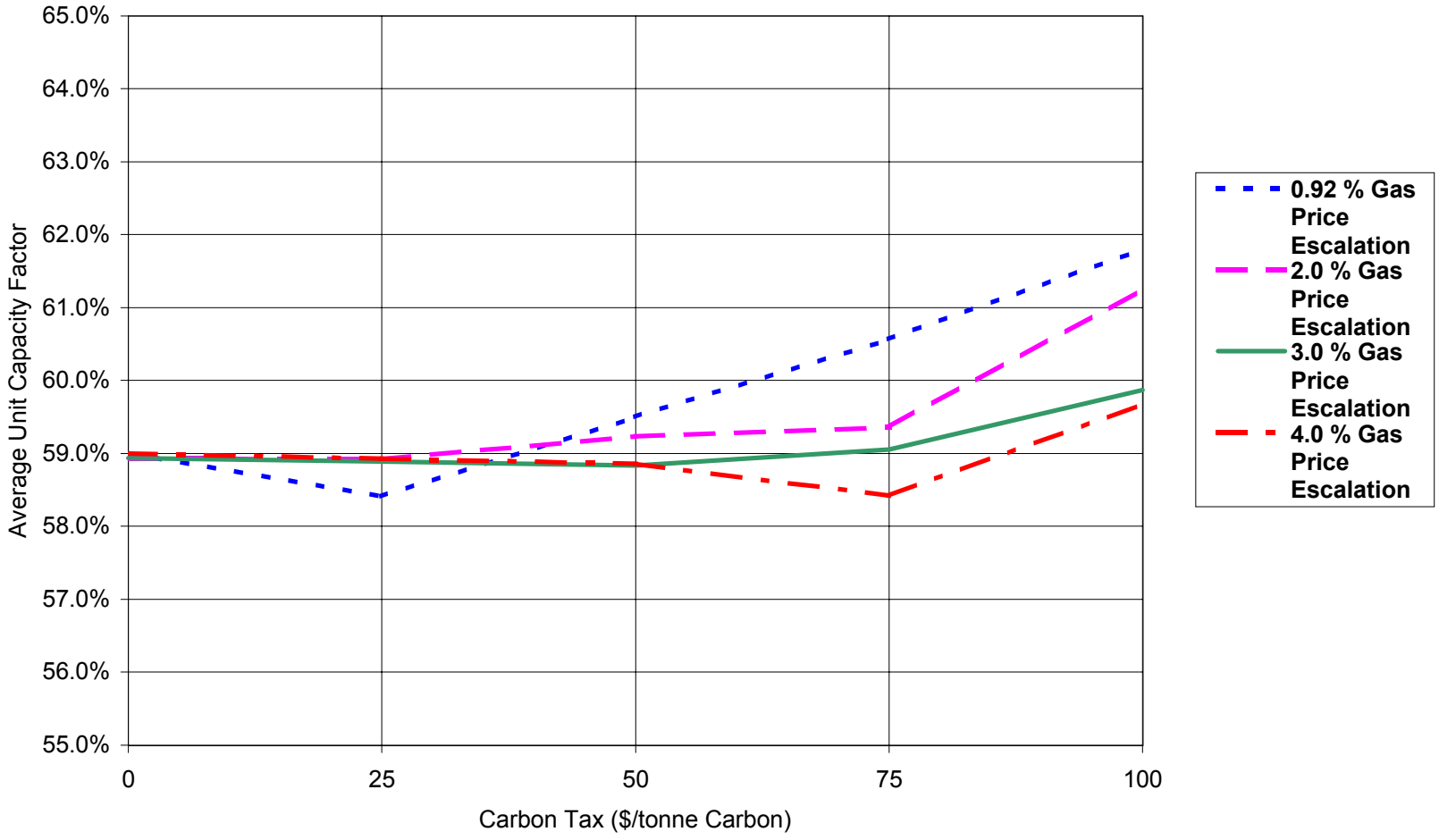


Figure 51. Average Unit Dispatch Rate
Existing Units



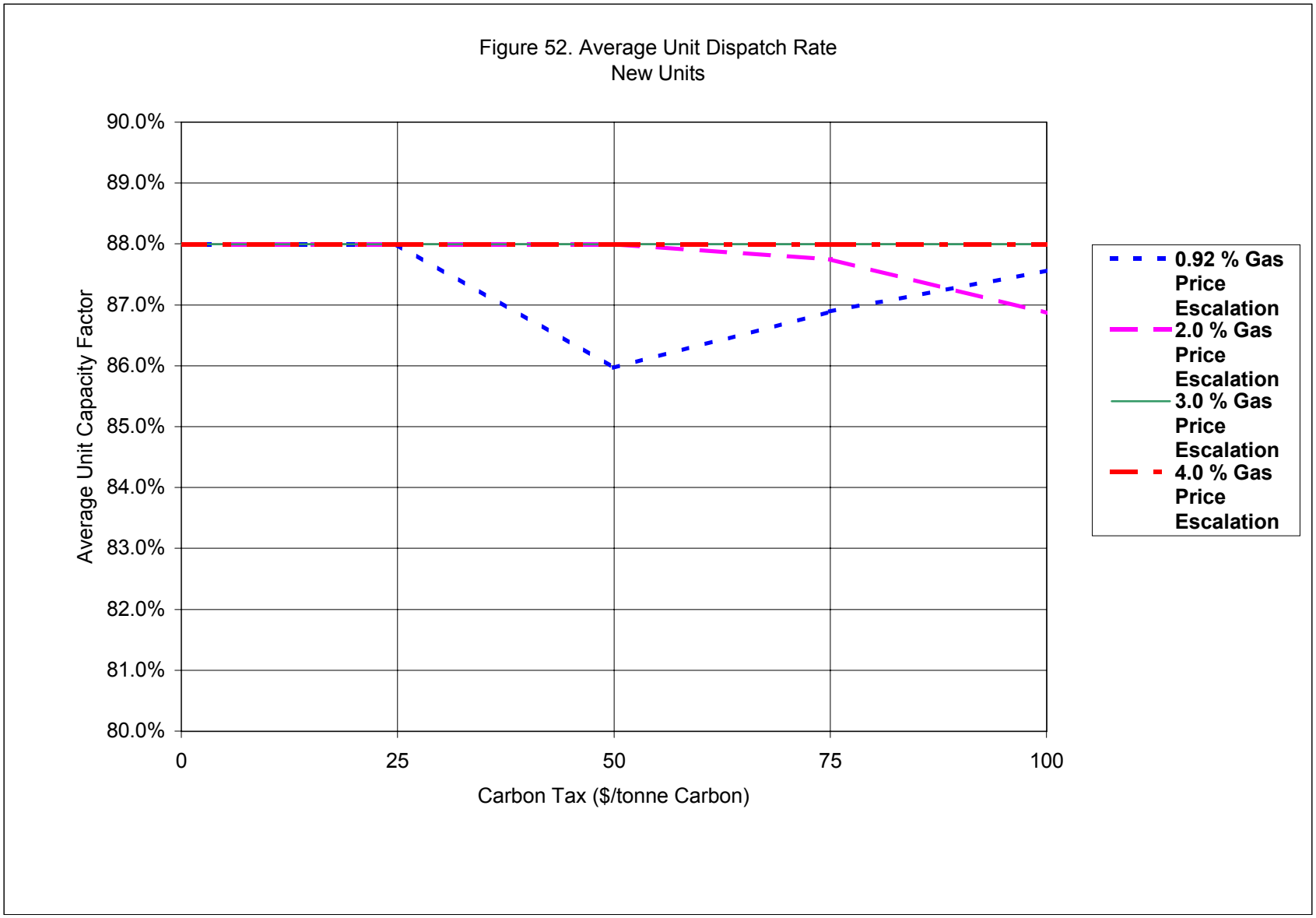


Figure 52. Average Unit Dispatch Rate
New Units
90.0%
89.0%
88.0%
87.0%
86.0%
85.0%
84.0%
83.0%
82.0%
81.0%
80.0%
Average Unit Capacity Factor
0
25
50
75
100
Carbon Tax ($/tonne Carbon)
0.92 % Gas Price Escalation
2.0 % Gas Price Escalation
3.0 % Gas Price Escalation
4.0 % Gas Price Escalation

Figure 53. Unit Dispatch at 0.92 % Gas Price Escalation
New Capacity

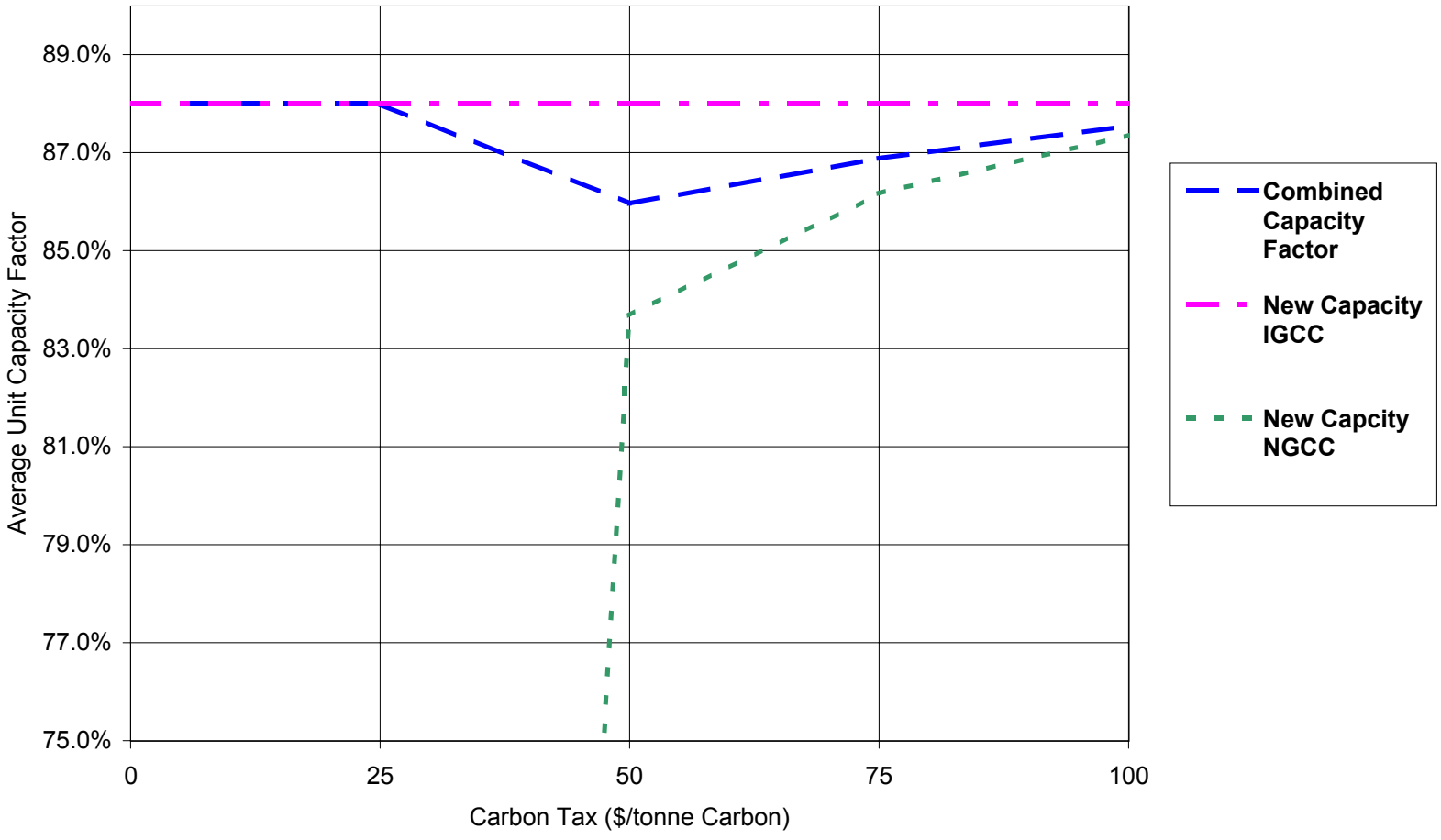


Figure 54. Annual Average Lambda, Adjusted Allowance Price, Existing Plants

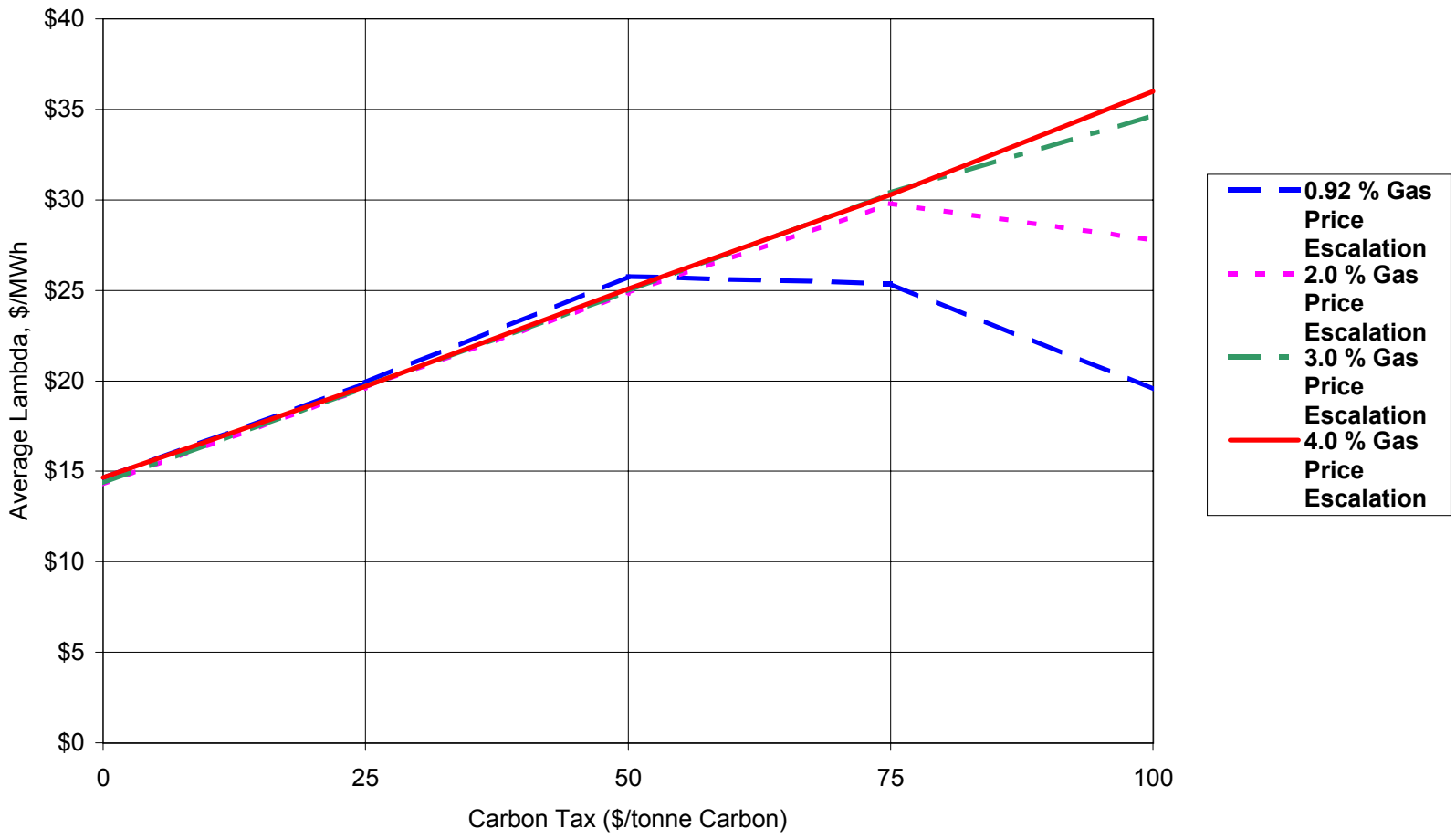


Figure 55. Annual Average Lambda, Adjusted Allowance Price, New Plants

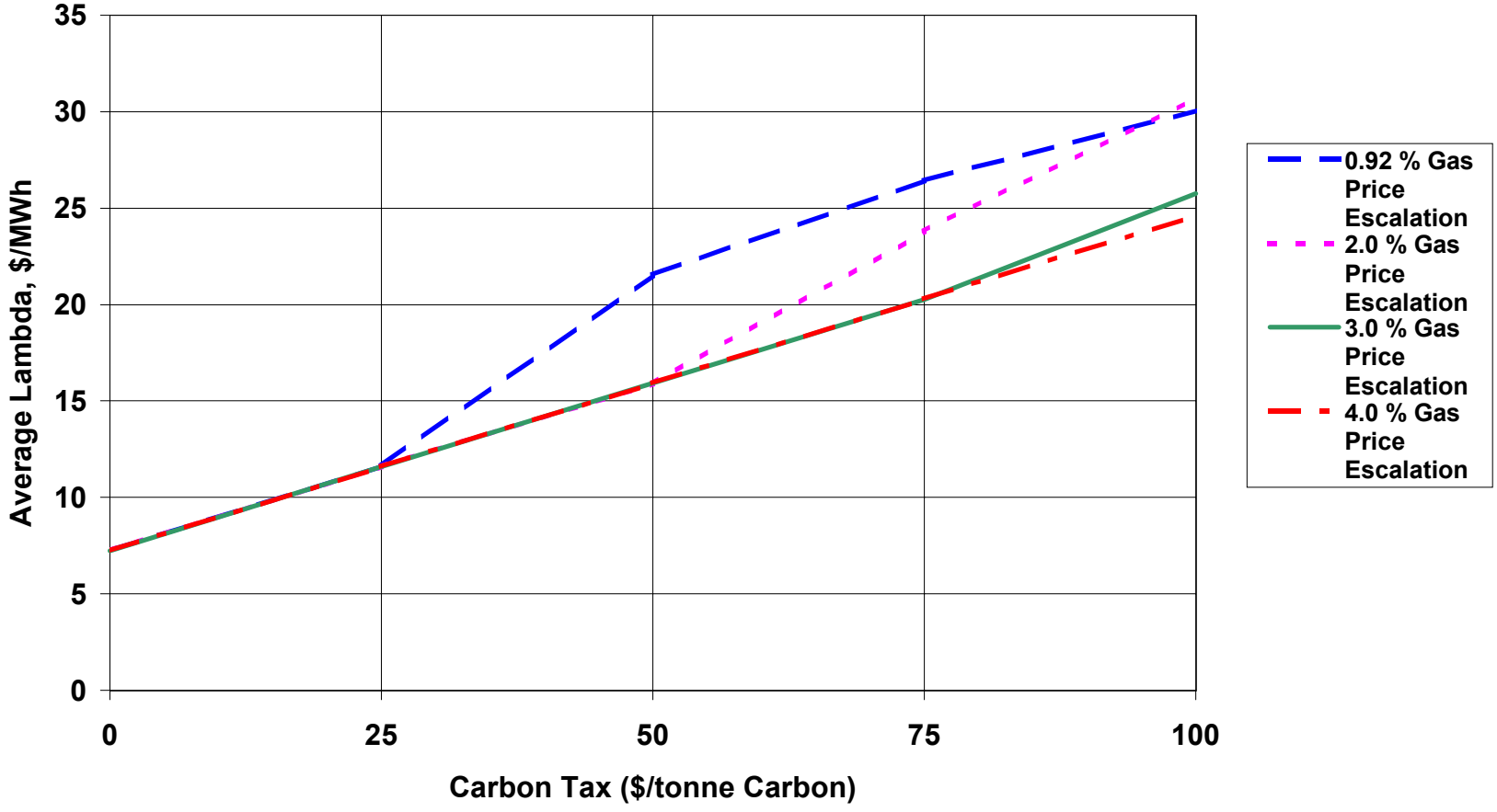


Figure 56. IGCC Market Penetration by Plants

Partially Advanced IGCC Development

10% Increase in IGCC Capital Cost

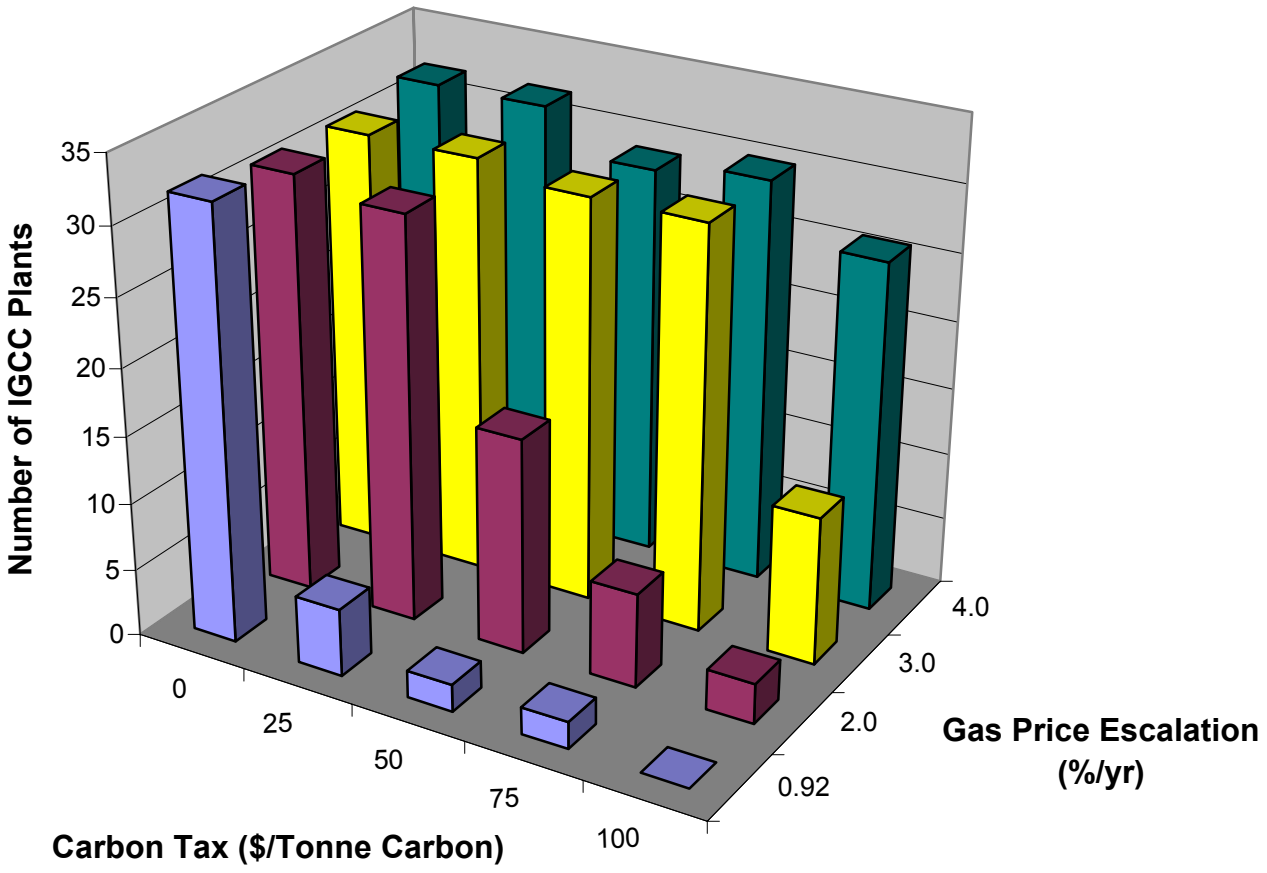


Figure 57. IGCC Market Penetration by Plants

Partially Advanced IGCC Development
20% Increase in IGCC Capital Cost

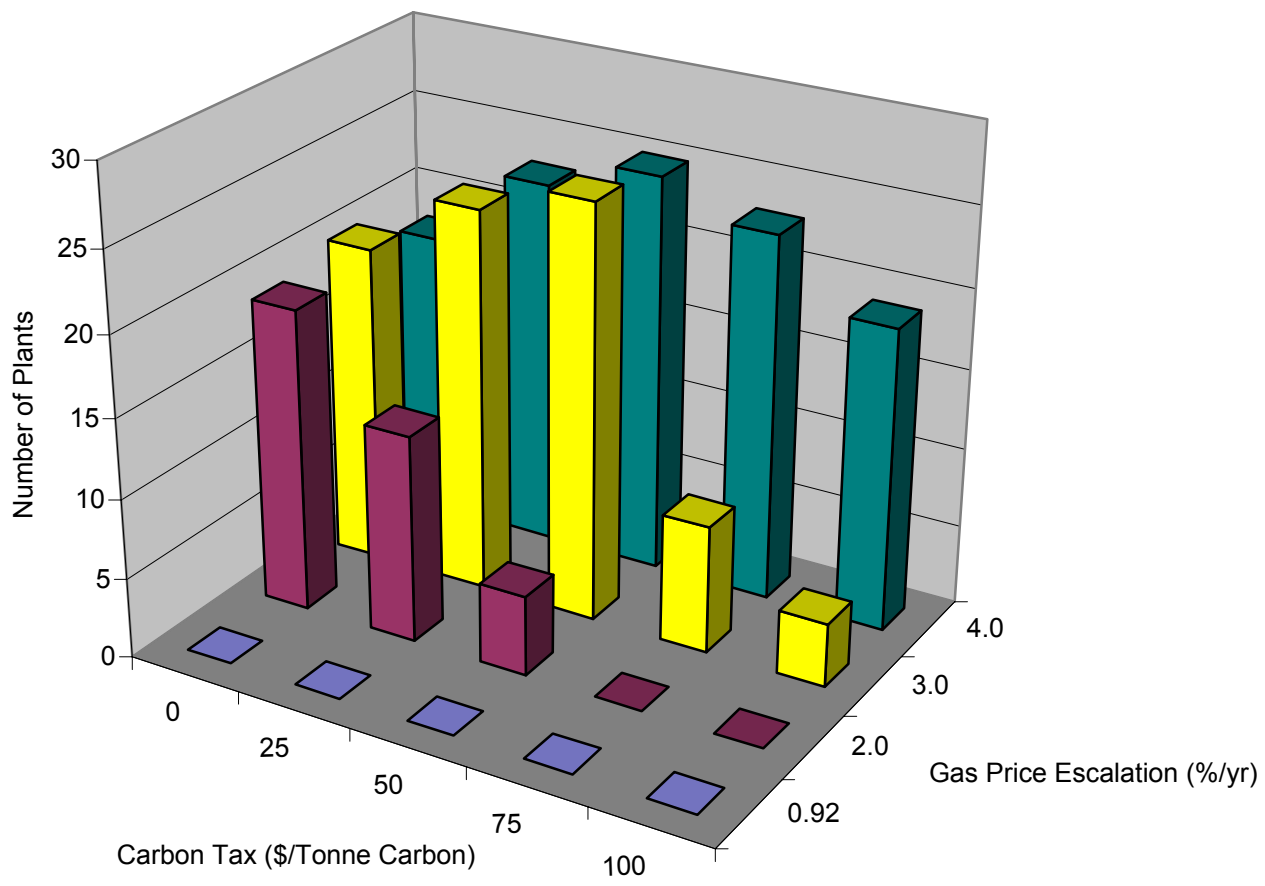


Figure 58. Technology Application versus Gas Price Escalation and Increase in IGCC Capital Cost

