ENERGY STAR®
Automatic Commercial Ice Makers
V 2.0 Draft 1
Stakeholder Meeting

May 23, 2011

McCormick Place

Chicago, Illinois

EPA

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Purpose of Revision

- ENERGY STAR market penetration is 42% for air cooled cube-type; opportunity for additional energy savings
- Expand the scope to include flake and nugget continuous type ice makers
- Update test standard references (AHRI 810-2007 and ASHRAE 29-2009)
- Align with the DOE TP NOPR and evaluate relevant energy efficiency initiatives for harmonization opportunities.

Definition Changes

- EPA proposes the following definition changes aligning with AHRI 810-2007, ASHRAE 29-2009, and DOE TP NOPR
  - "Automatic Commercial Ice Makers" rather than "Commercial Ice Machines"
  - "Batch-Type" rather than "Cube-Type"
  - Adding "Continuous-Type"

Product Categories

- EPA proposes three overall product categories: Batch, Nugget, and Flake
  - Defines the three major ice product types
  - According to manufacturer input consumer purchase is highly dependent on the desired ice product and application