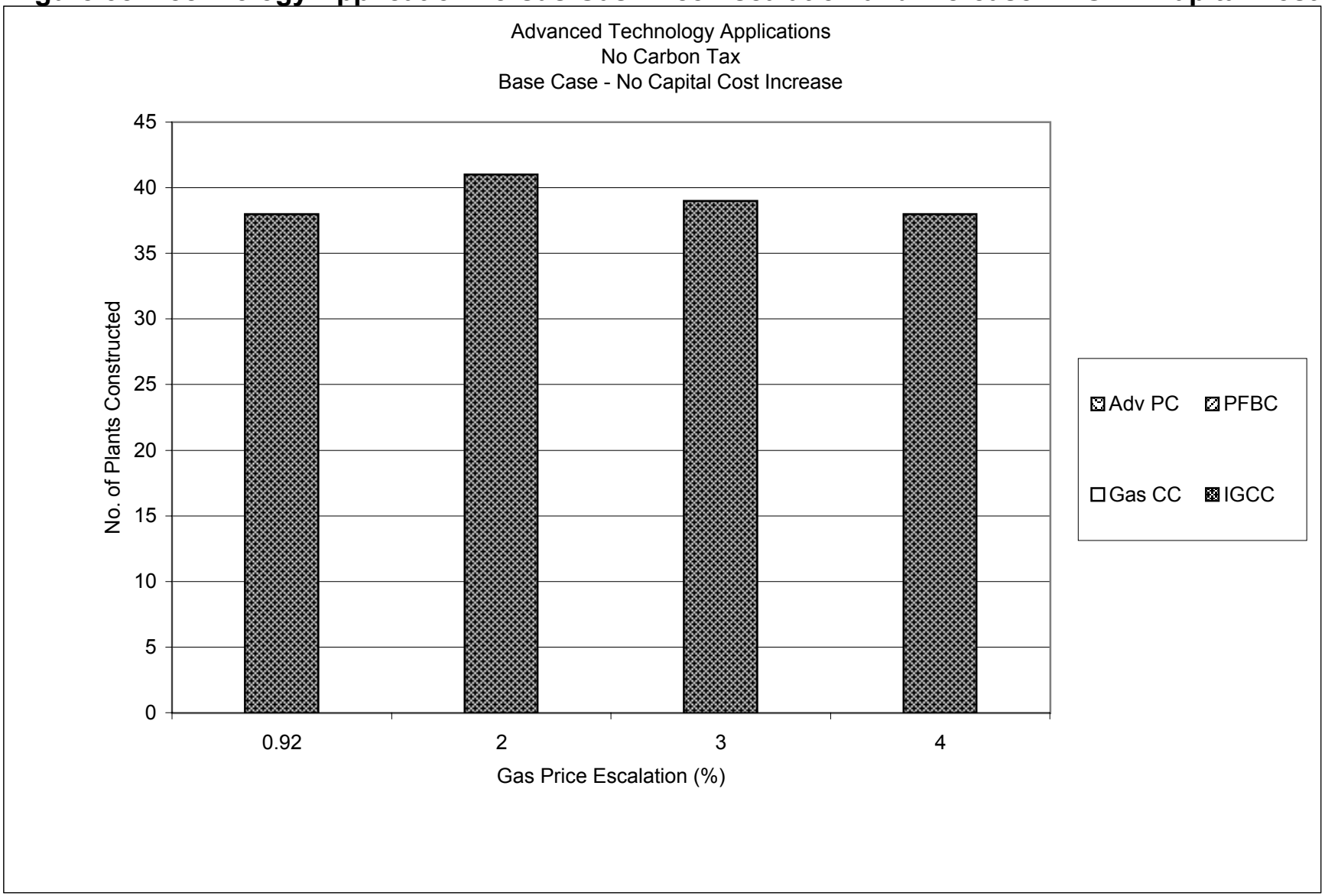


Figure 58. Technology Application versus Gas Price Escalation and Increase in IGCC Capital Cost (Continued)

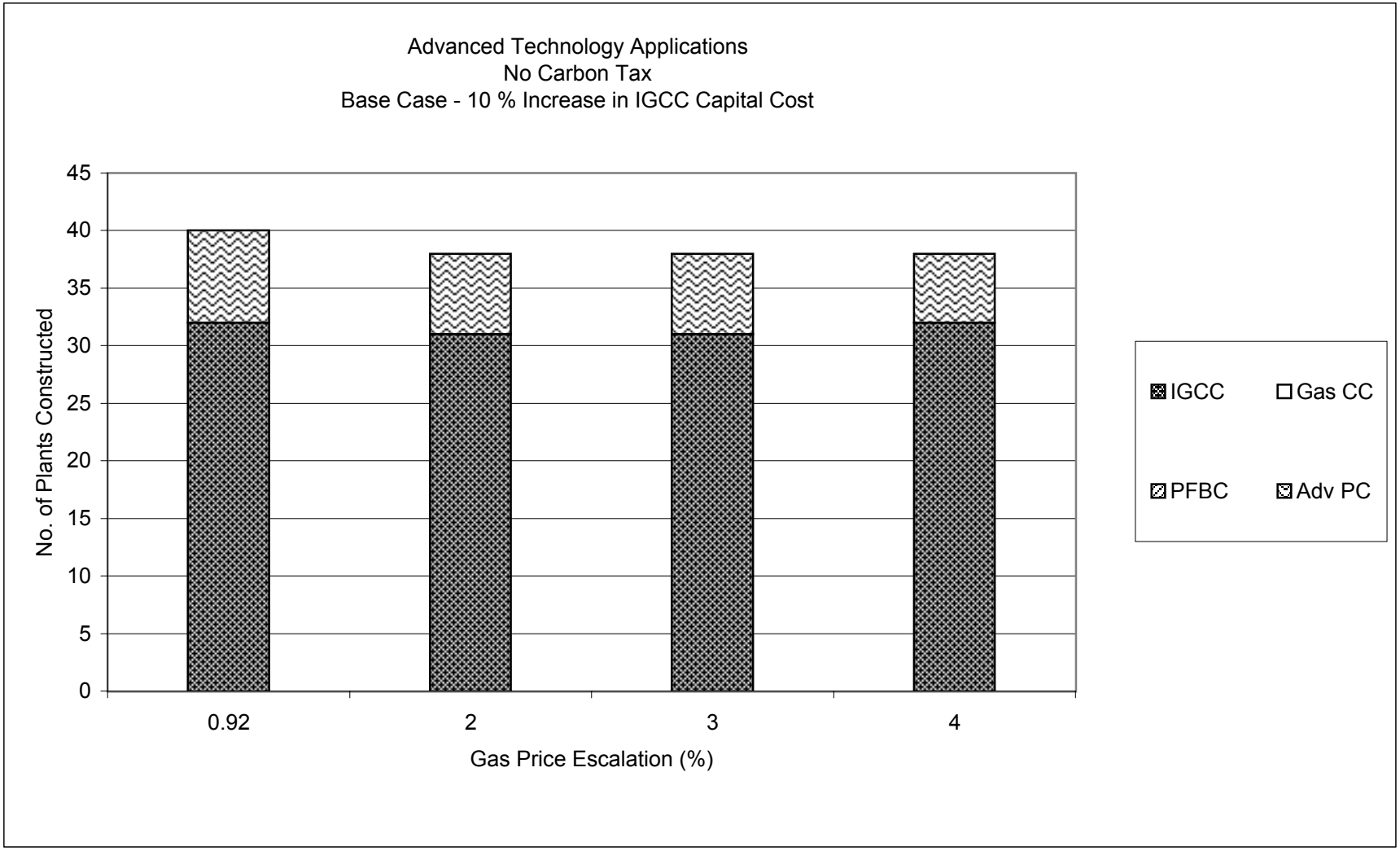


Figure 58. Technology Application versus Gas Price Escalation and Increase in IGCC Capital Cost (Continued)

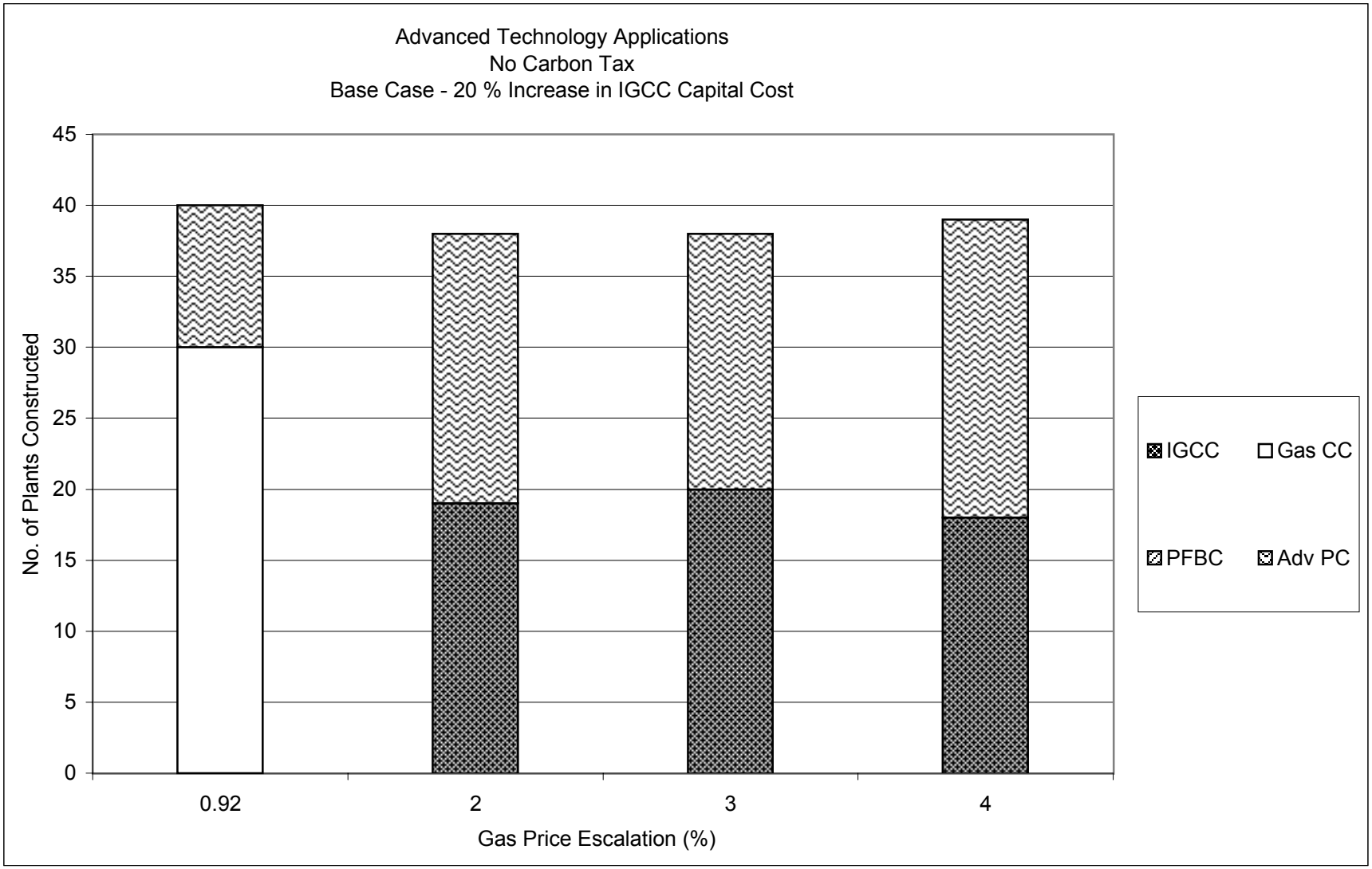


Figure 59. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$25/tonne Carbon Tax

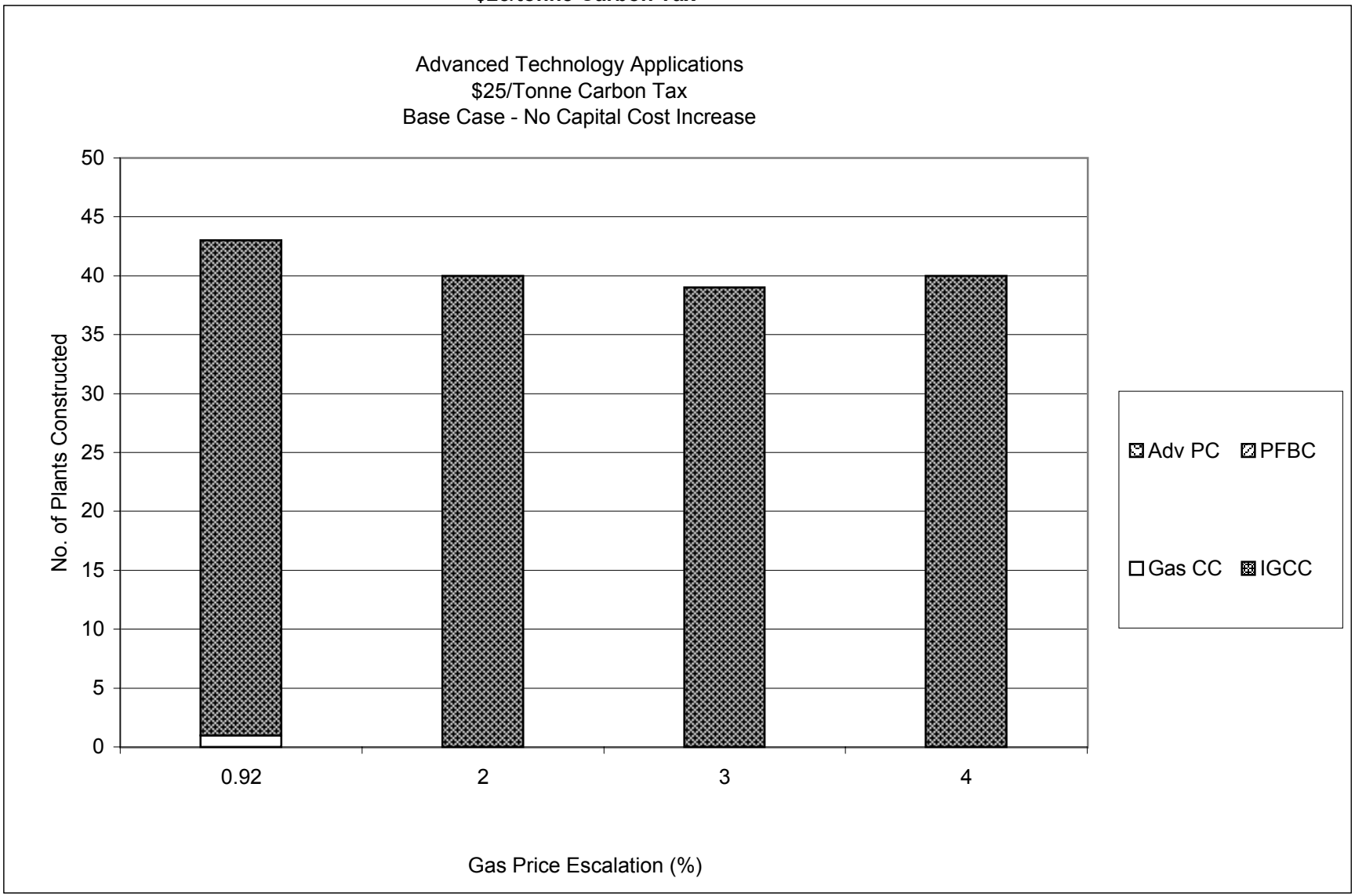


Figure 59. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$25/tonne Carbon Tax
(Continued)

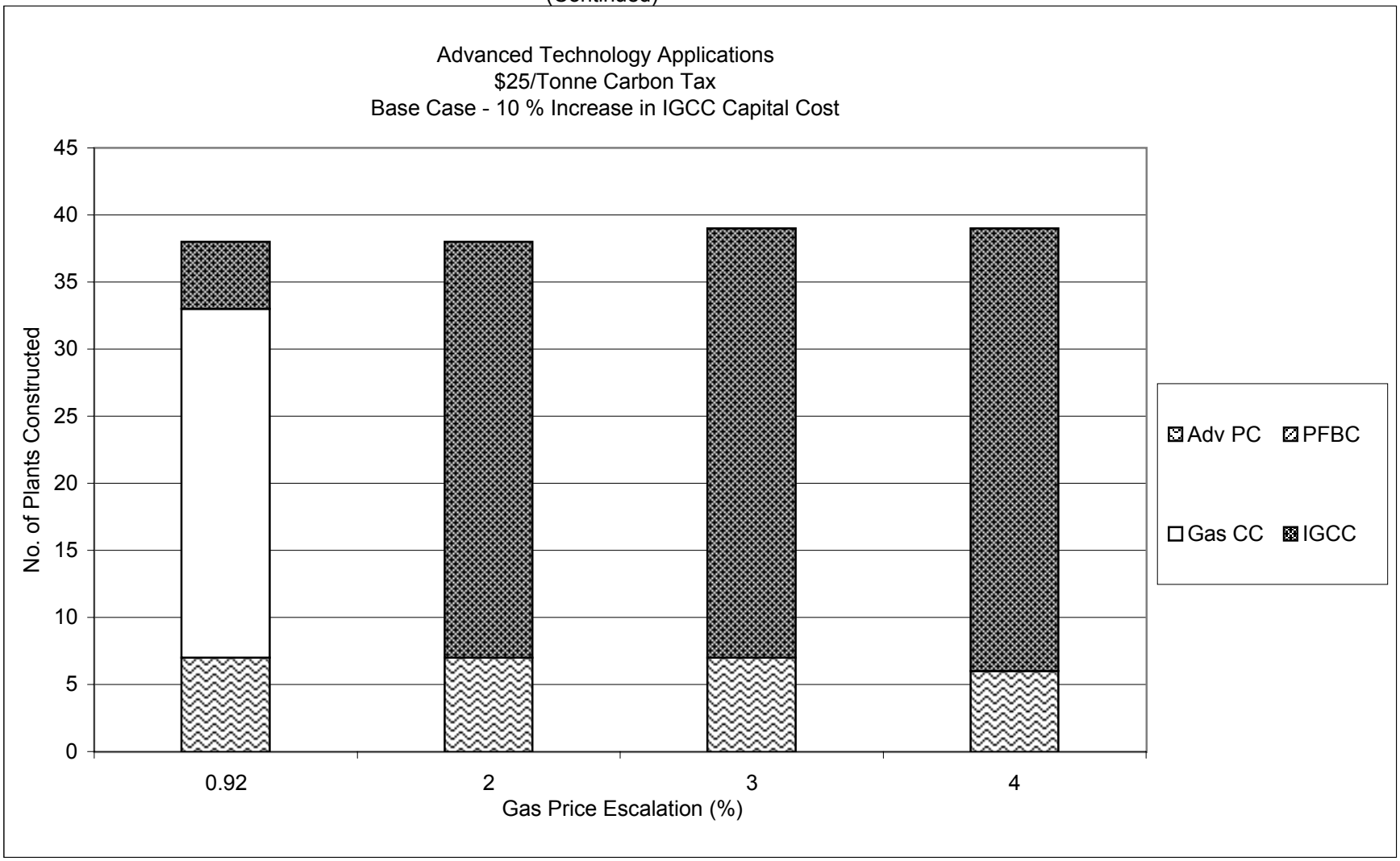


Figure 59. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$25/tonne Carbon Tax
(Continued)

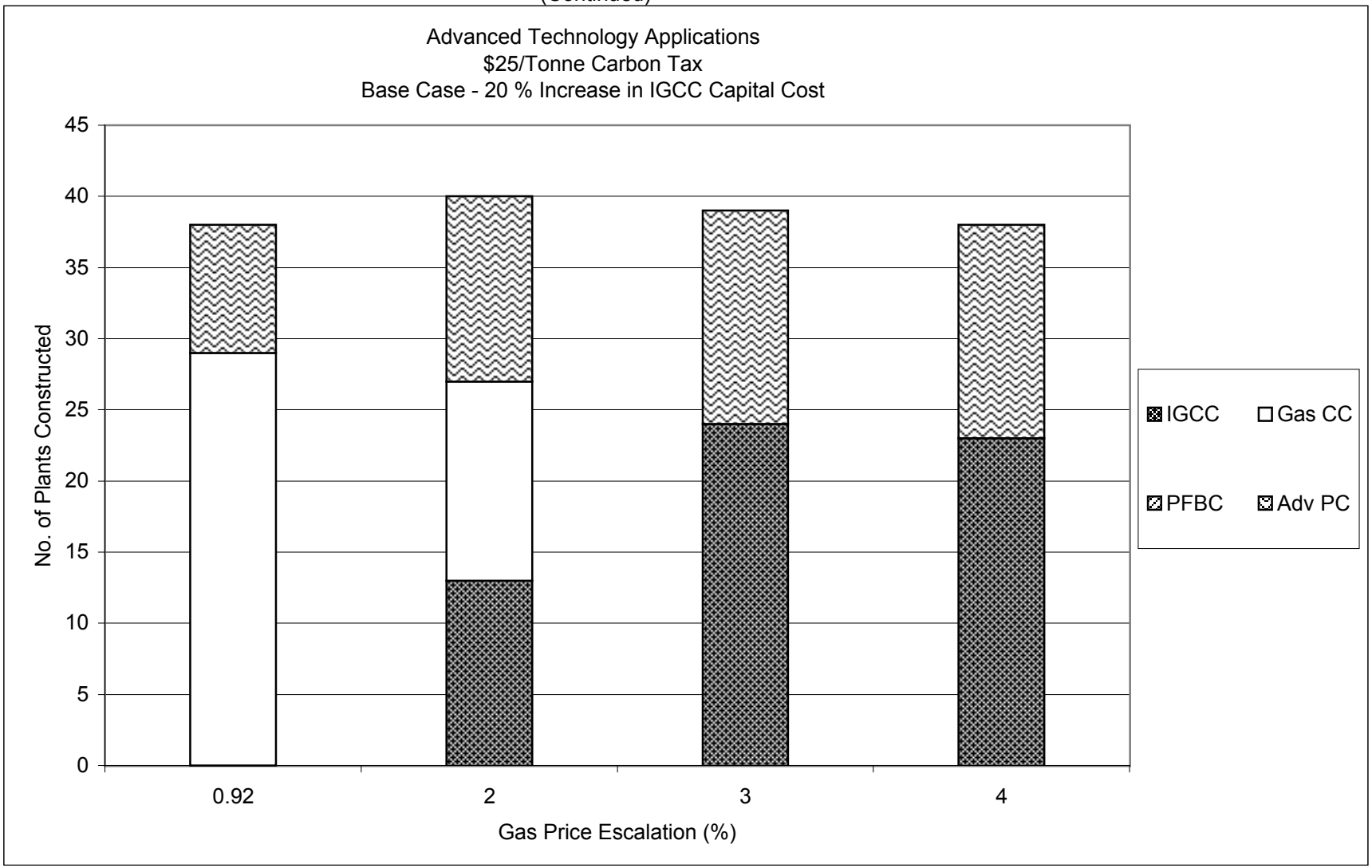


Figure 60. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$50/tonne Carbon Tax

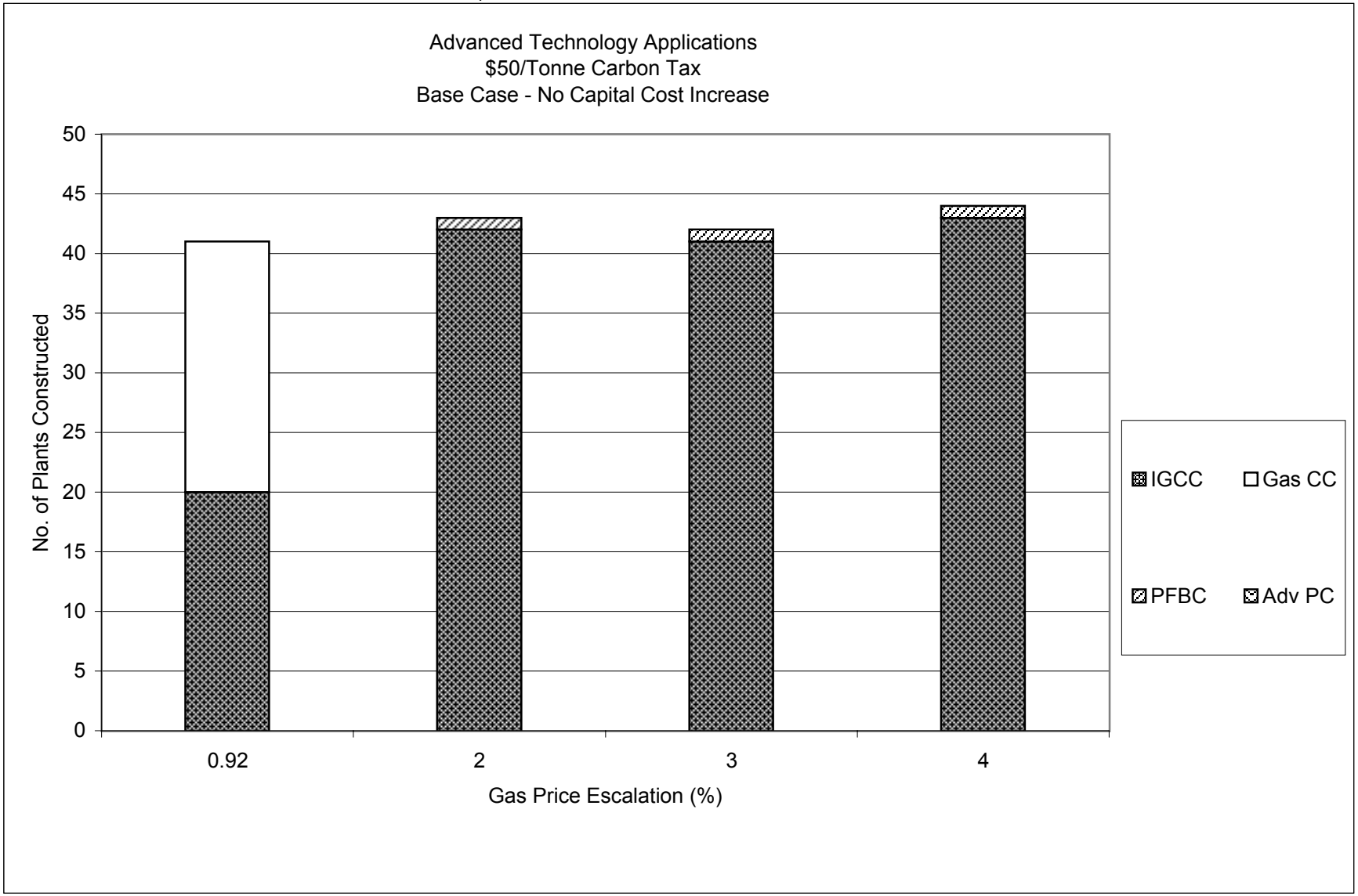


Figure 60. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$50/tonne Carbon Tax
(Continued)

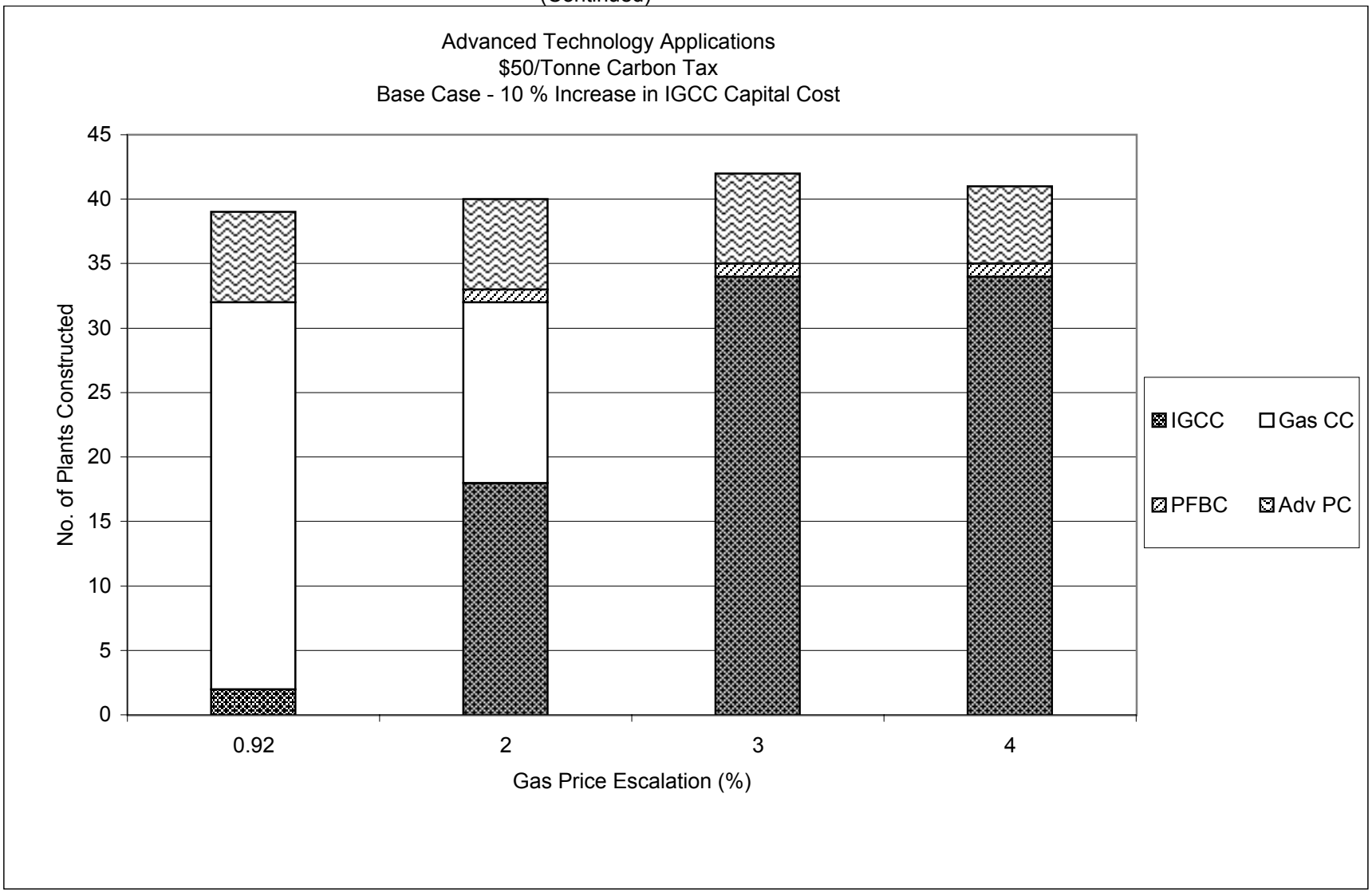


Figure 60. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$50/tonne Carbon Tax
(Continued)

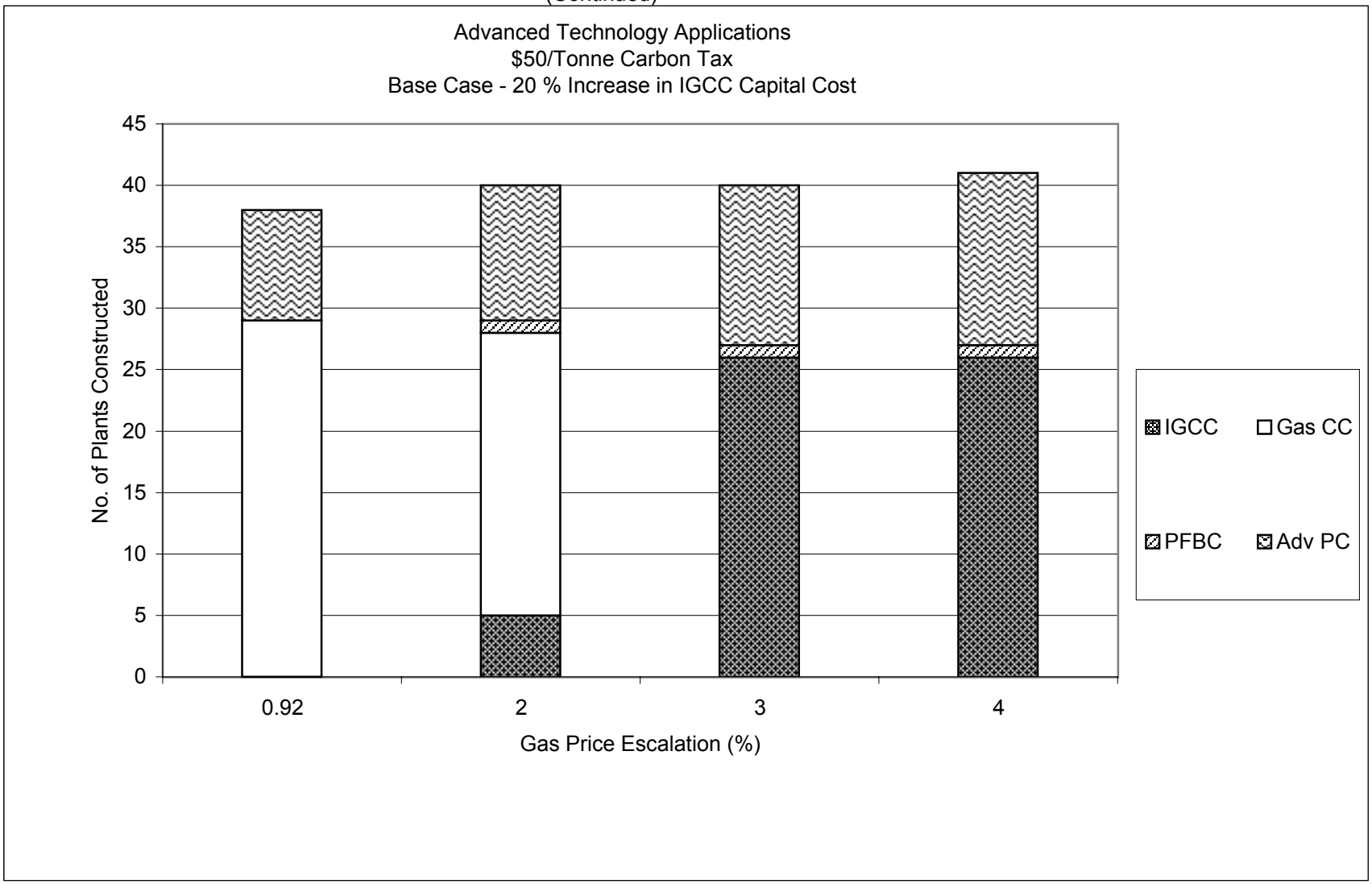


Figure 61. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$75/tonne Carbon Tax

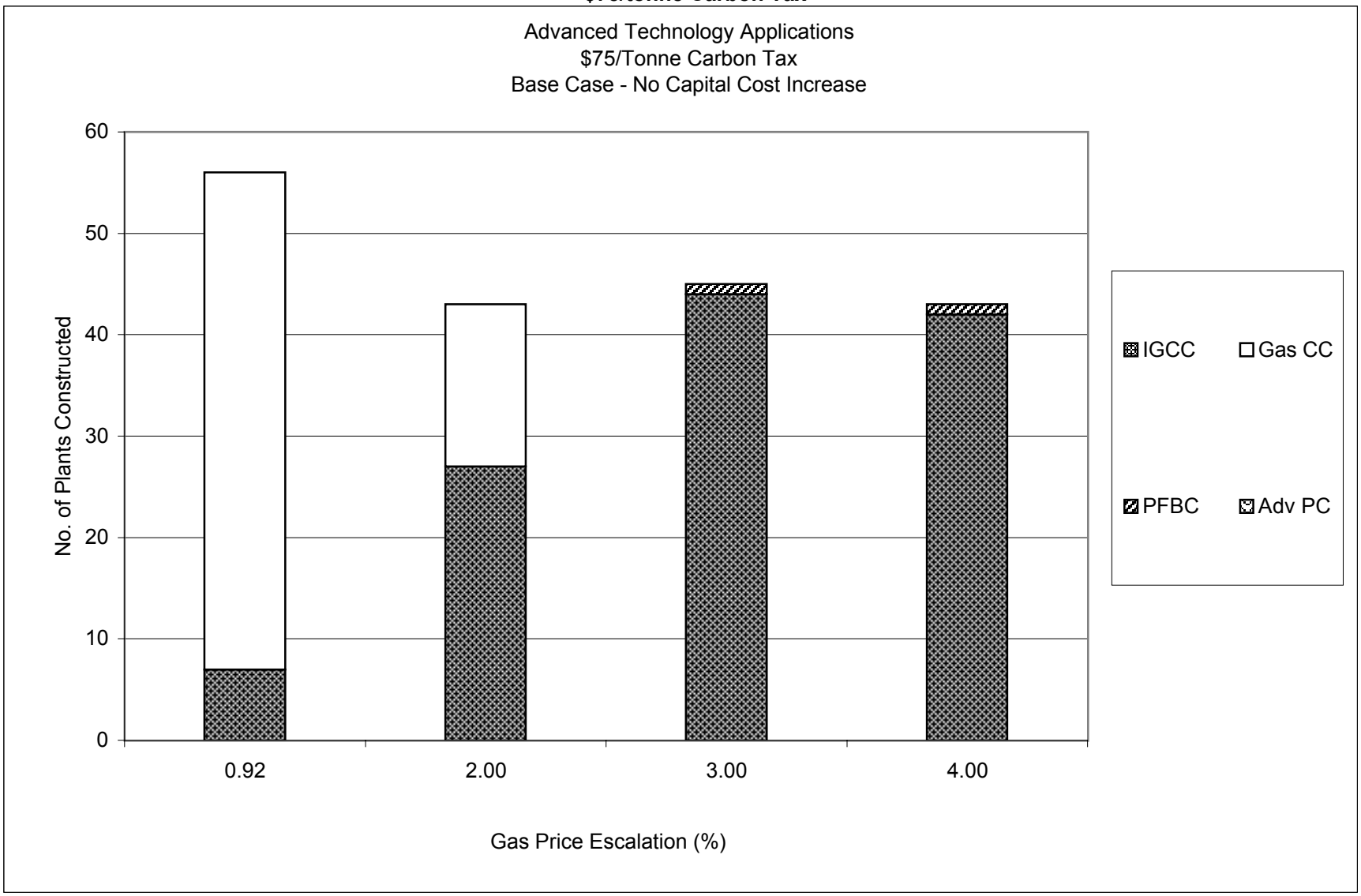


Figure 61. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$75/tonne Carbon Tax (Continued)

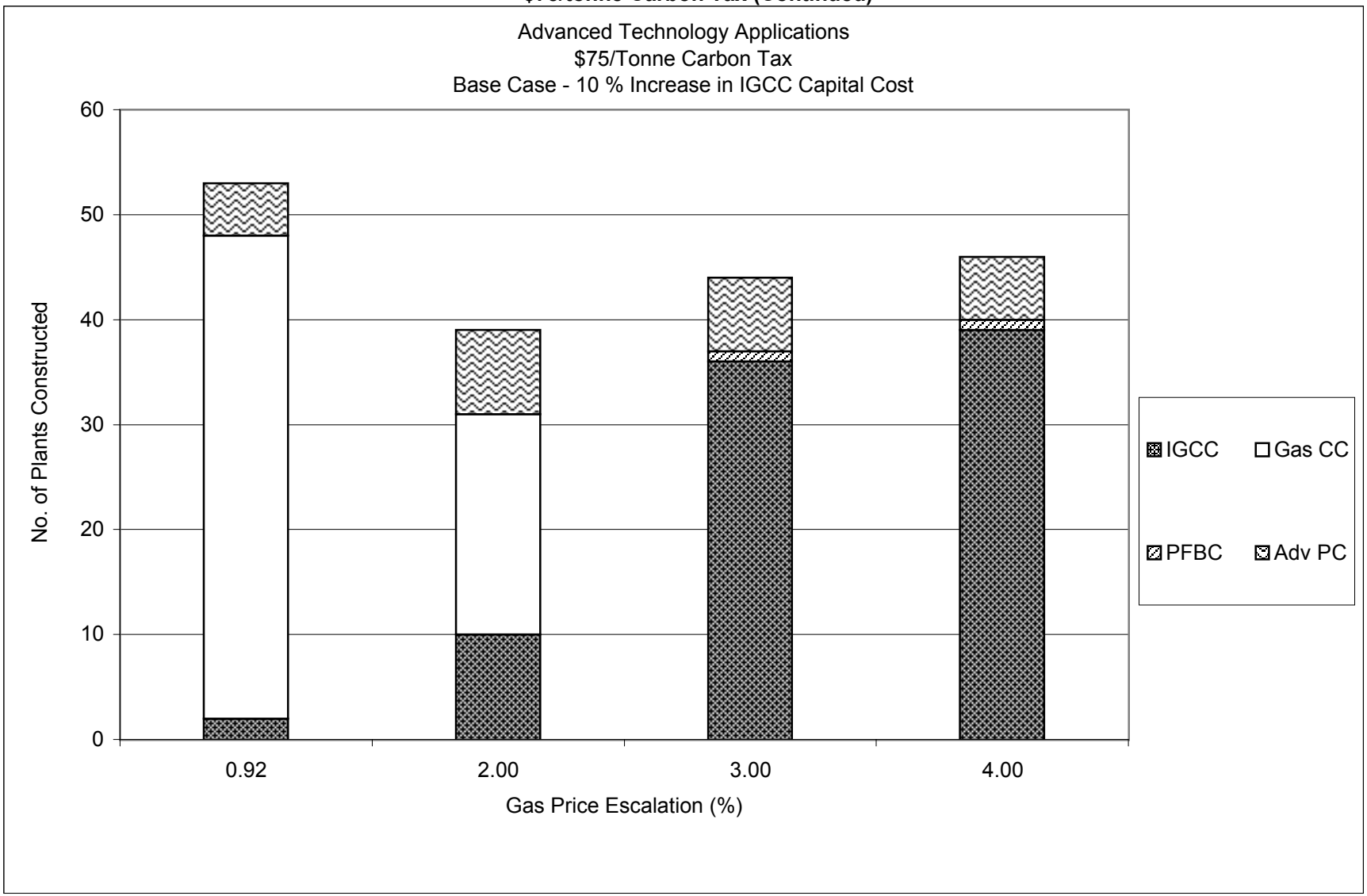


Figure 61. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$75/tonne Carbon Tax (Continued)

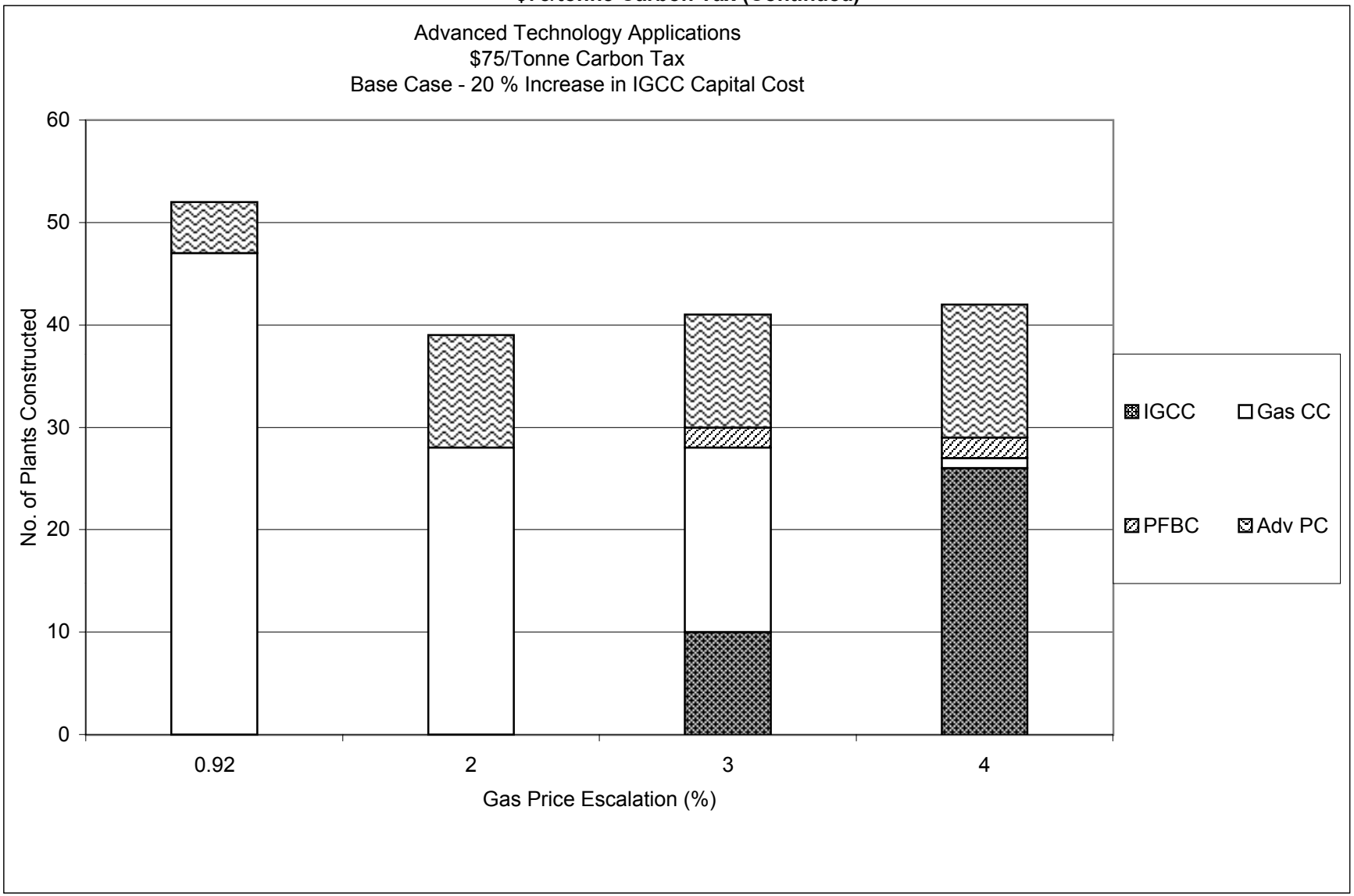


Figure 62. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost $100/tonne Carbon Tax

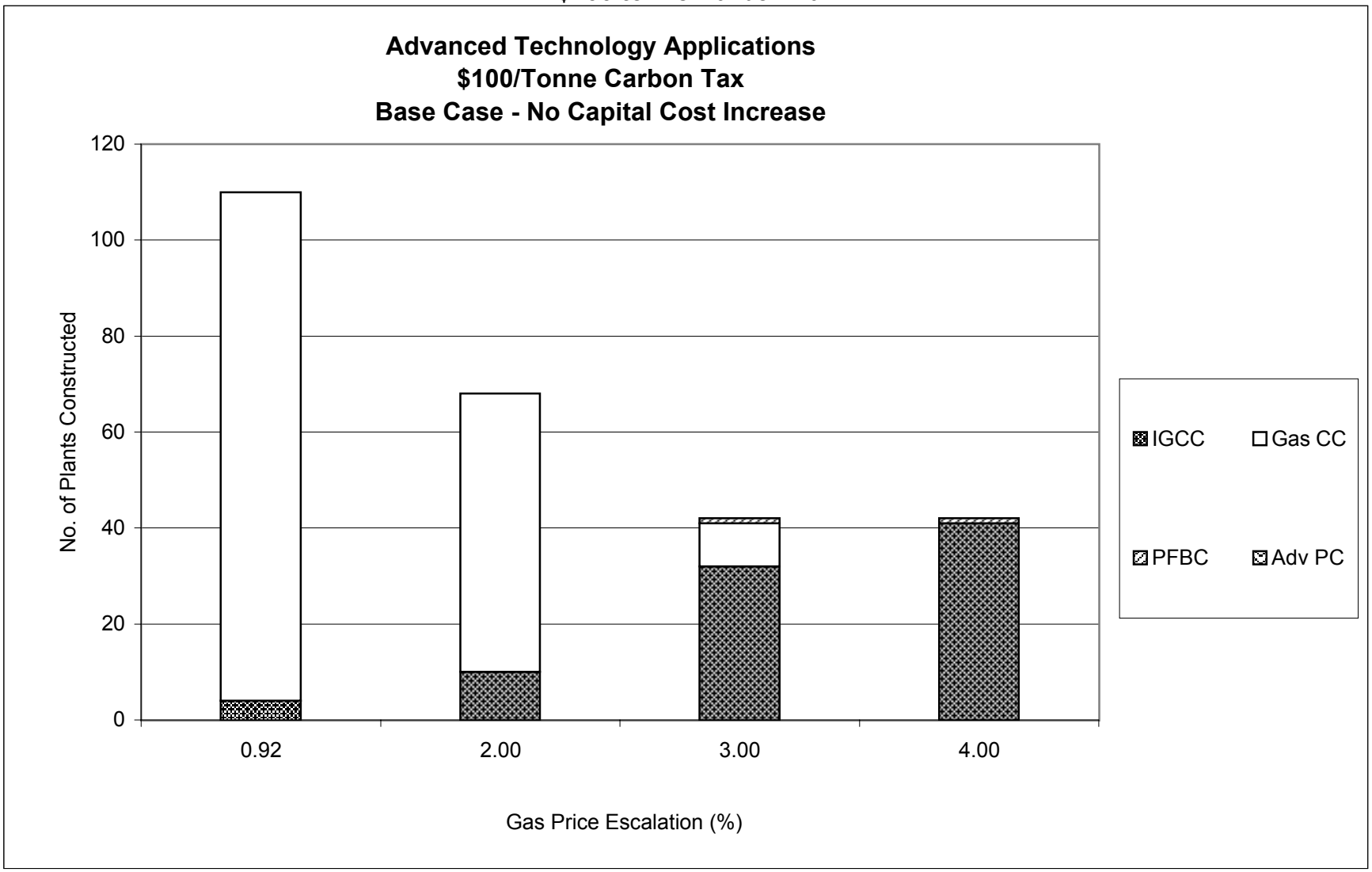


Figure 62. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost $100/tonne Carbon Tax (Continued)

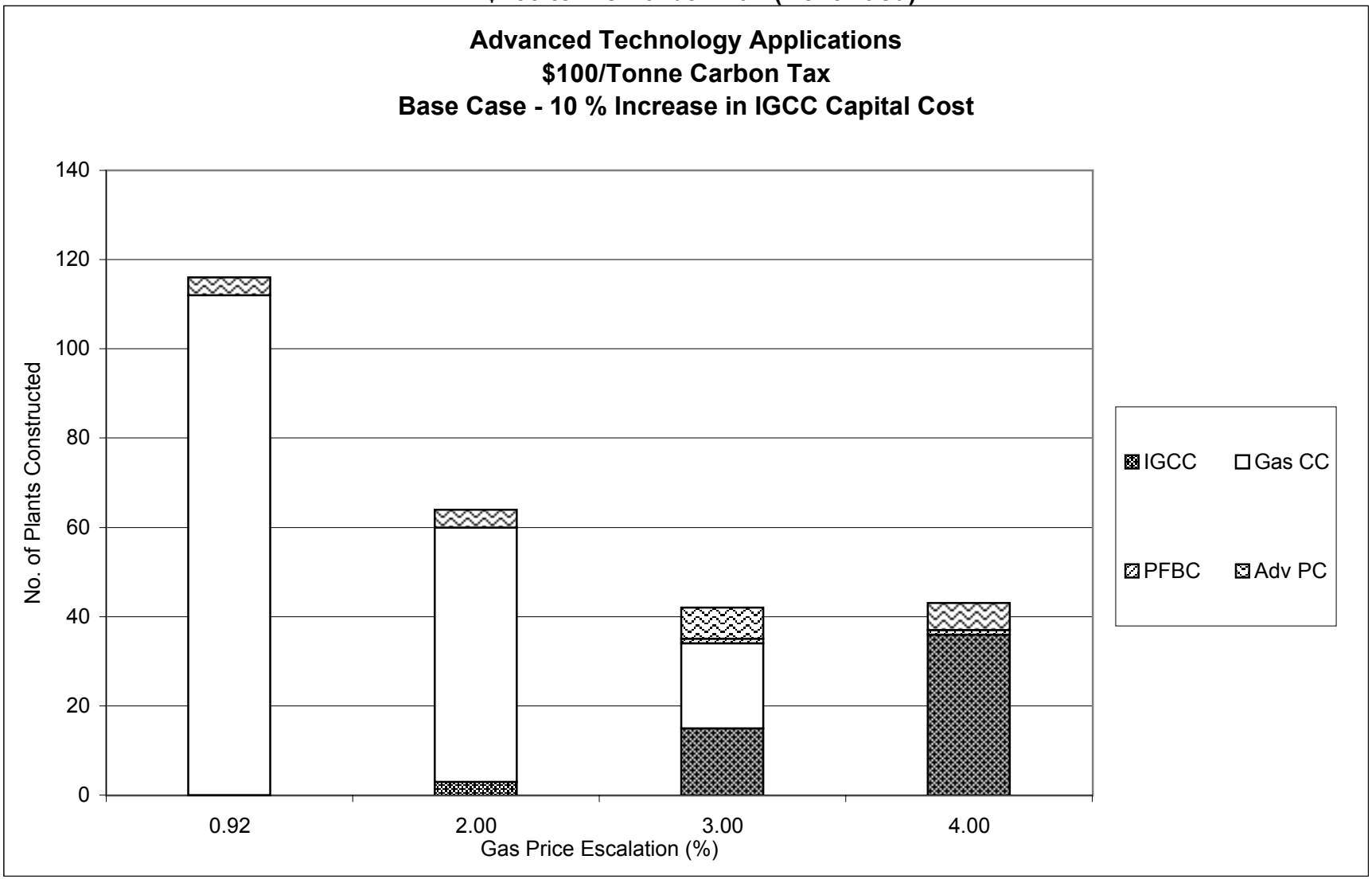


Figure 62. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost $100/tonne Carbon Tax (Continued)

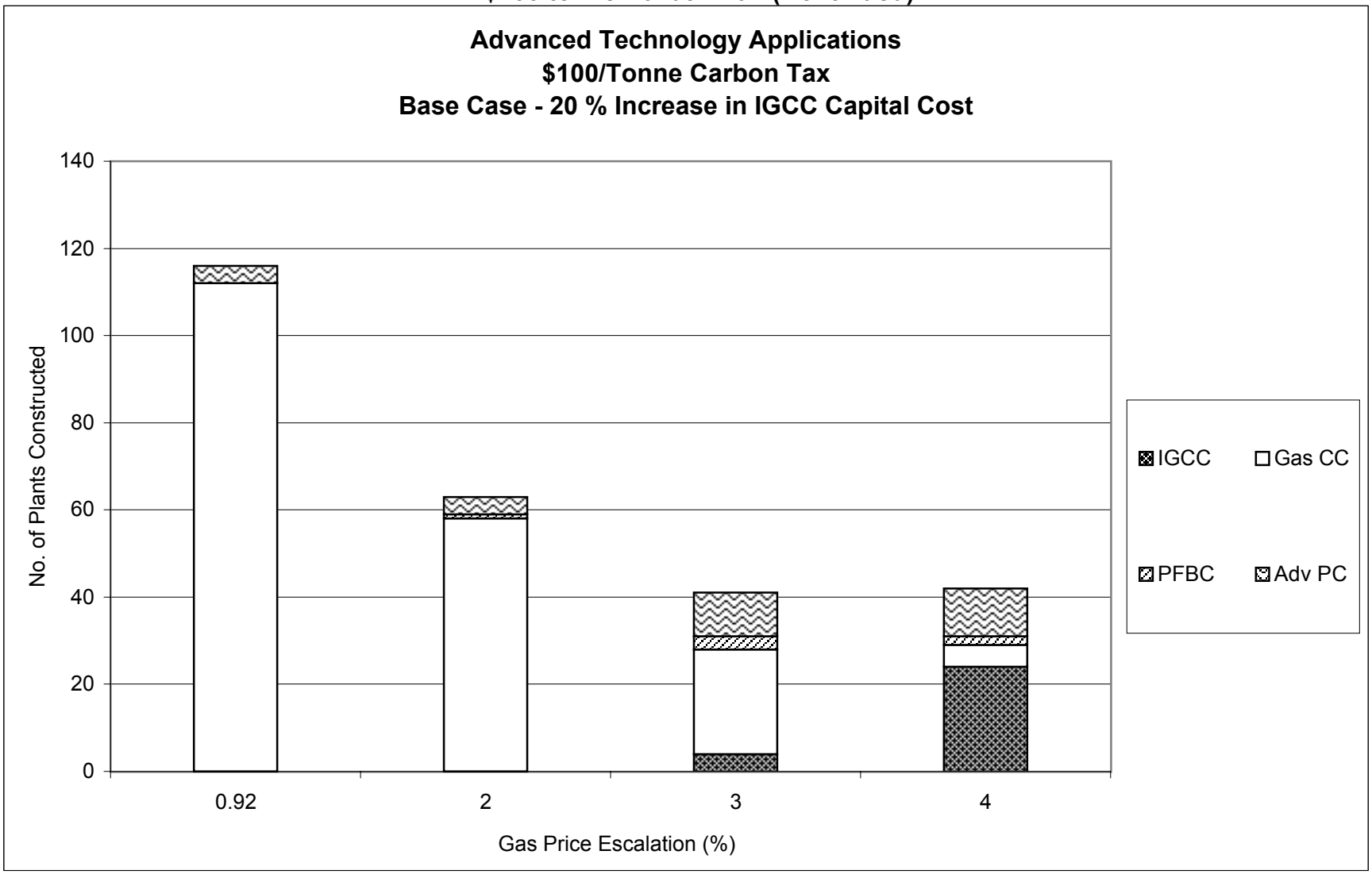


Figure 63.IGCC Market Penetration by Plants
Partially Advanced IGCC Development
(10% Increase in IGCC Heat Rate)

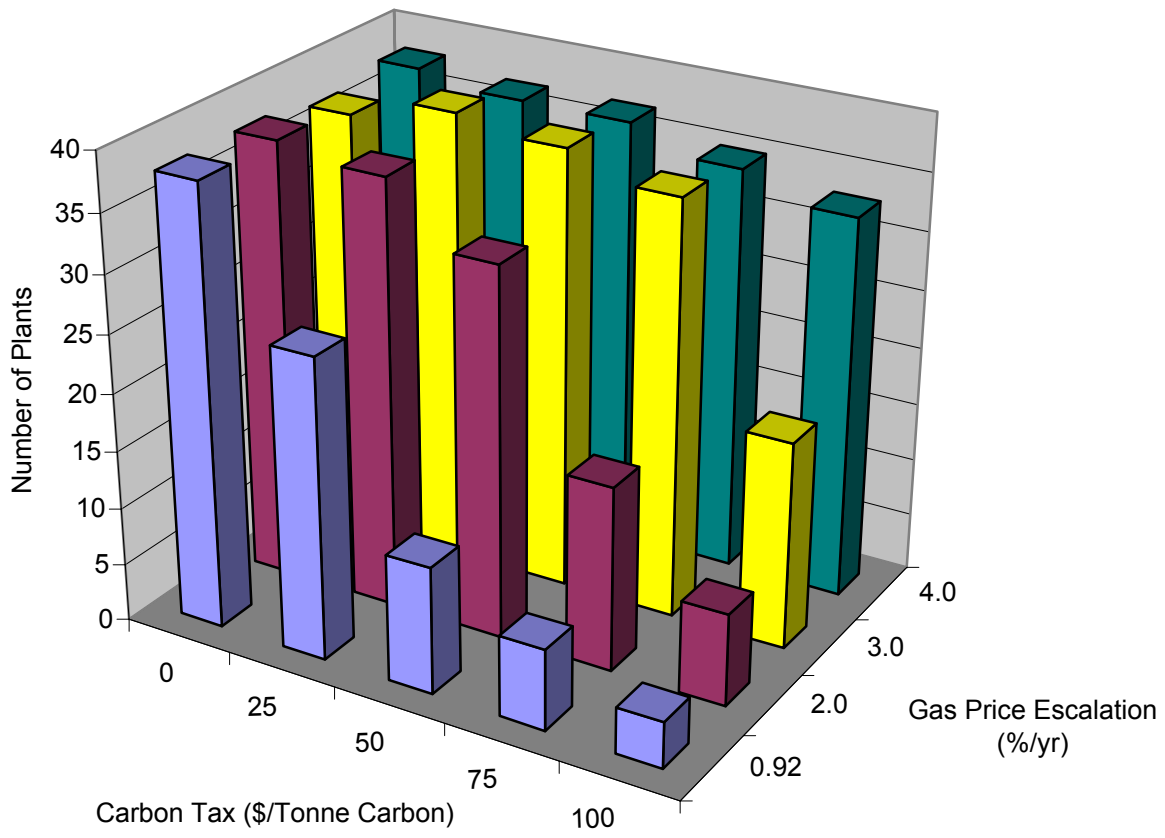


Figure 64.IGCC Market Penetration by Plants
Partially Advanced IGCC Development
20% Increase in IGCC Capital Cost

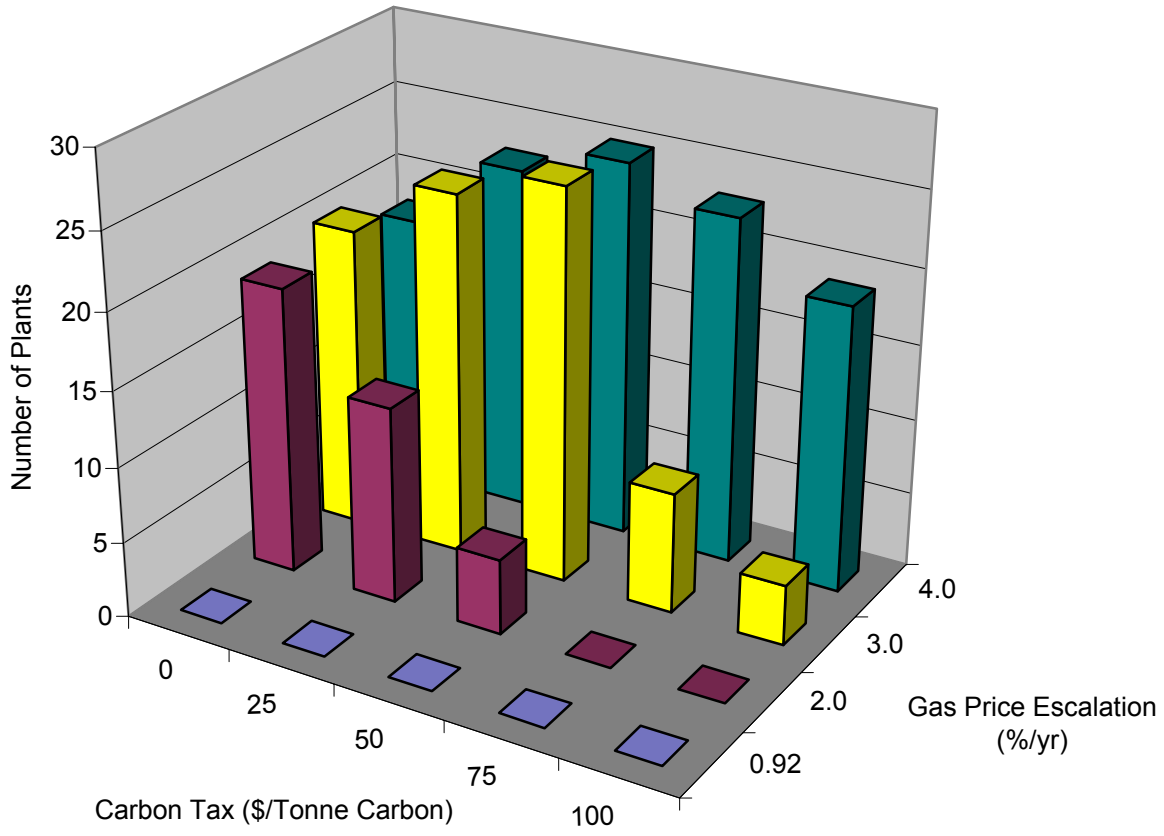


Figure 65. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

No Carbon Tax

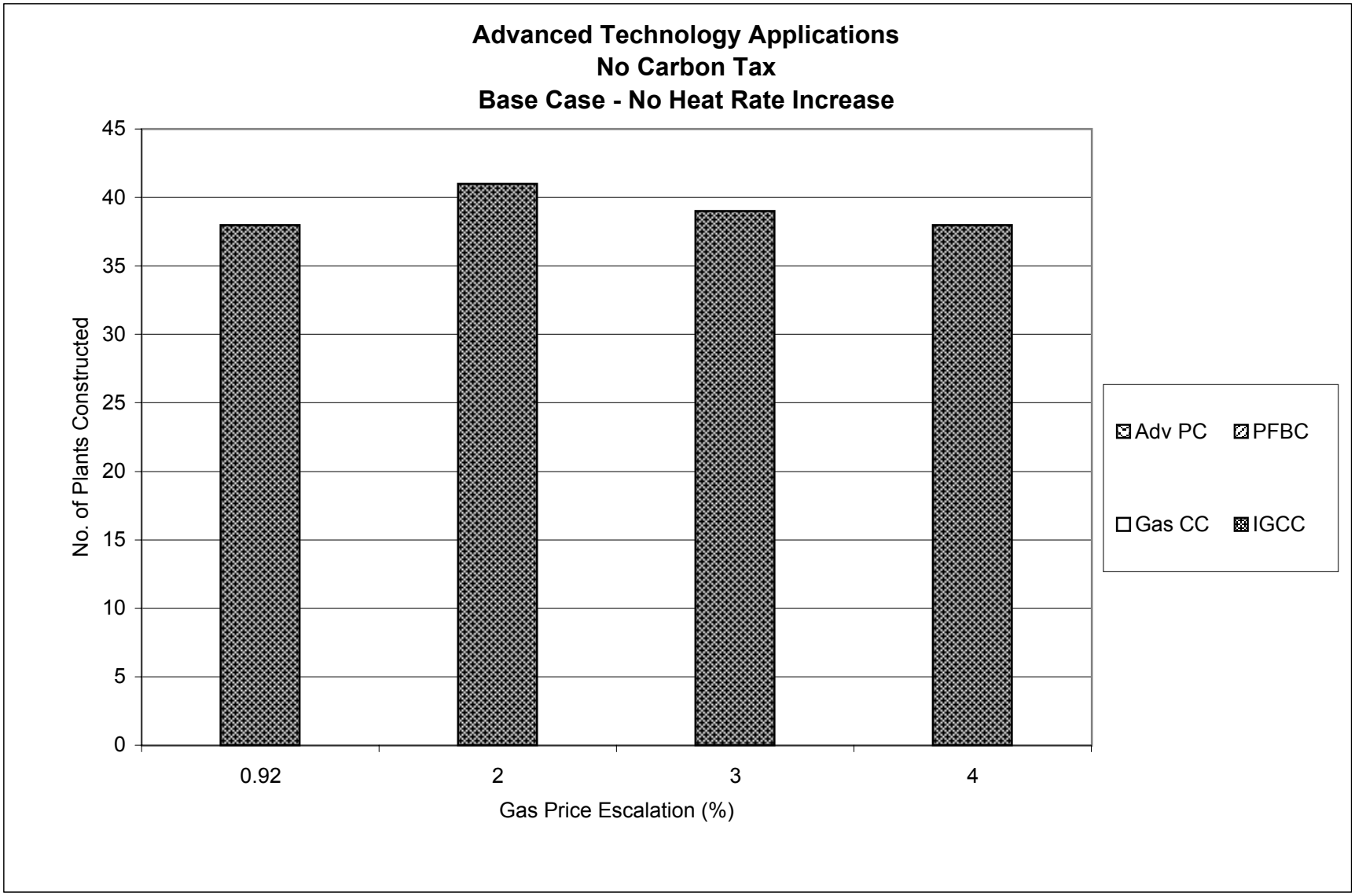


Figure 65. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

No Carbon Tax (Continued)

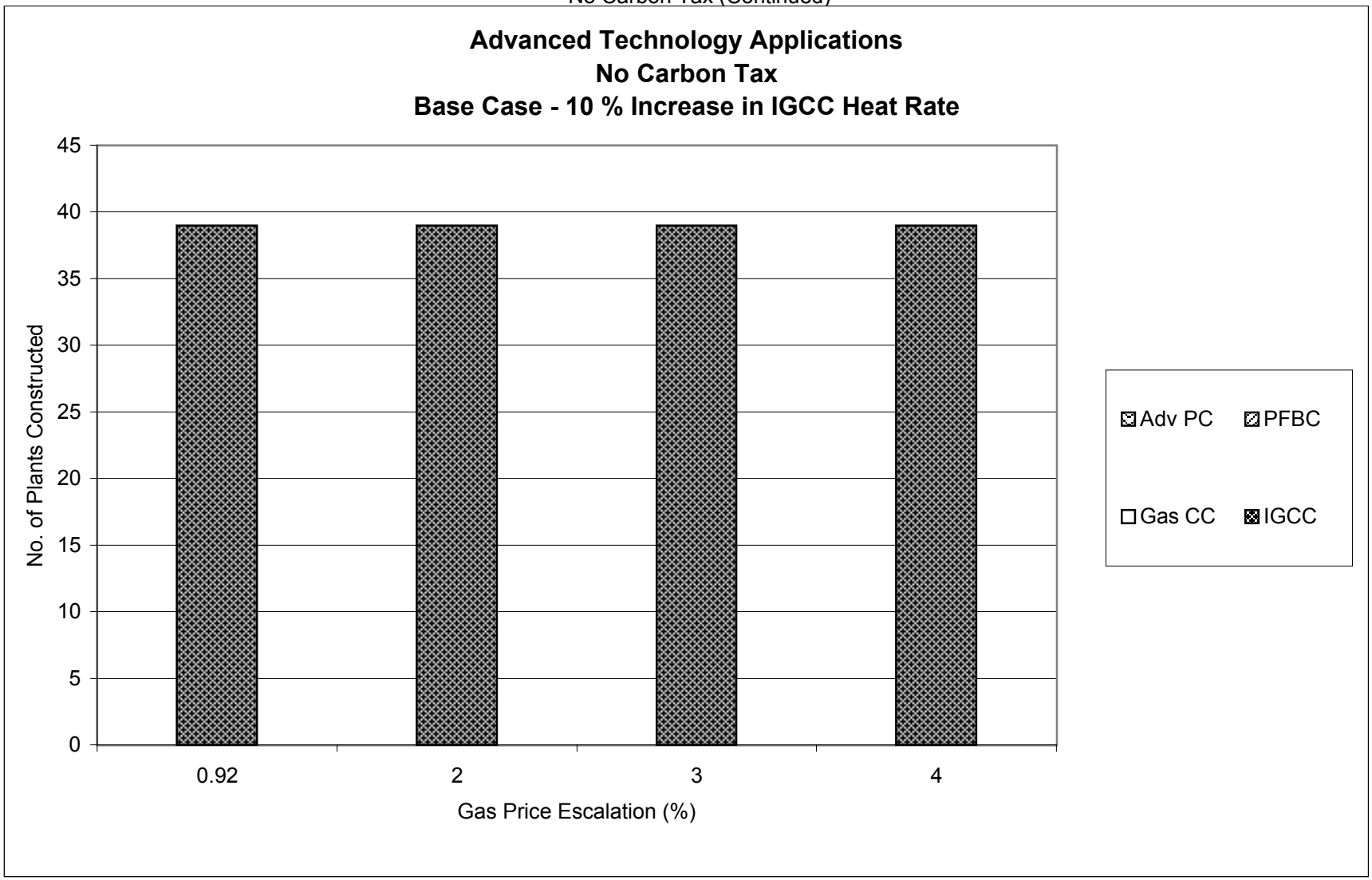


Figure 65. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

No Carbon Tax (Continued)

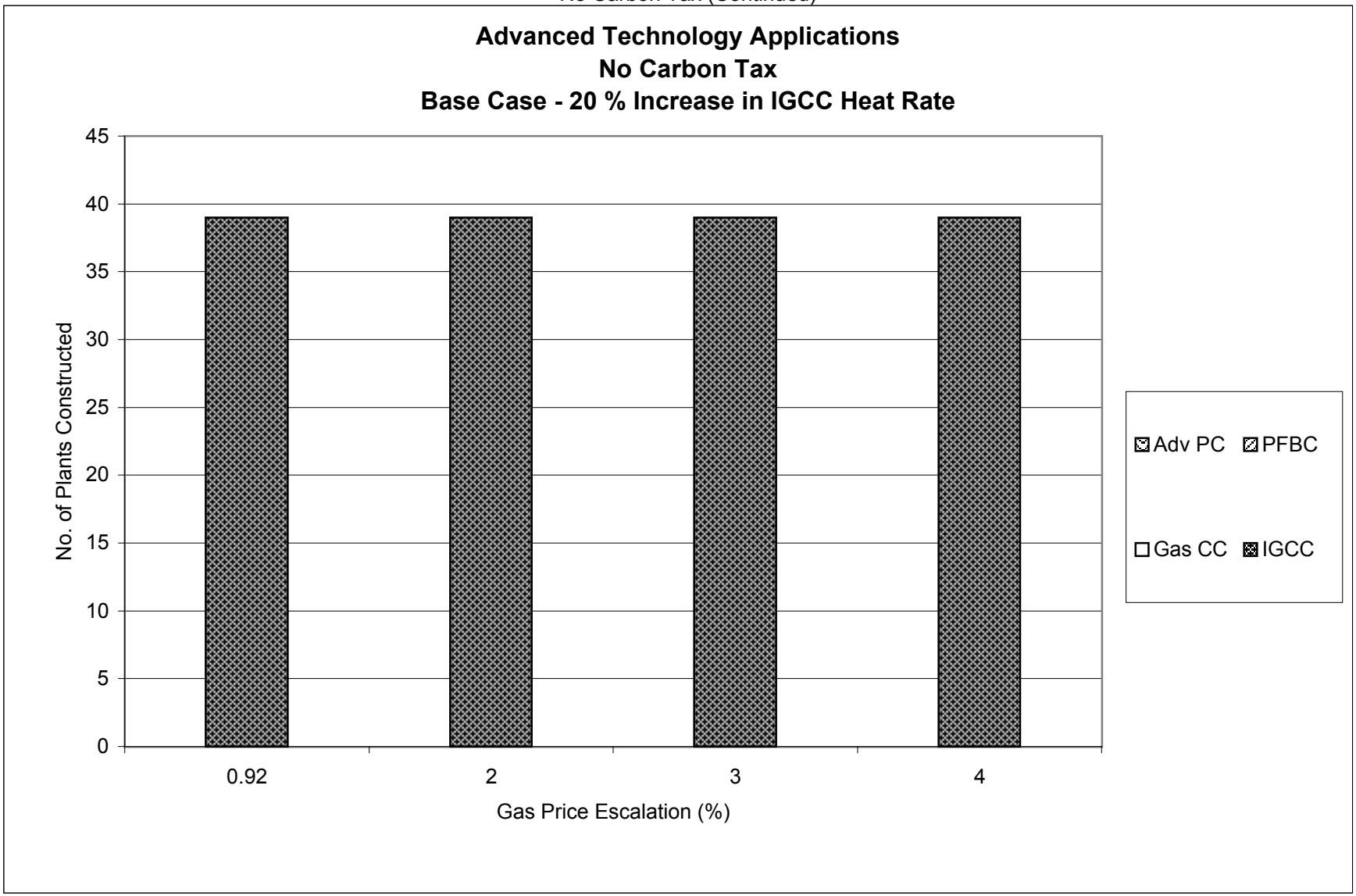


Figure 66. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

$25/tonne Carbon Tax

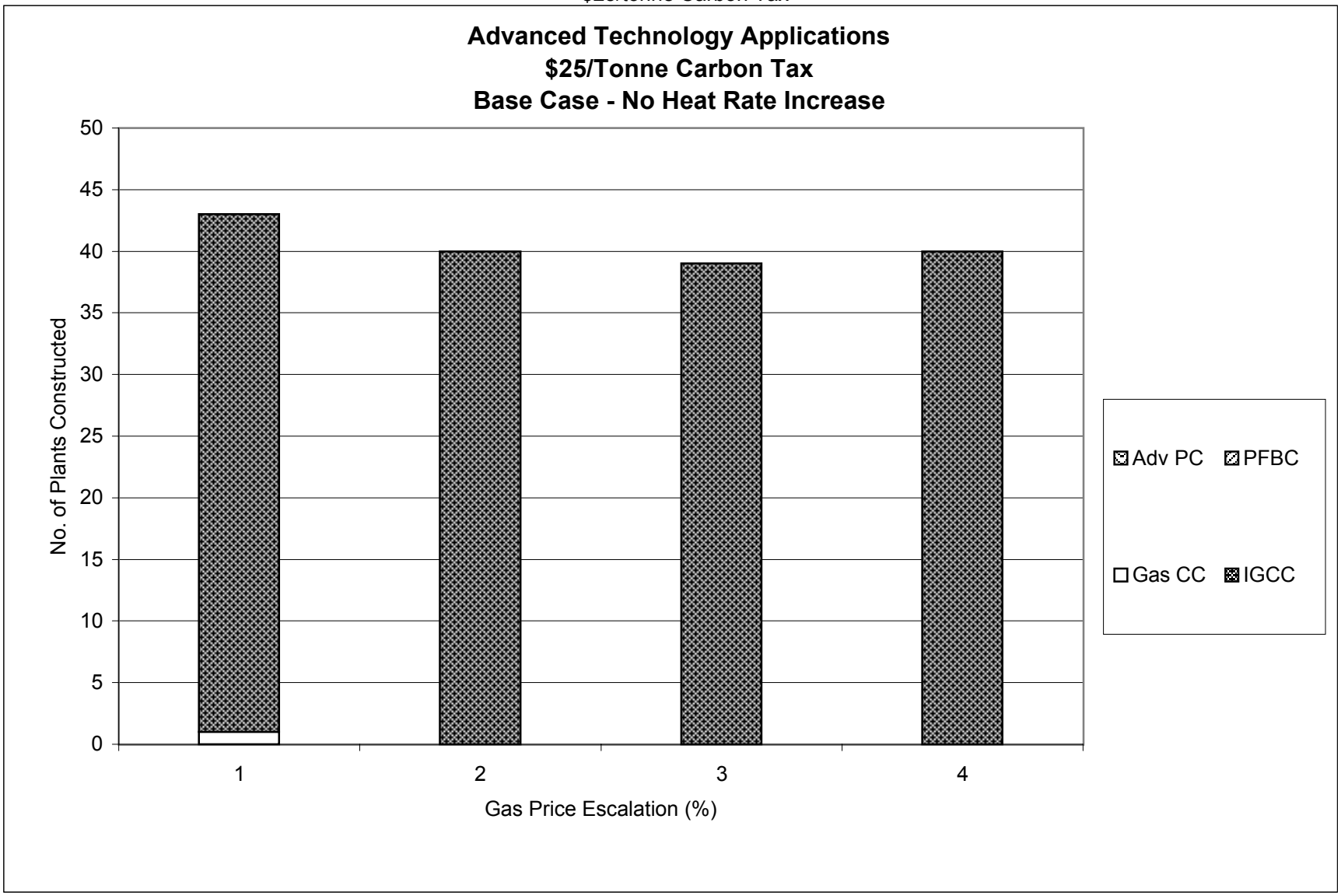


Figure 66. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

$25/tonne Carbon Tax (Continued)

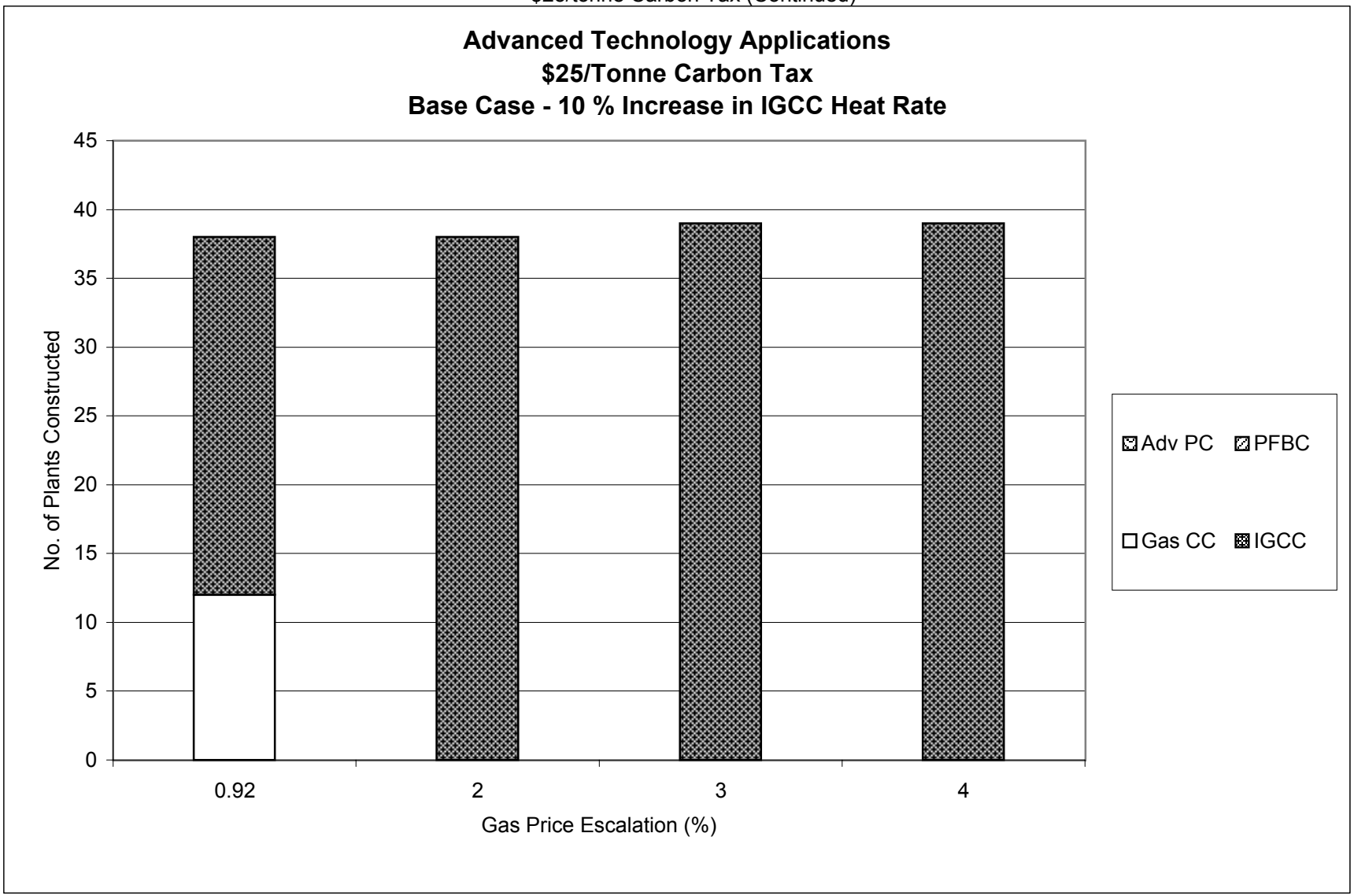


Figure 66. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

$25/tonne Carbon Tax (Continued)

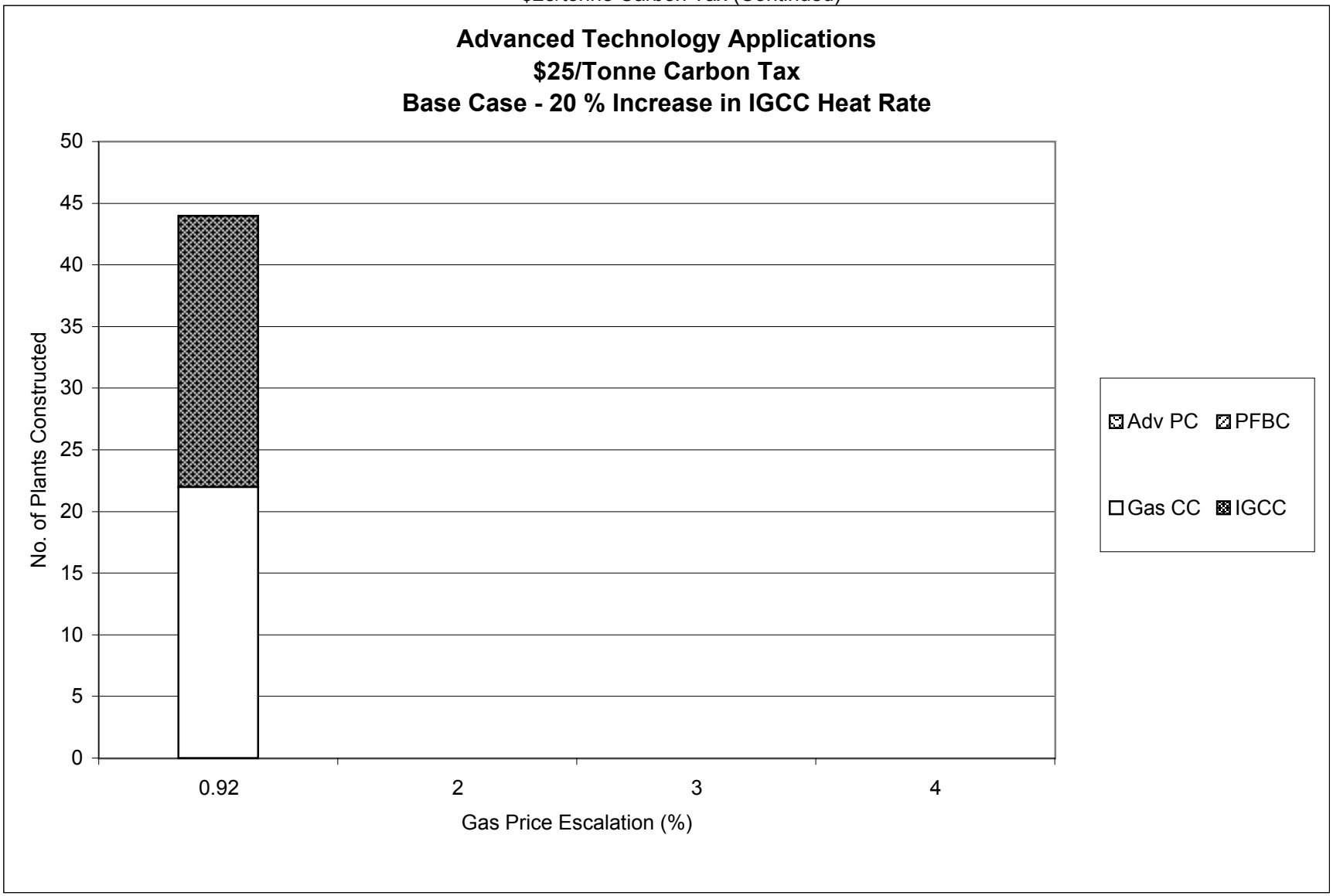


Figure 67. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$50/tonne Carbon Tax

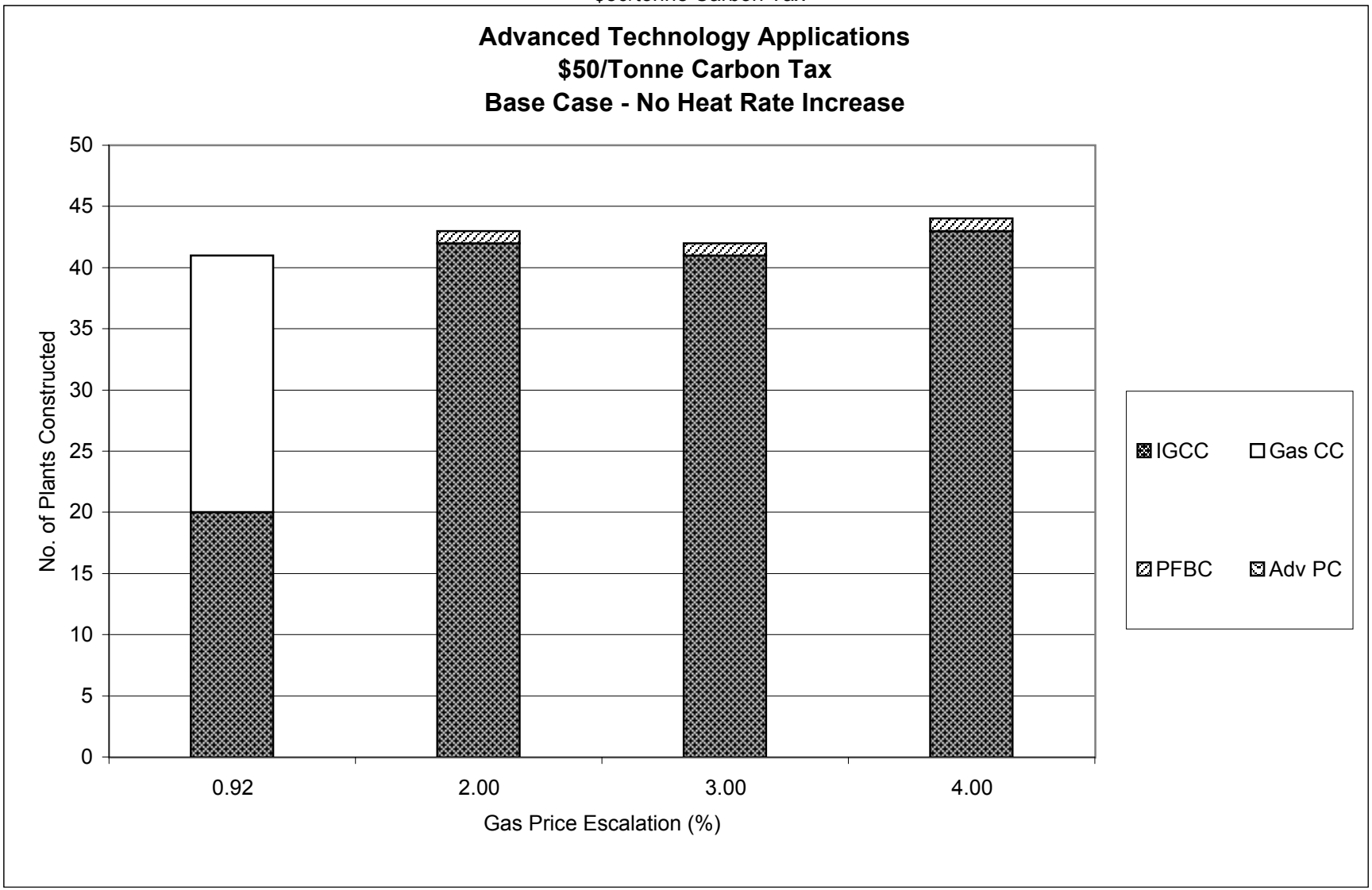


Figure 67. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$50/tonne Carbon Tax (Continued)

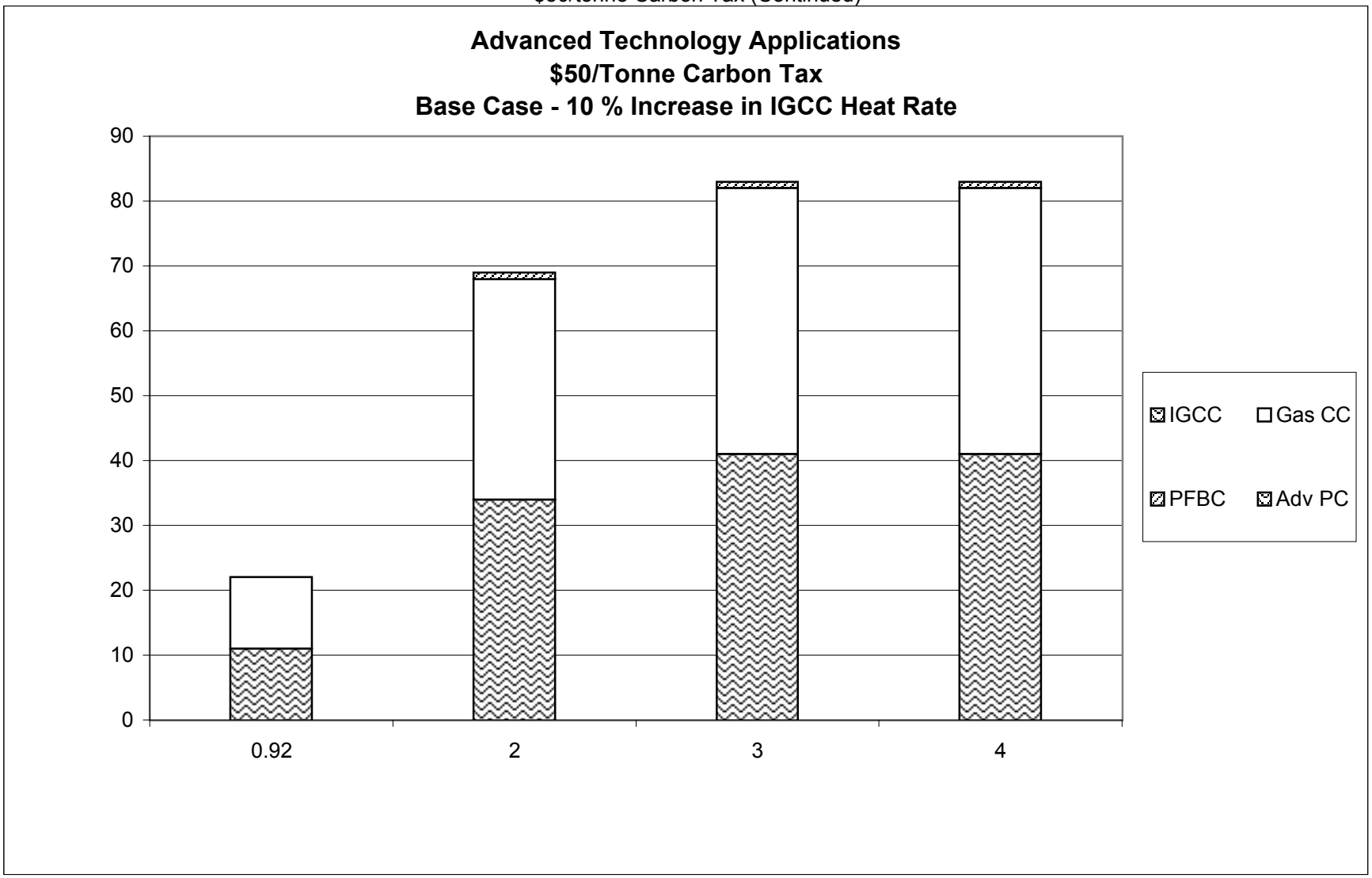


Figure 67. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$50/tonne Carbon Tax (Continued)

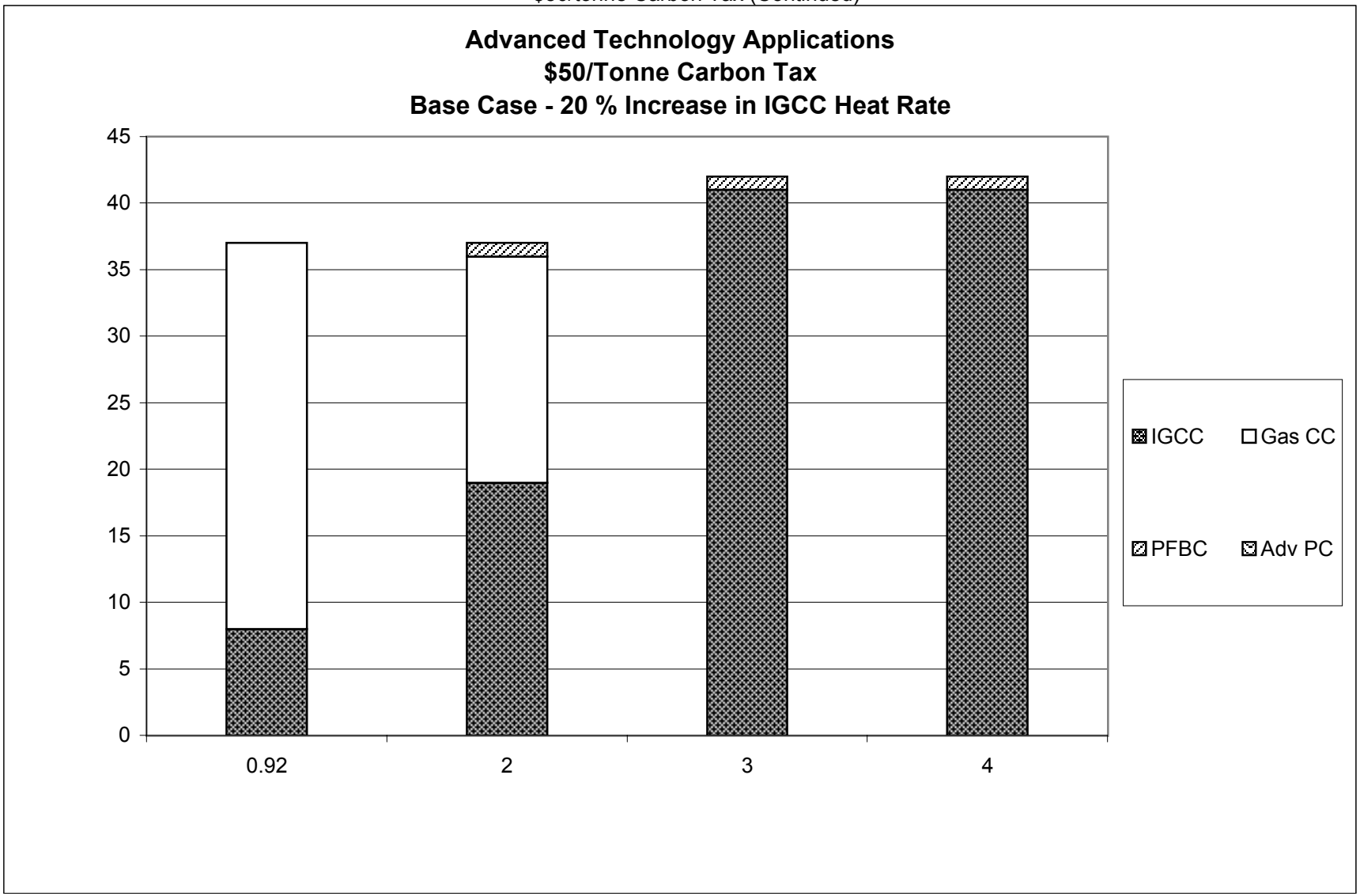


Figure 68. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

$75/tonne Carbon Tax

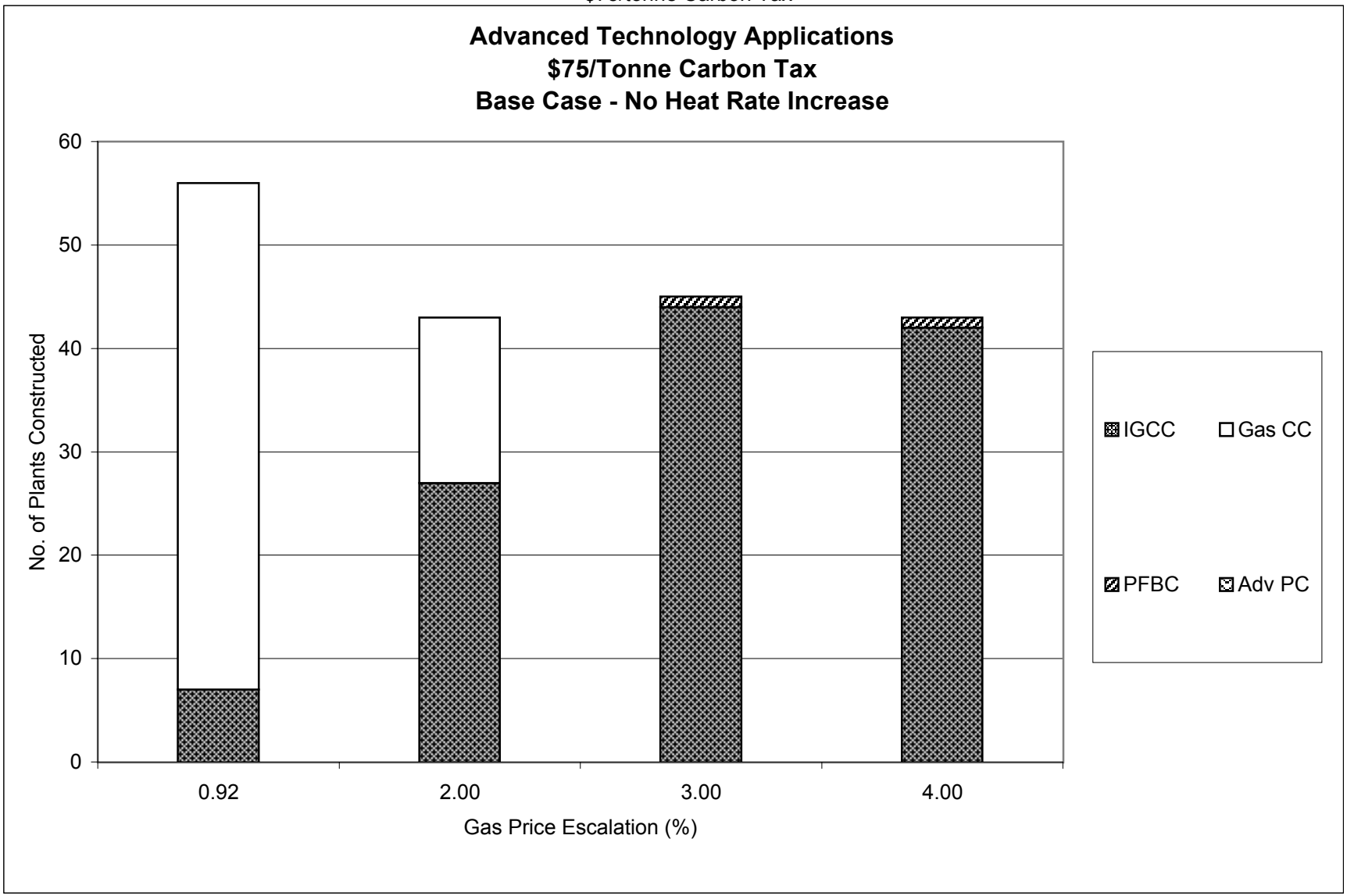


Figure 68. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

$75/tonne Carbon Tax (Continued)

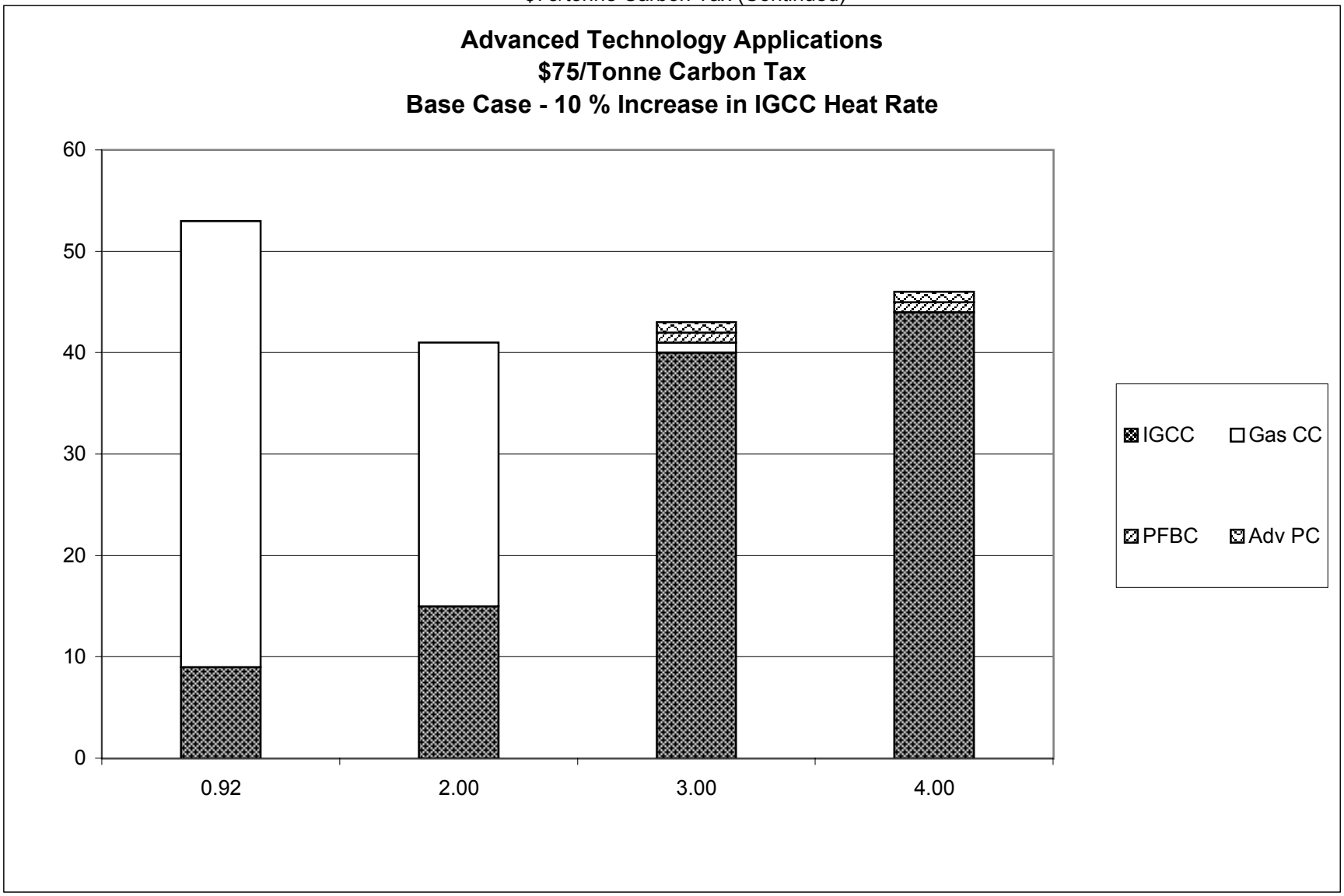


Figure 68. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

$75/tonne Carbon Tax (Continued)

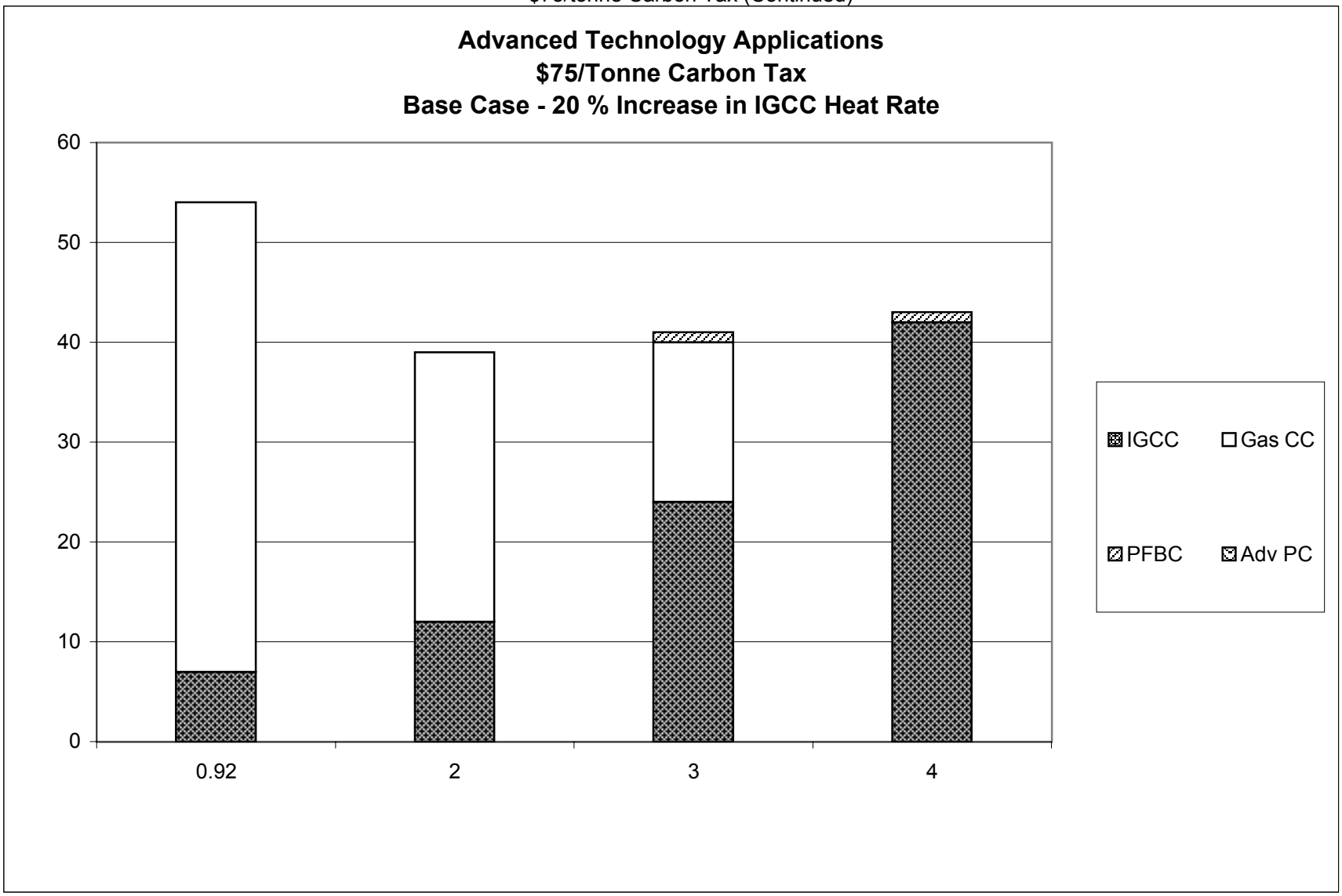


Figure 69. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

$100/tonne Carbon Tax

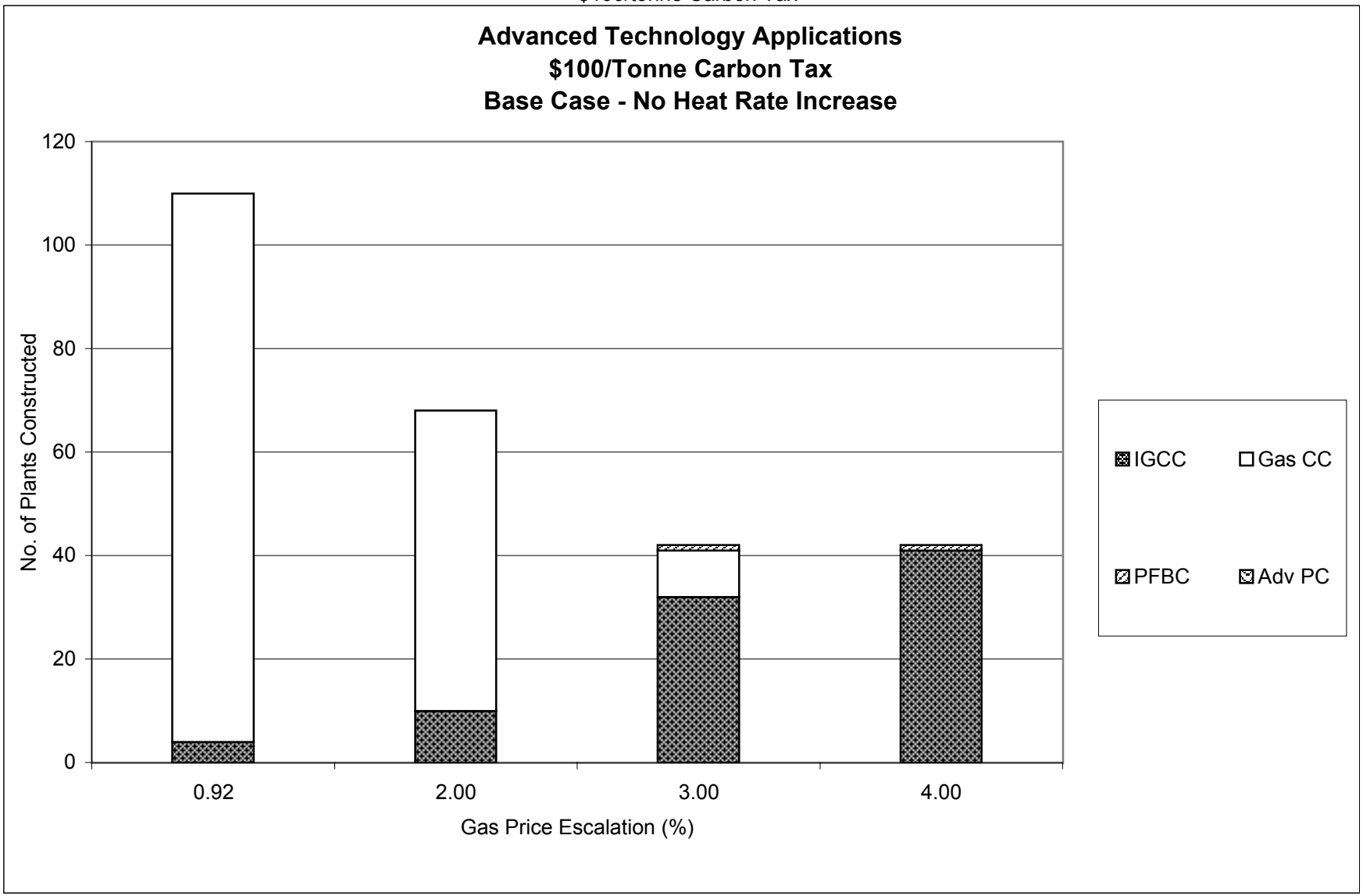


Figure 69. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

$100/tonne Carbon Tax (Continued)

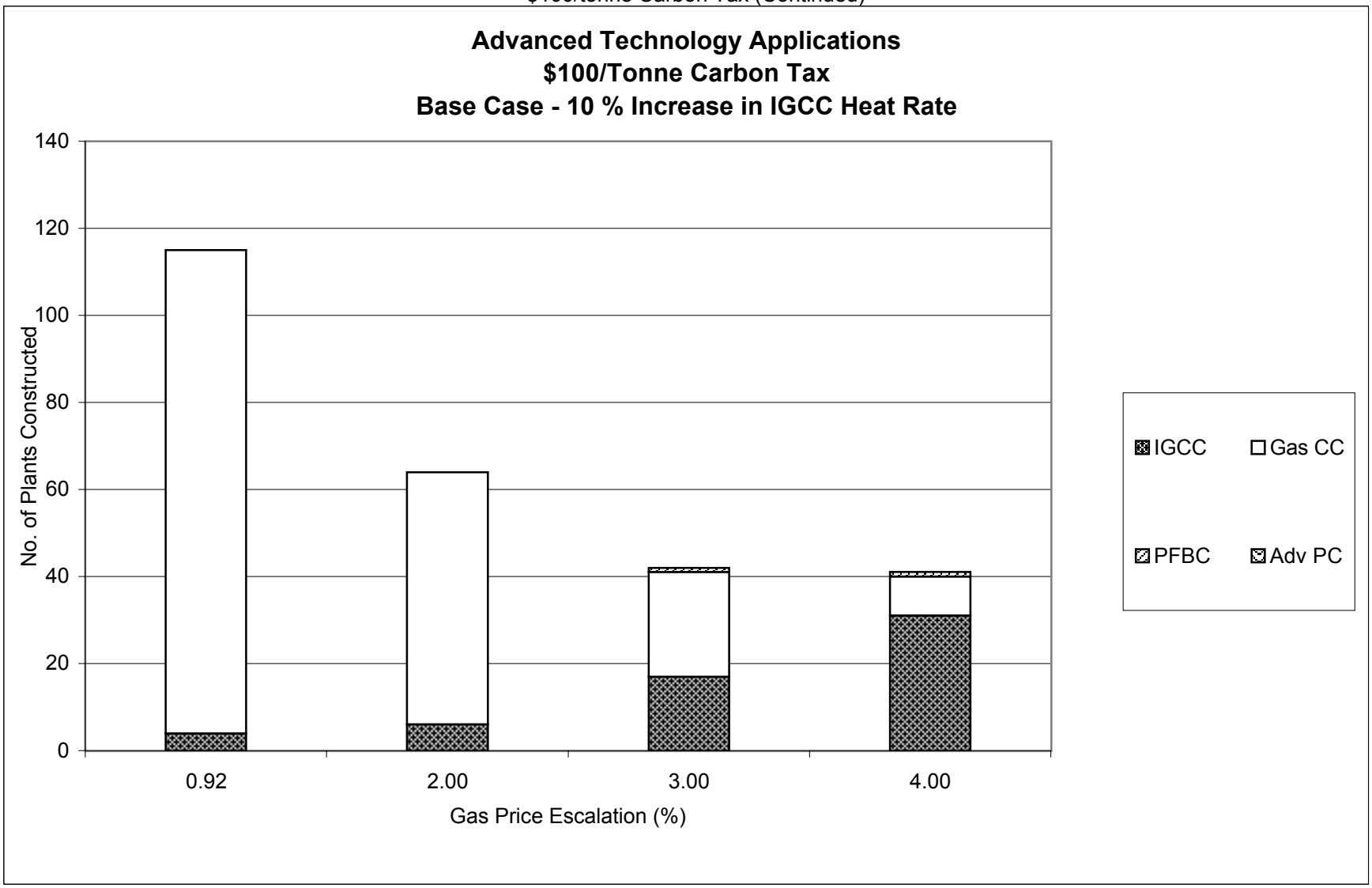


Figure 69. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

$100/tonne Carbon Tax (Continued)

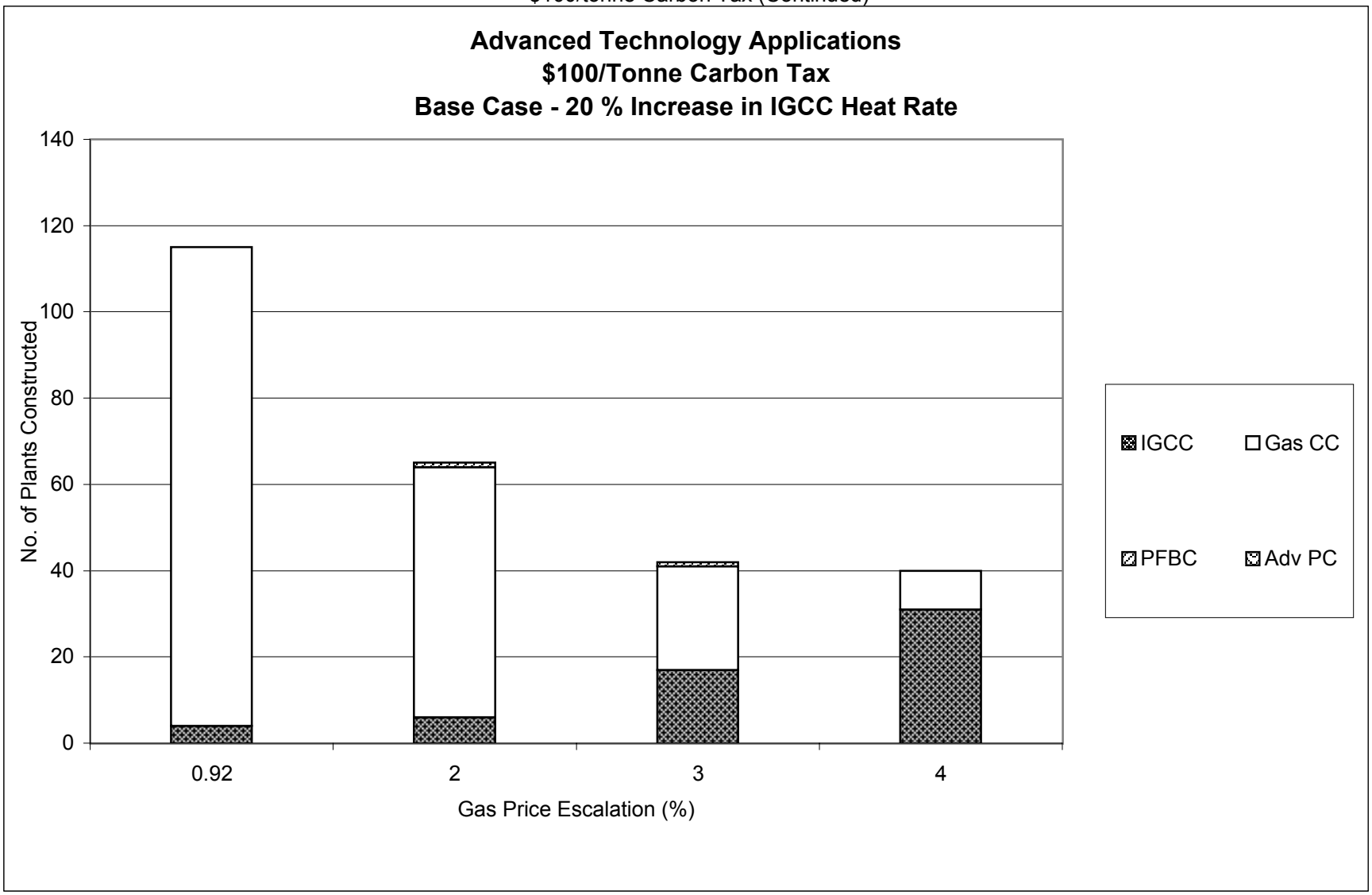


Figure 70. IGCC Market Penetration by Plants
Partially Advanced IGCC Development
(5% Increase in Both IGCC Heat Rate and Capital Cost)

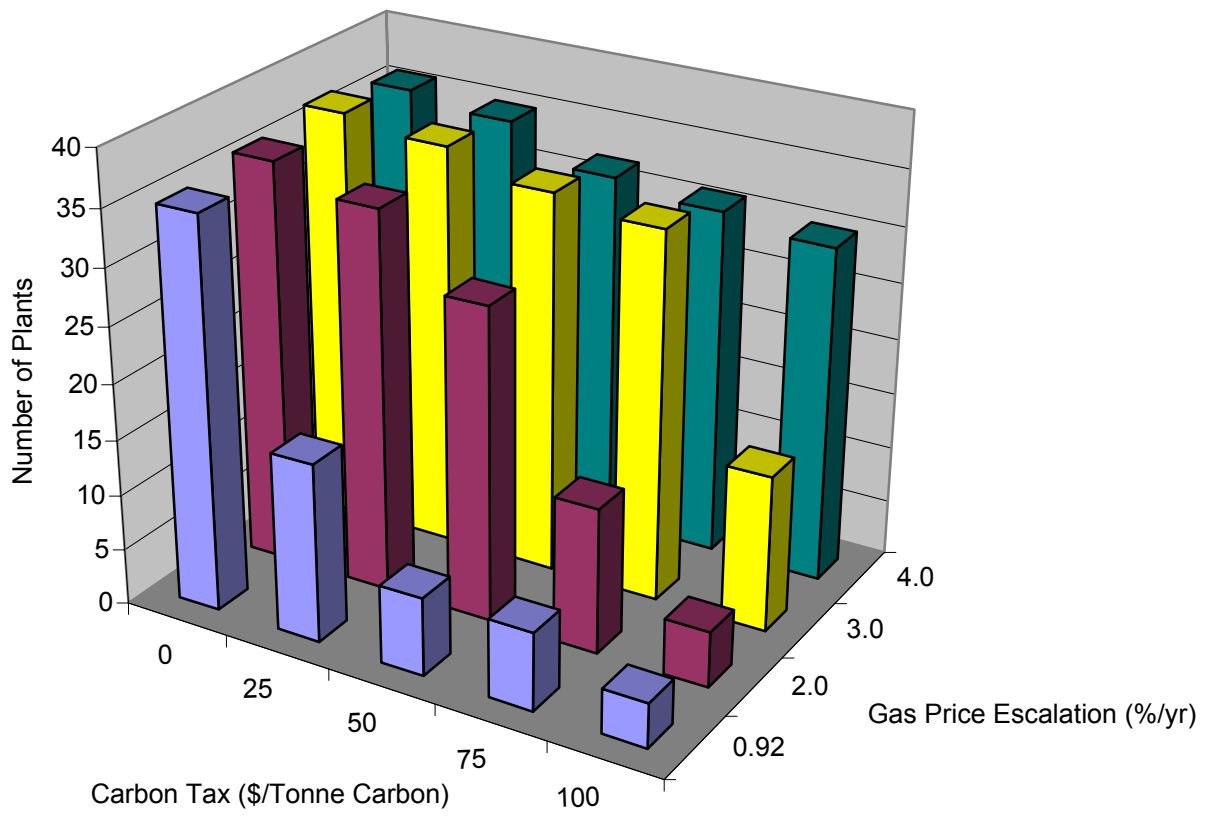


Figure 71. IGCC Market Penetration by Plants
Partially Advanced IGCC Development
(10% Increase in Both IGCC Heat Rate and Capital Cost)

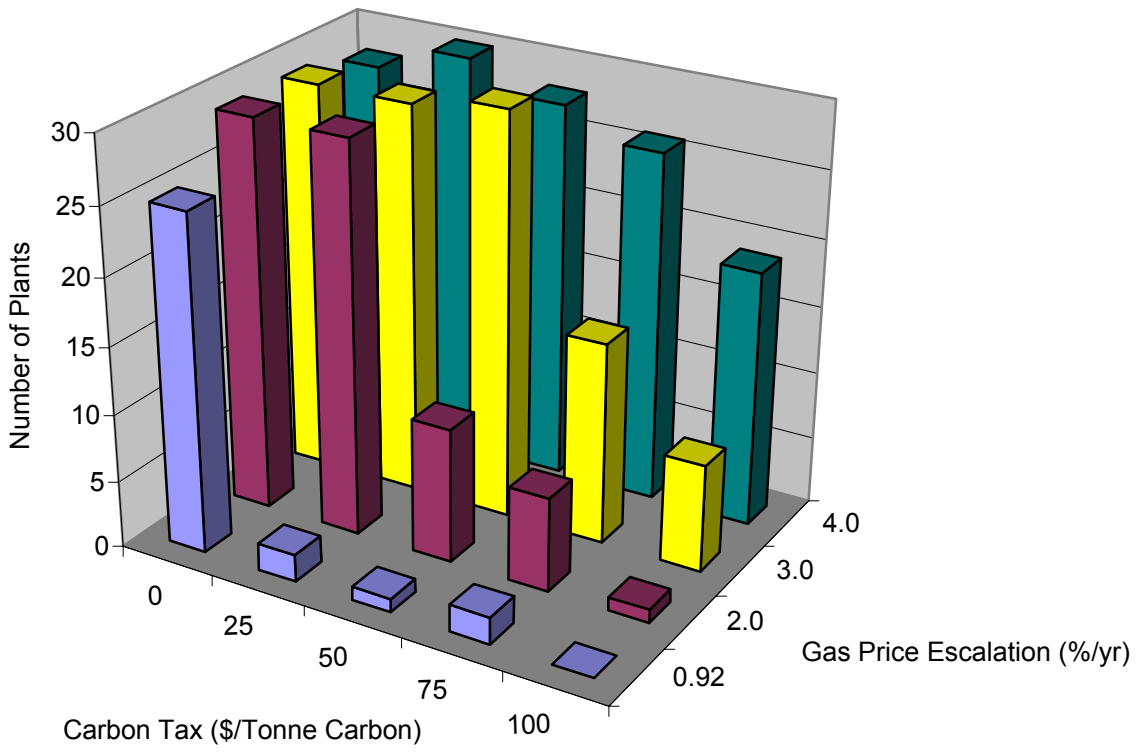


Figure 72. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
No Carbon Tax

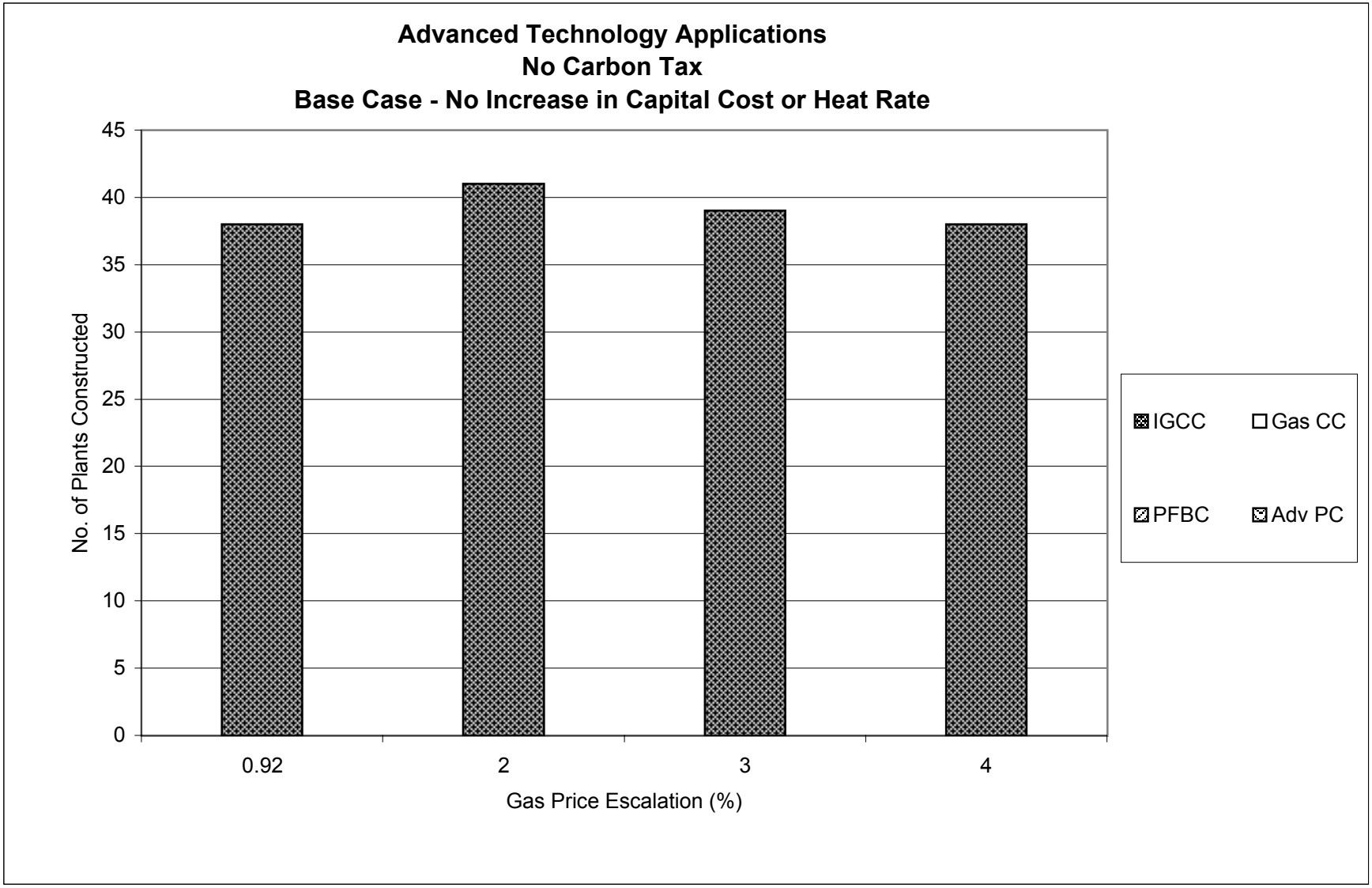


Figure 72. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
No Carbon Tax (Continued)

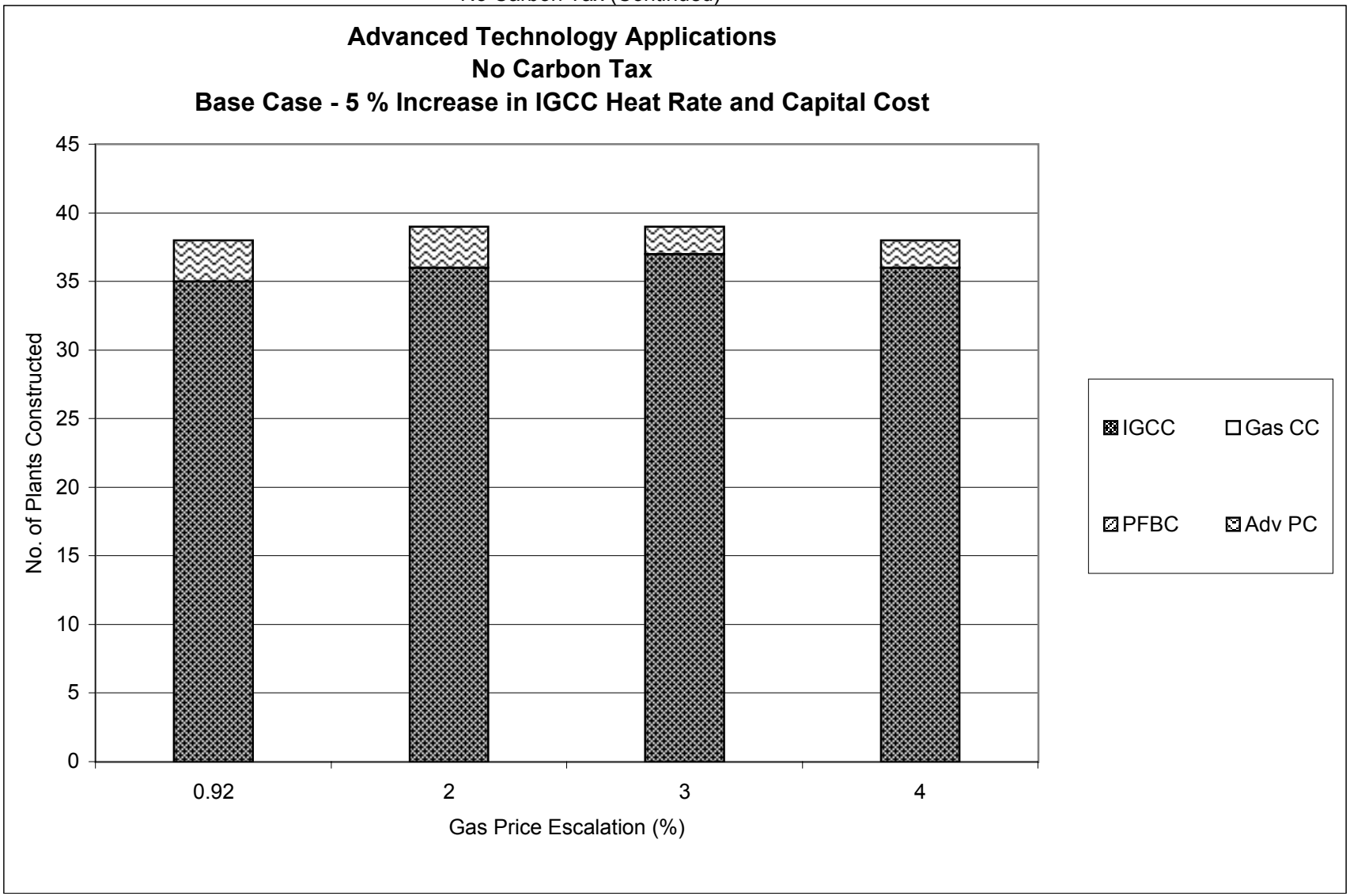


Figure 72. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
No Carbon Tax (Continued)

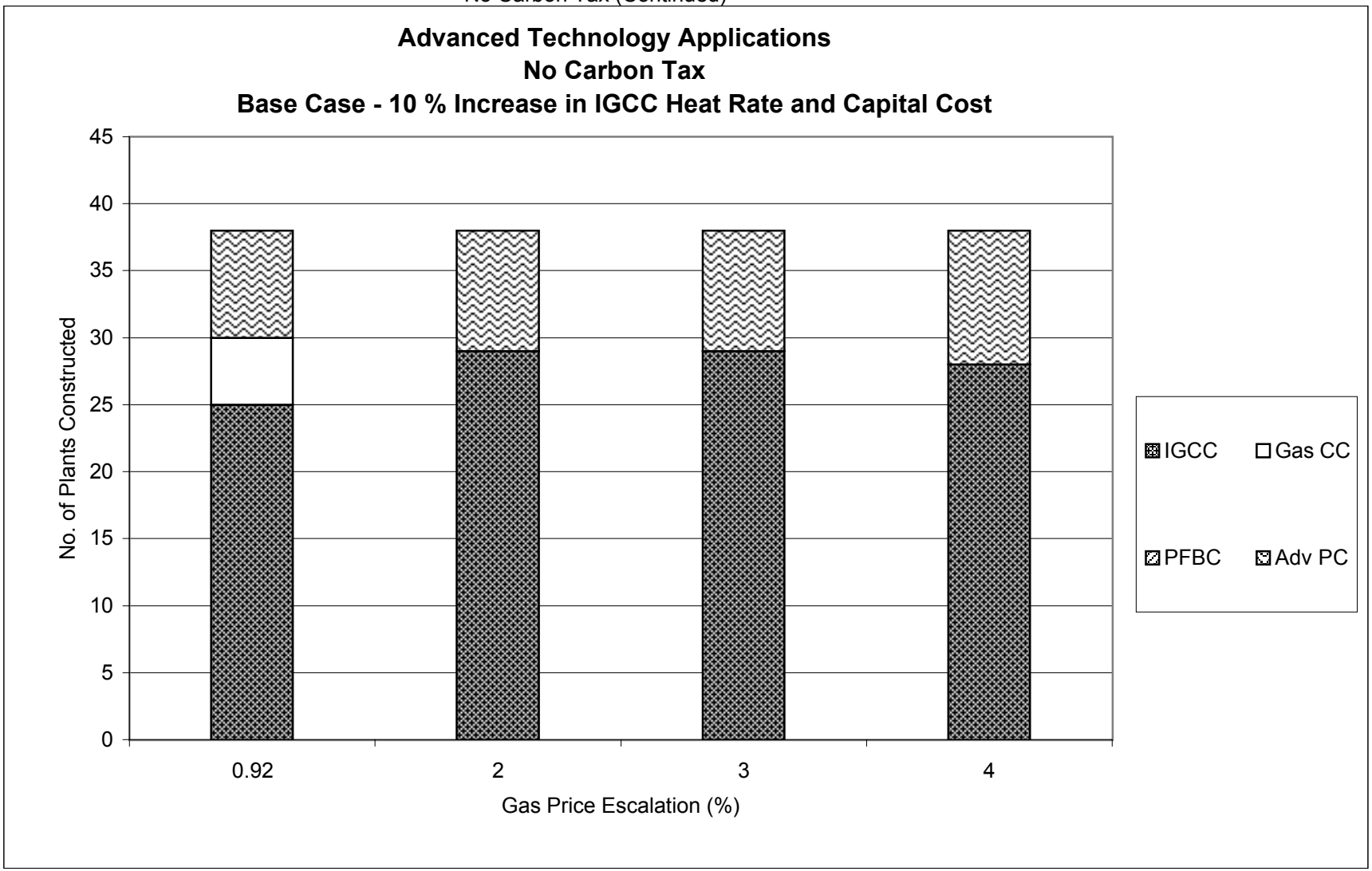


Figure 73. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$25/tonne Carbon Tax

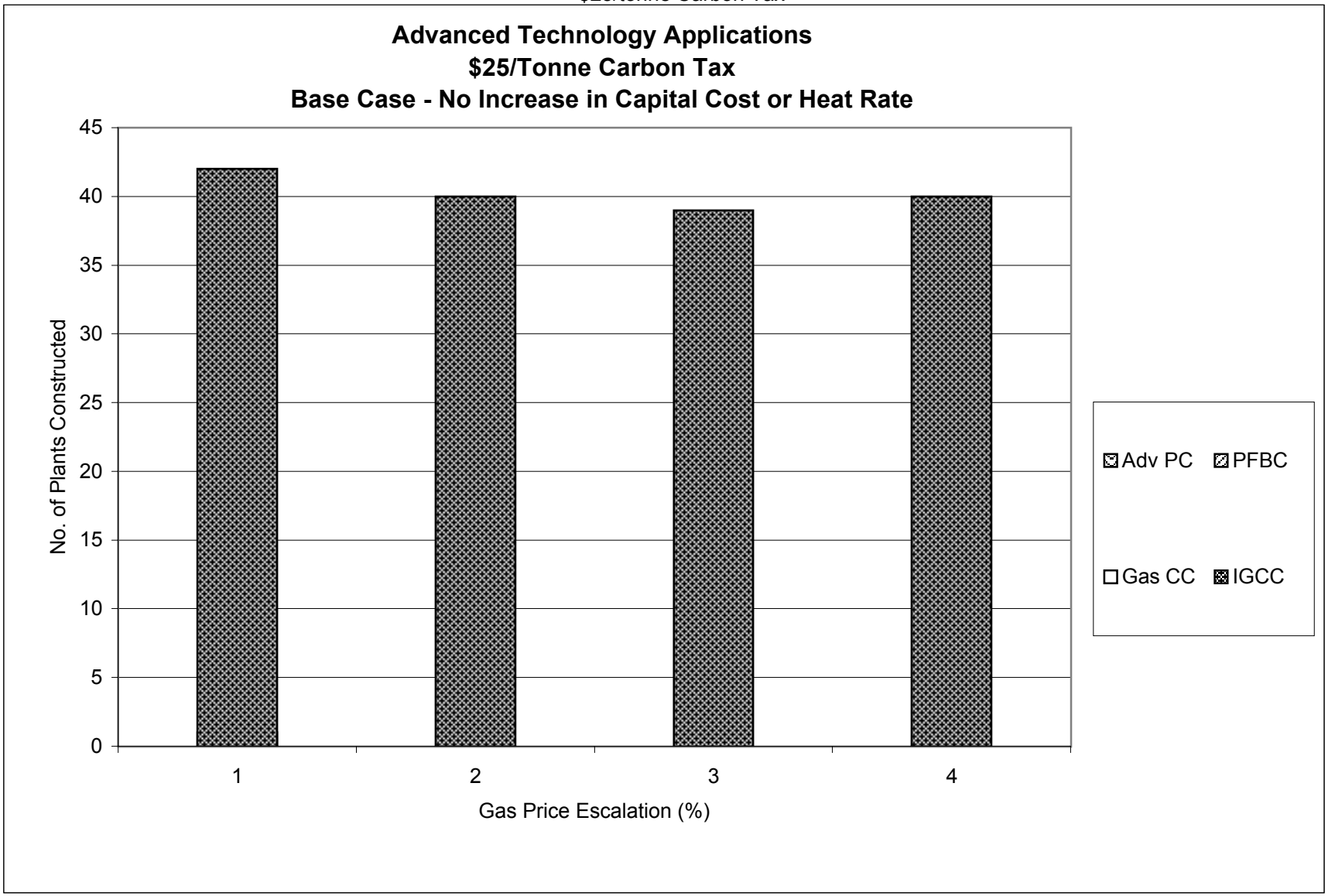


Figure 73. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$25/tonne Carbon Tax (Continued)

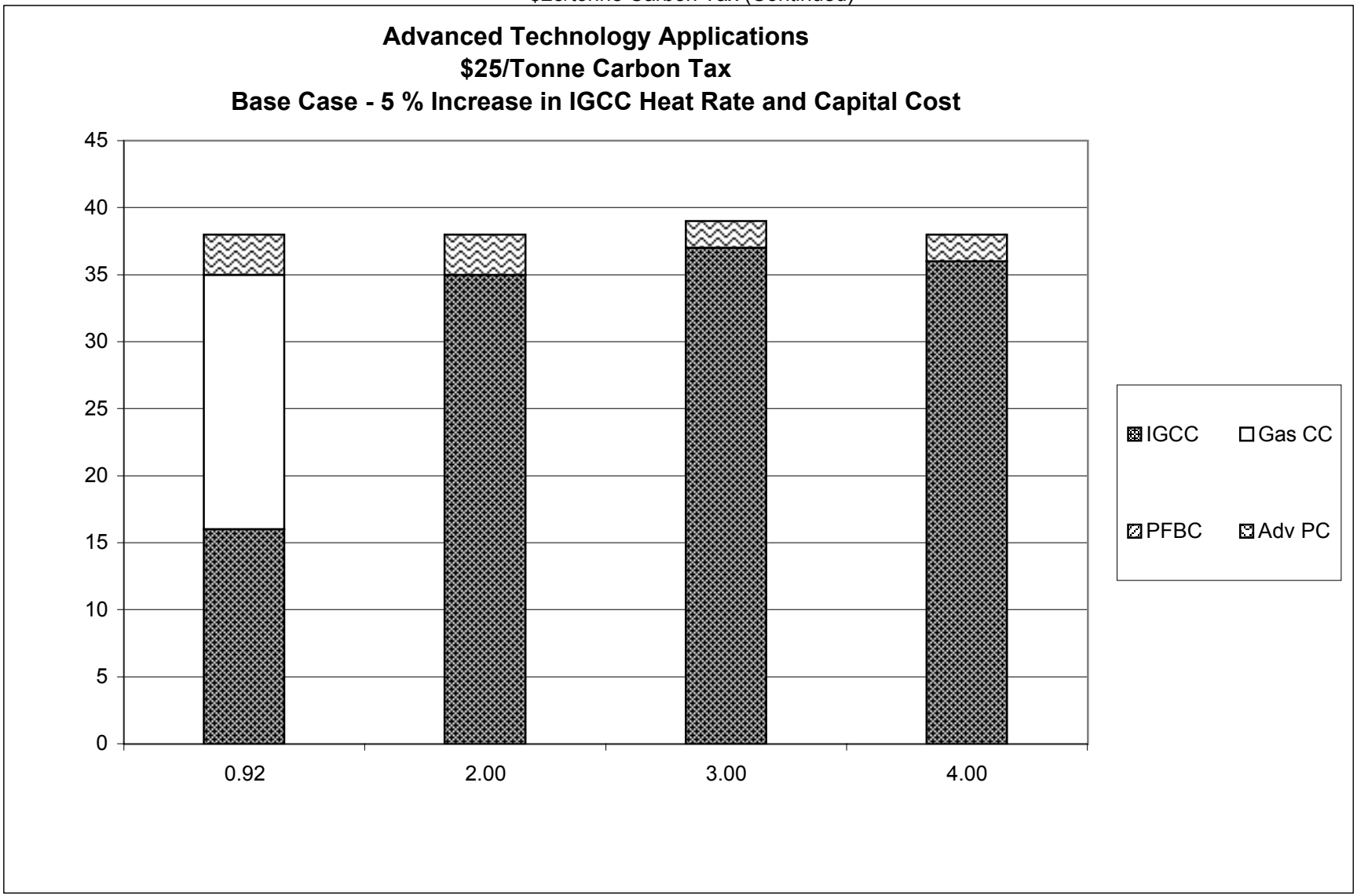


Figure 73. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$25/tonne Carbon Tax (Continued)

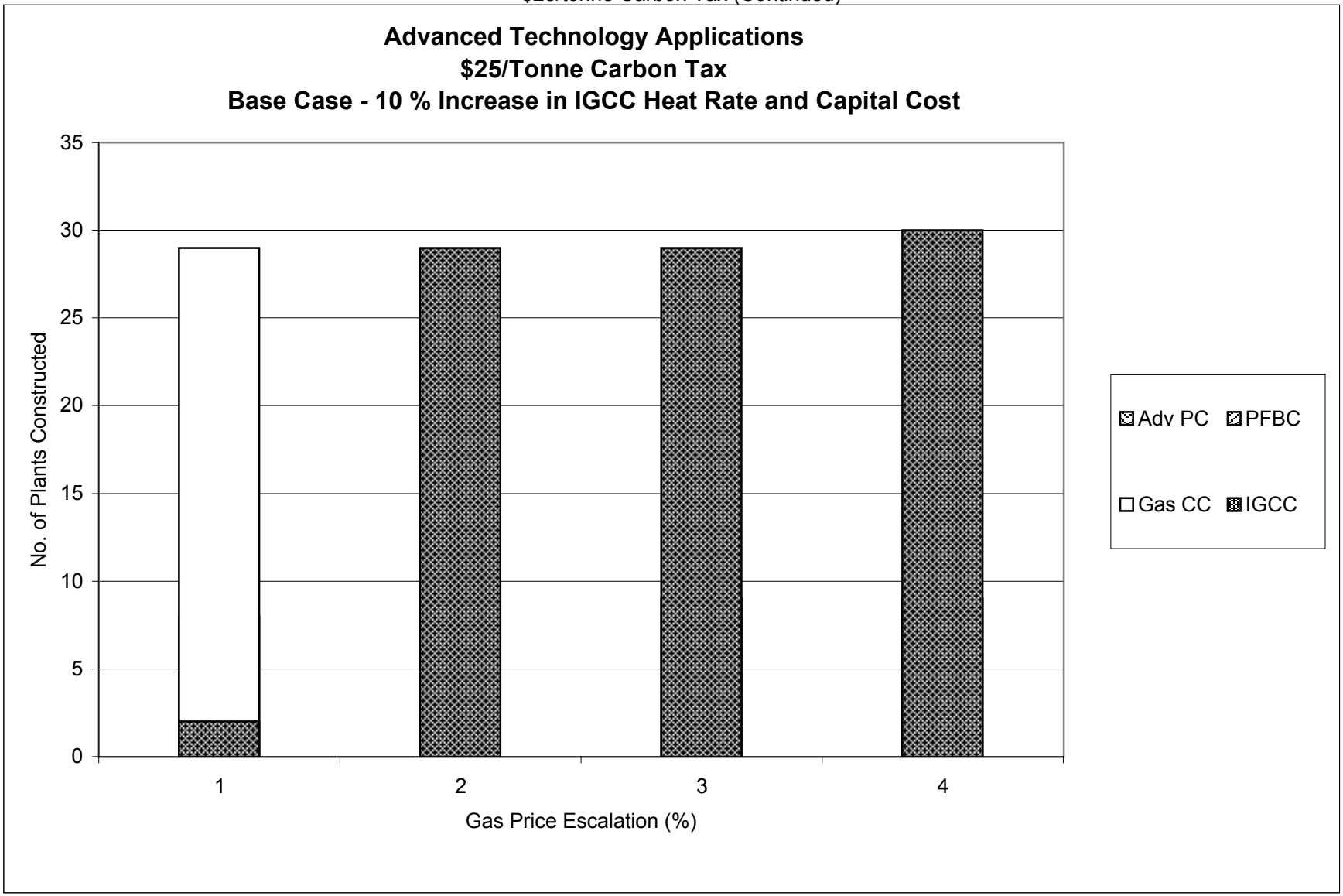


Figure 74. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

$50/tonne Carbon Tax

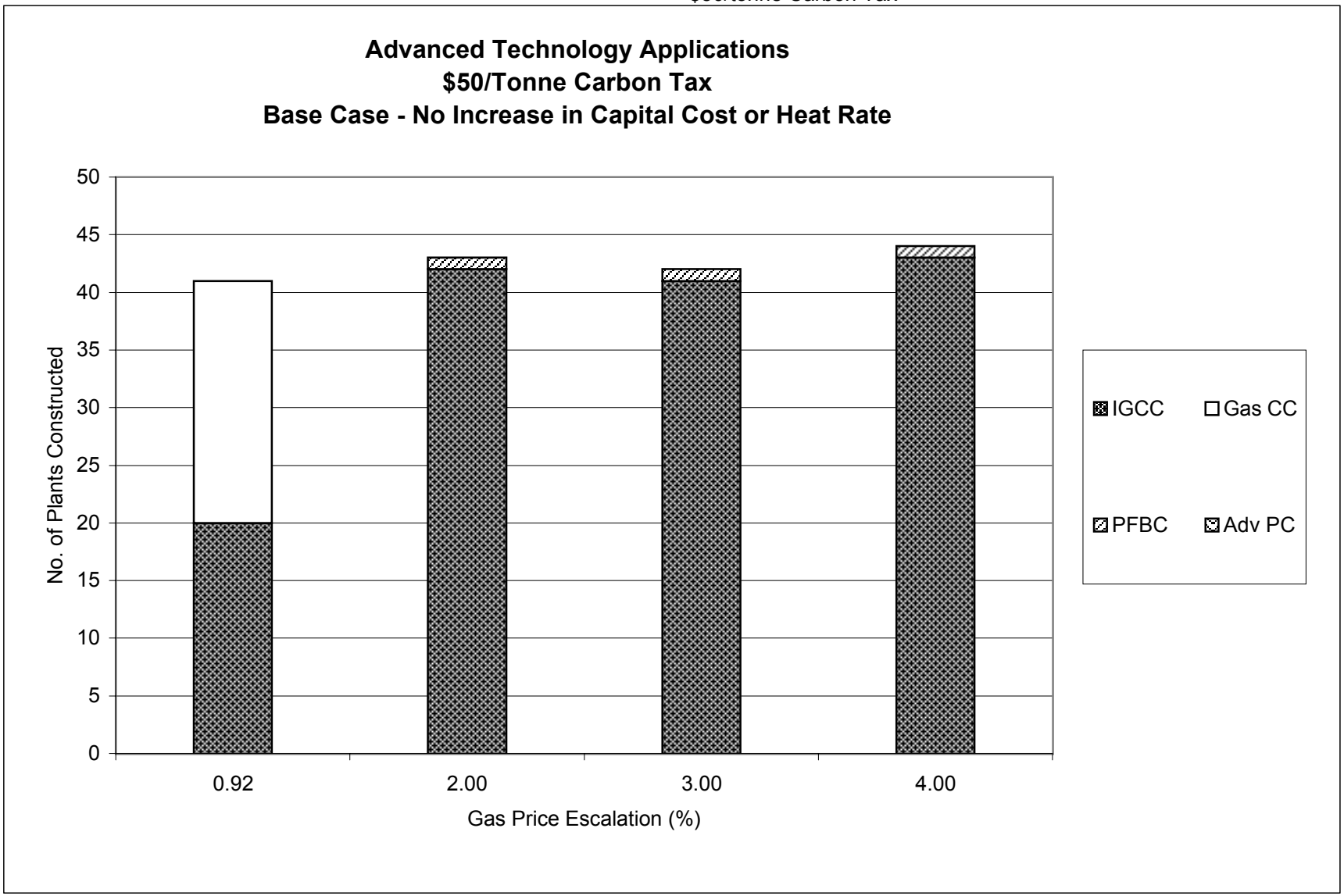


Figure 74. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

$50/tonne Carbon Tax (Continued)

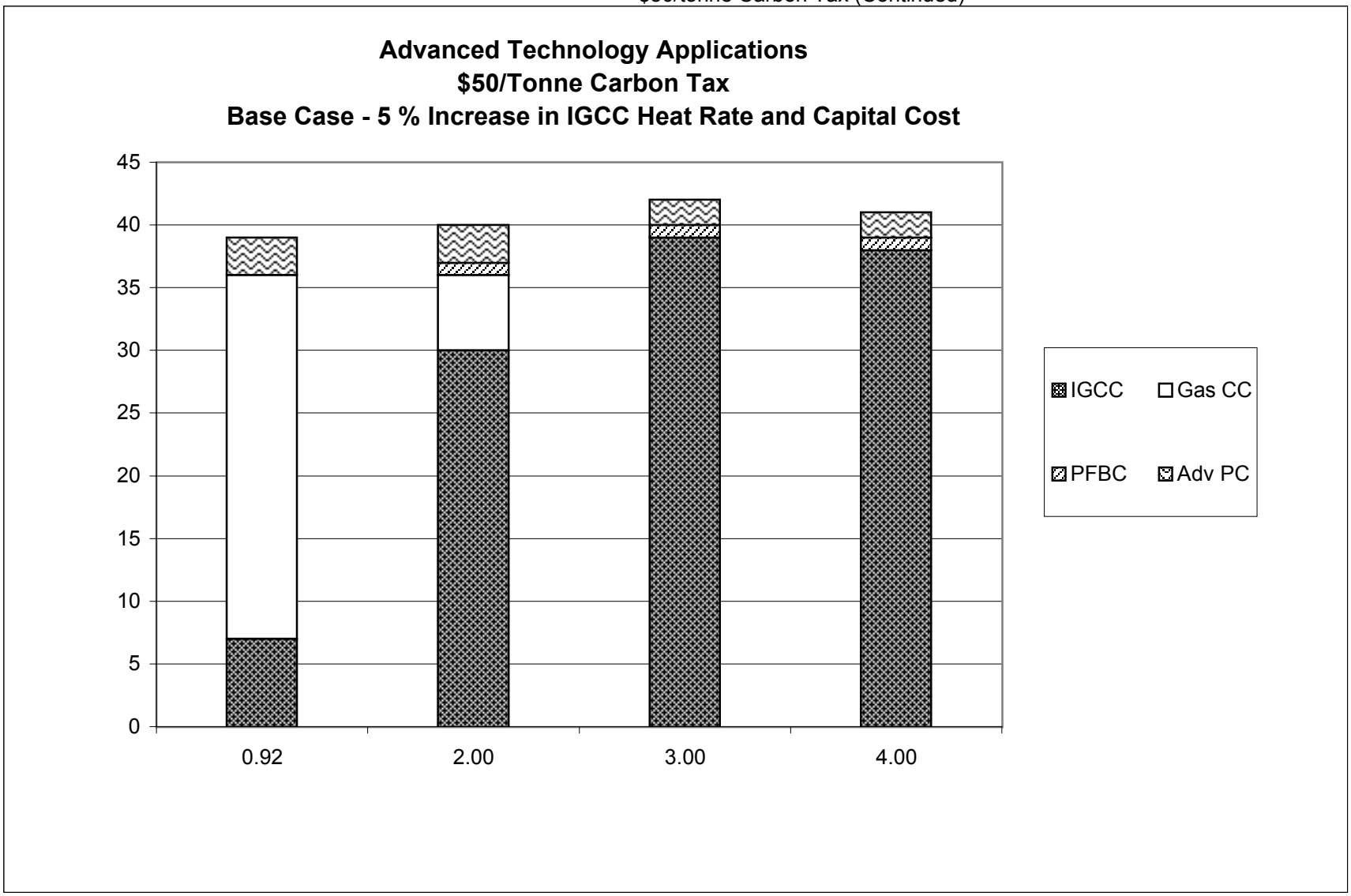


Figure 74. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost

$50/tonne Carbon Tax (Continued)

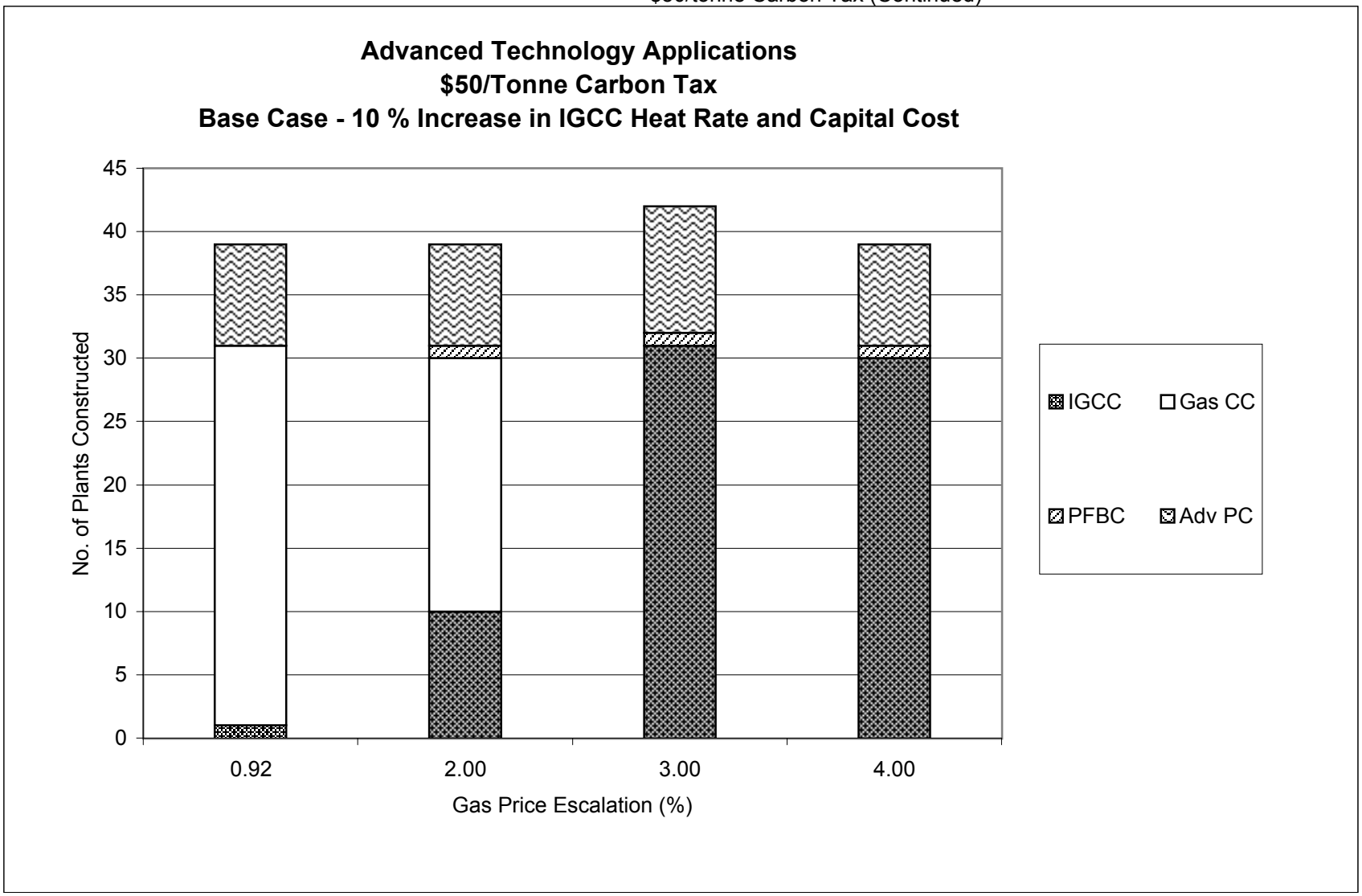


Figure 75. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$75/tonne Carbon Tax

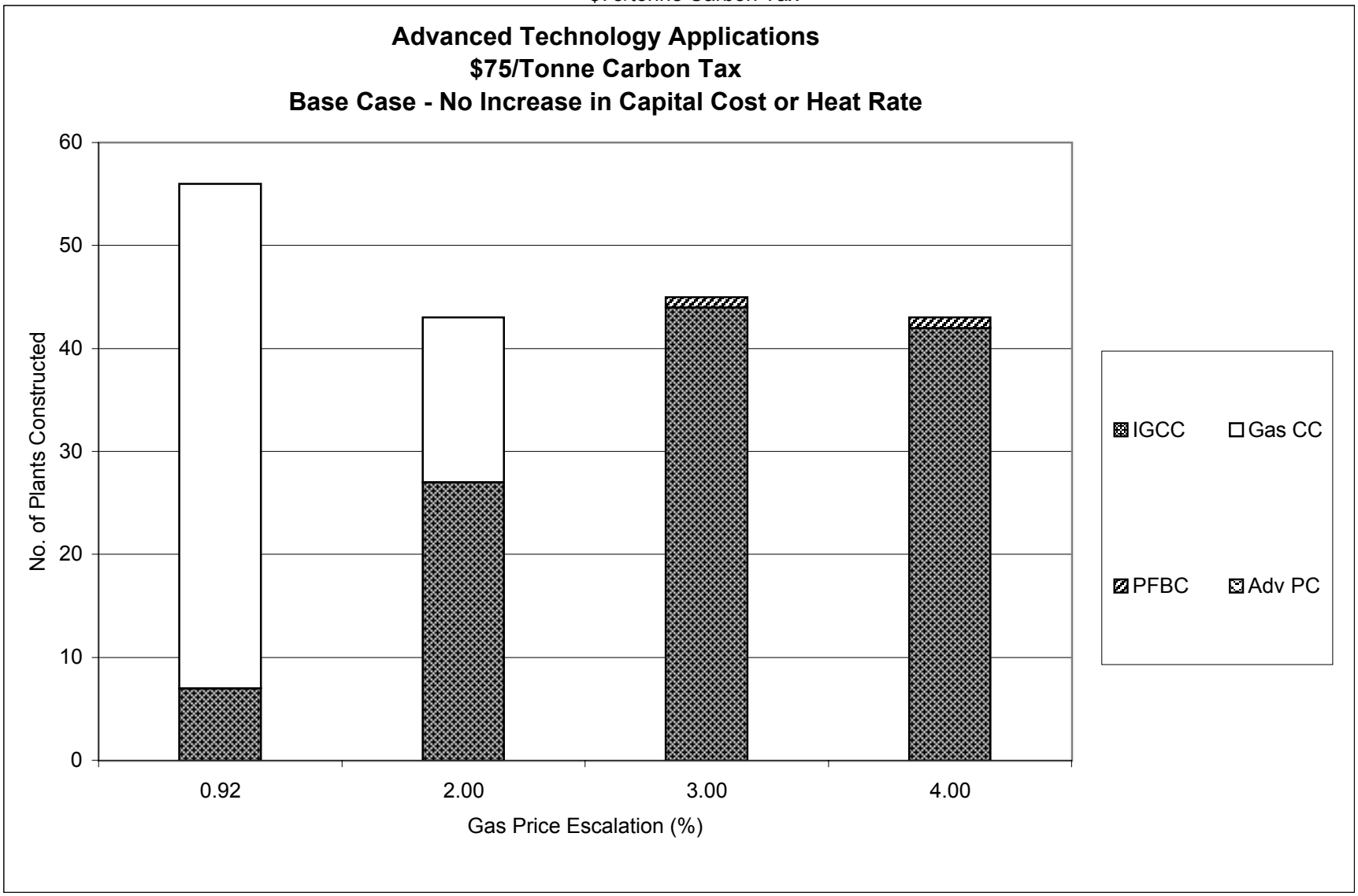


Figure 75. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$75/tonne Carbon Tax (Continued)

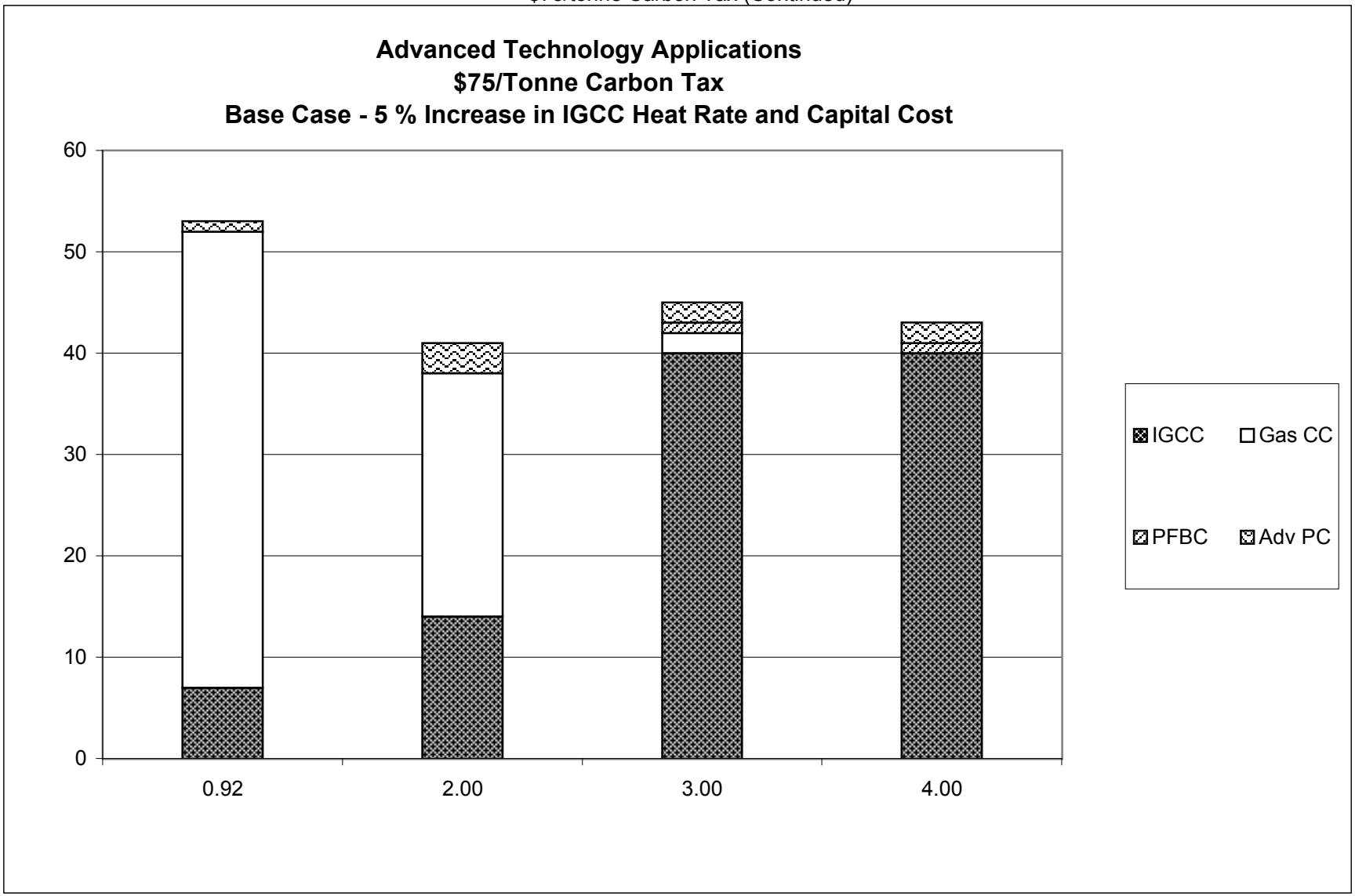


Figure 75. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$75/tonne Carbon Tax (Continued)

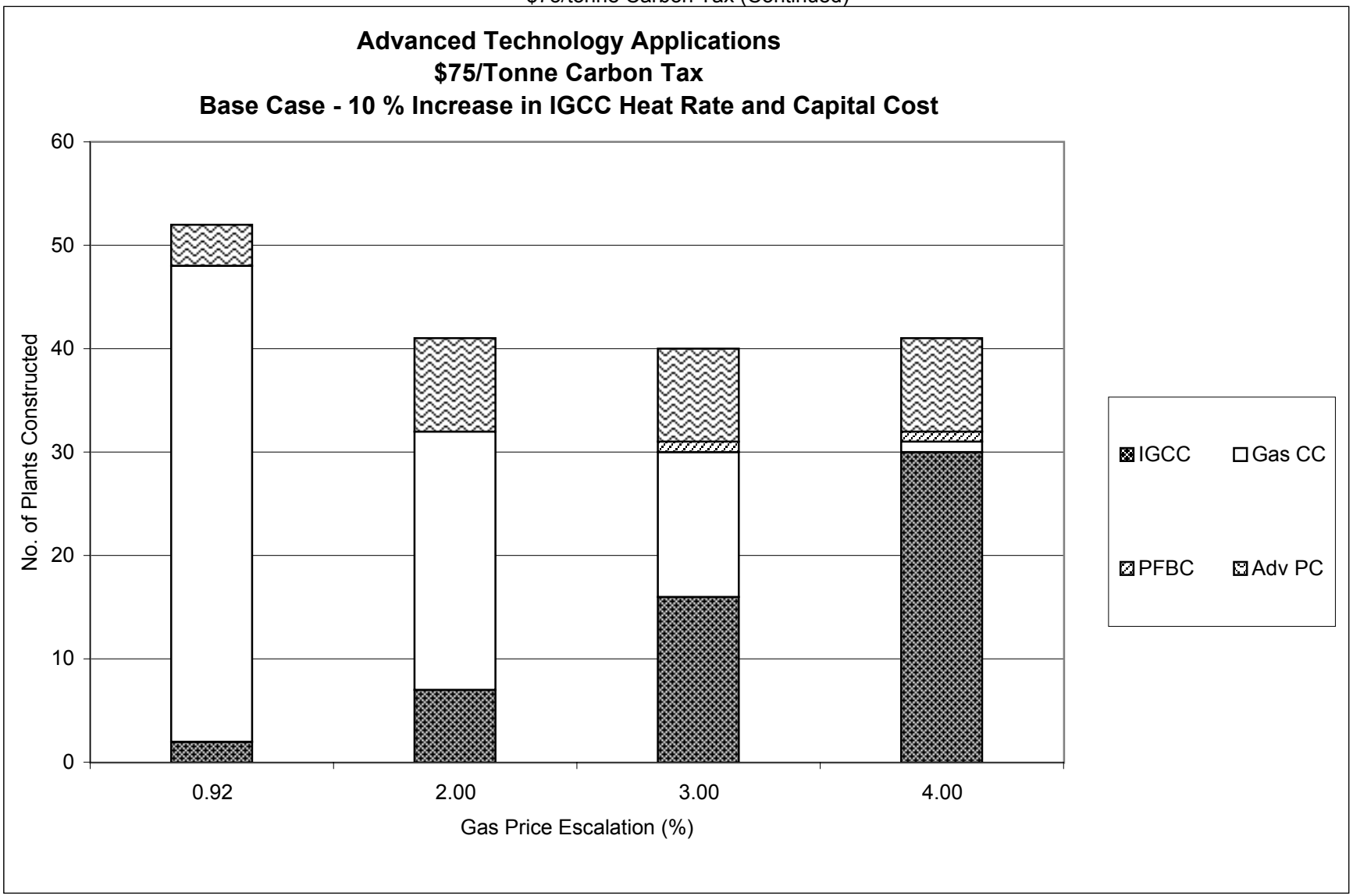


Figure 76. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$100/tonne Carbon Tax

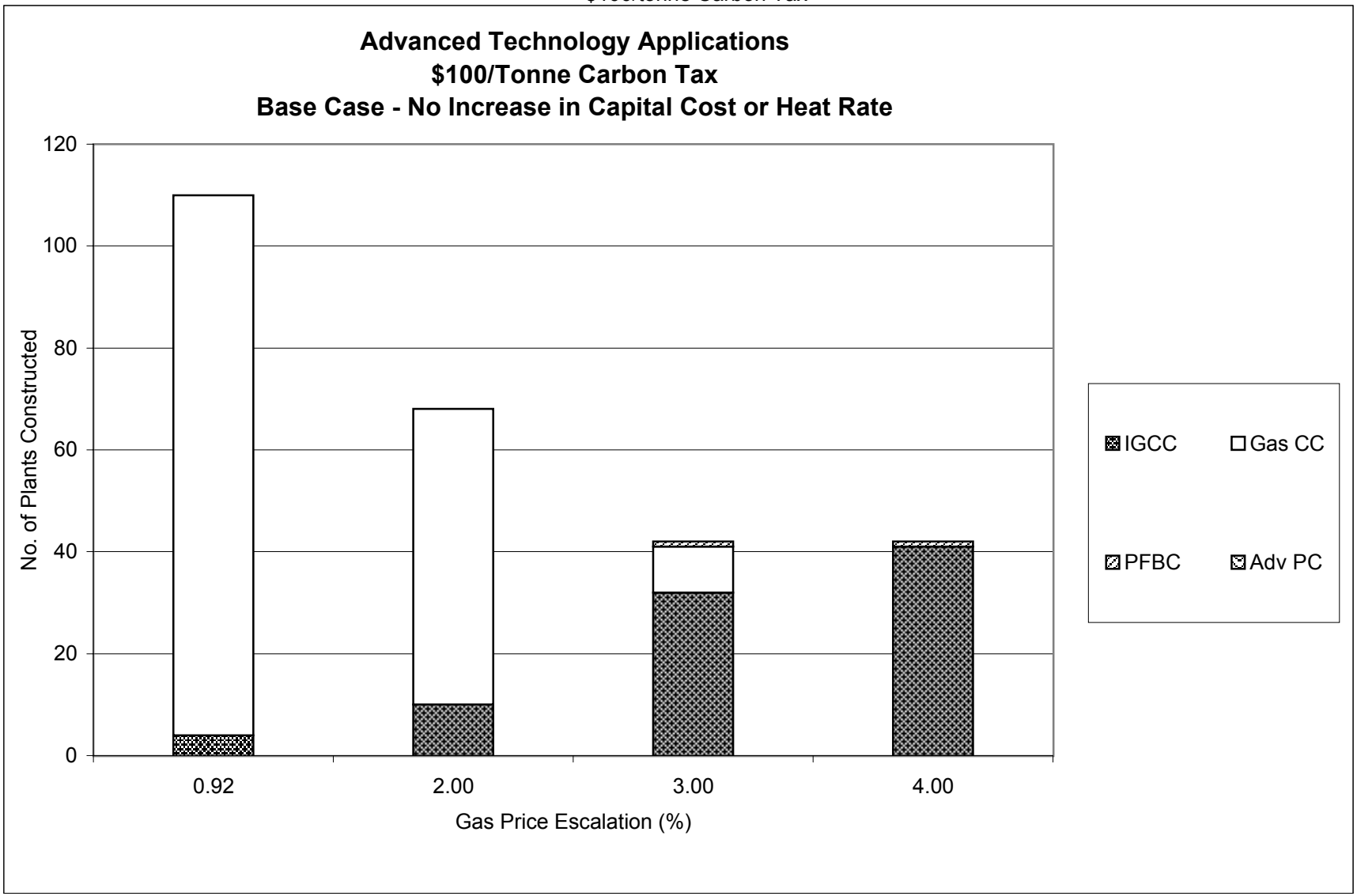


Figure 76. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$100/tonne Carbon Tax (Continued)

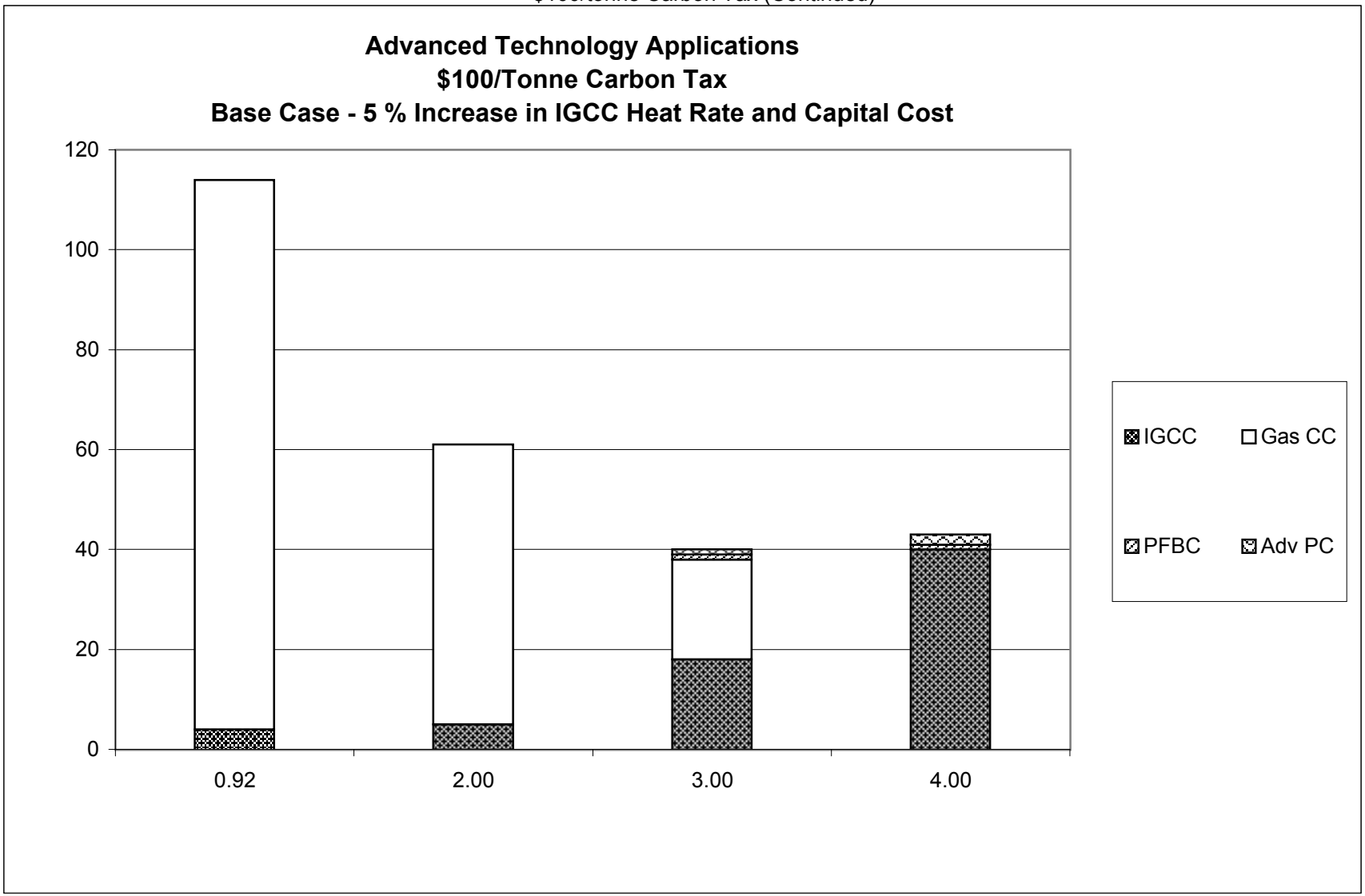


Figure 76. Technology Applications versus Gas Price Escalation and Increase in IGCC Capital Cost
$100/tonne Carbon Tax (Continued)

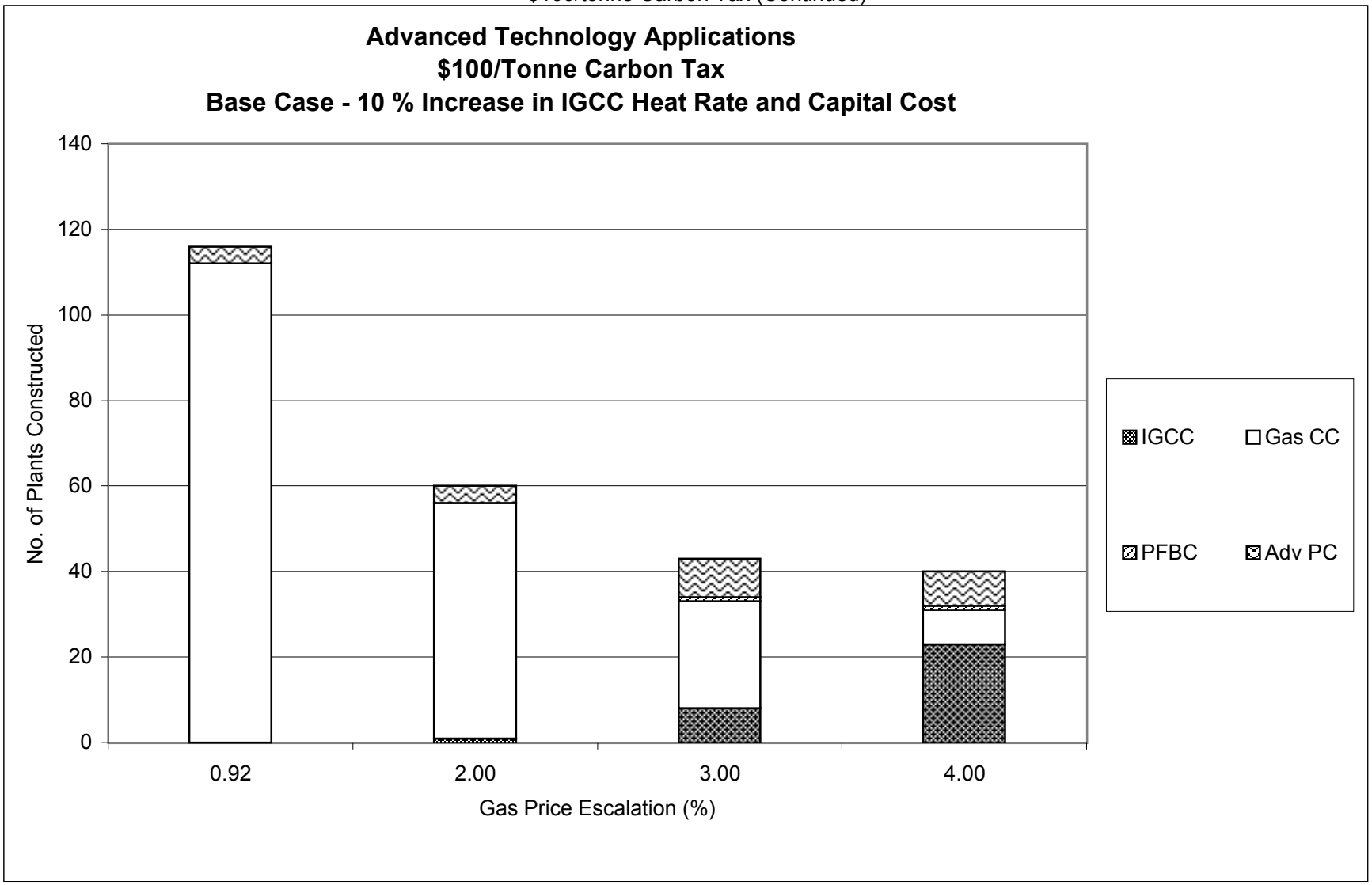


Figure 77. Carbon Dioxide Emissions
Advanced IGCC Development
($1500/ton Ozone Season and Non-Ozone Season NOx Allowance Prices, $800/ton SOx Allowance Price)

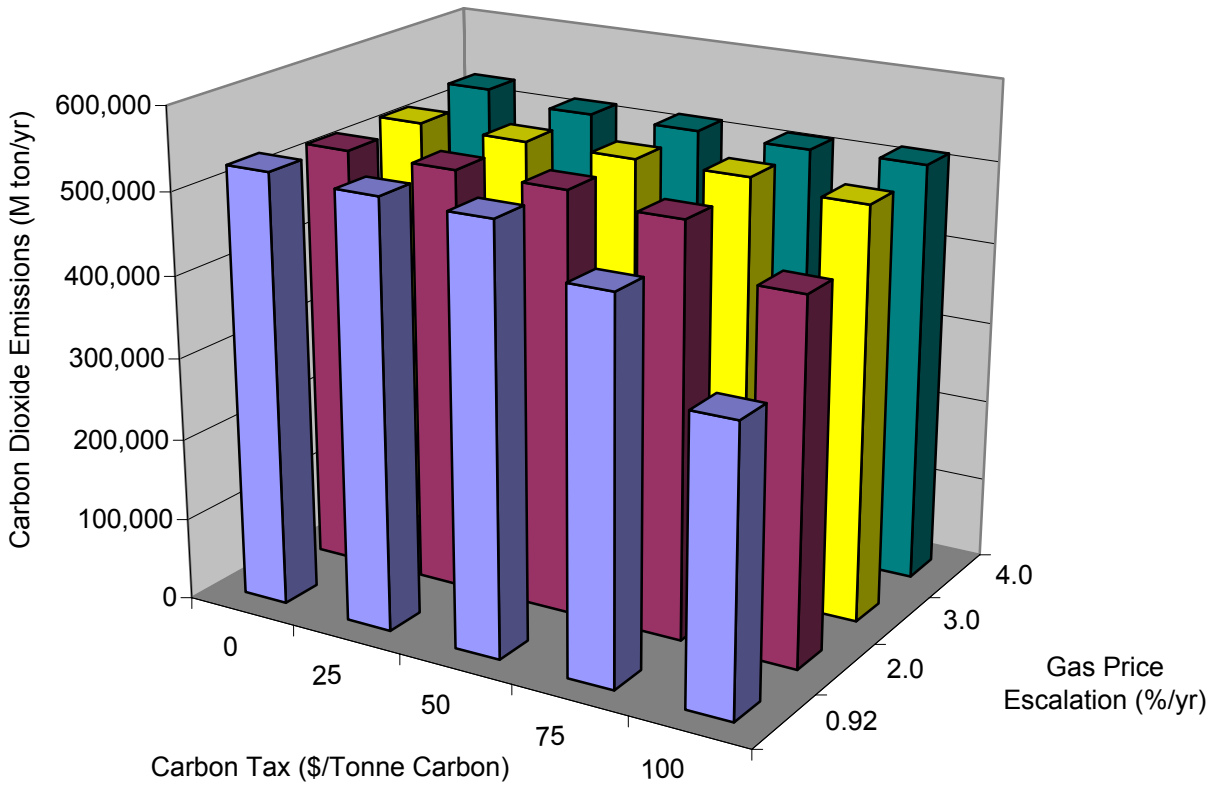
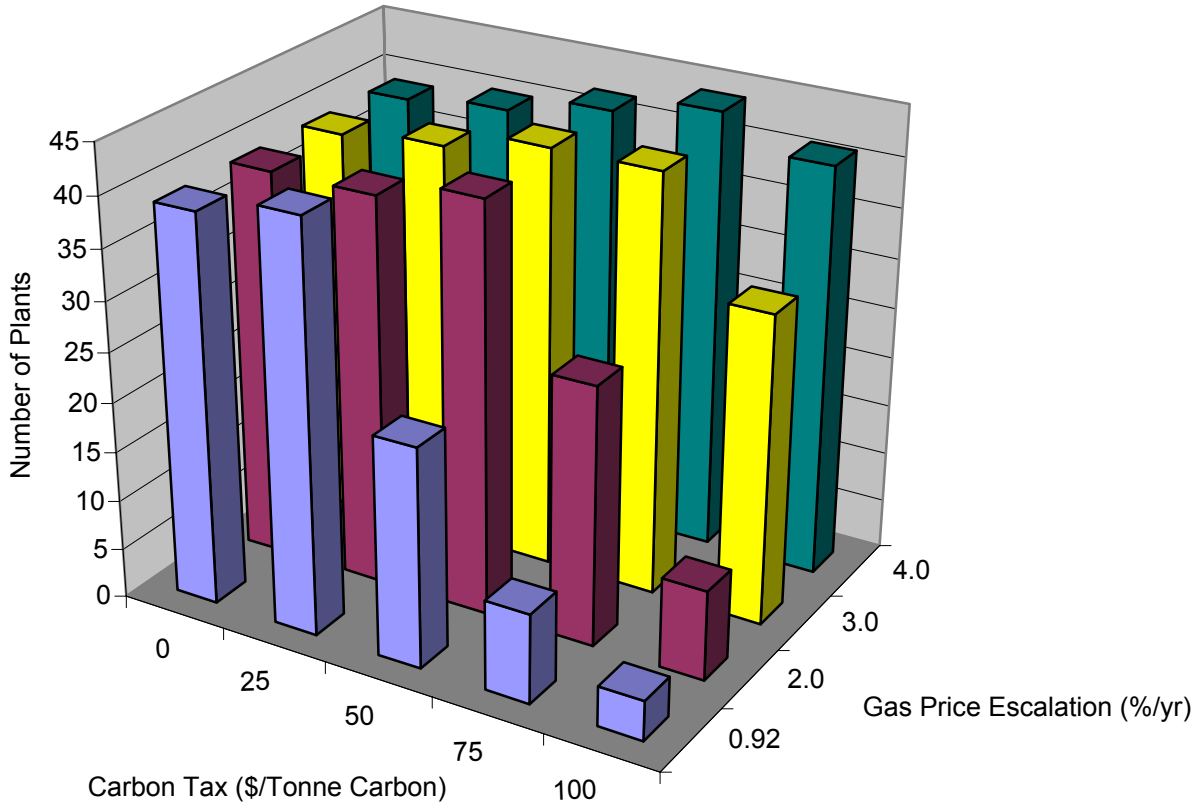



Figure 78. IGCC Market Penetration by Plants
Advanced IGCC Development
($1500/ton Ozone Season and Non-Ozone Season NOx Allowance Prices, $800/ton SOx Allowance Price)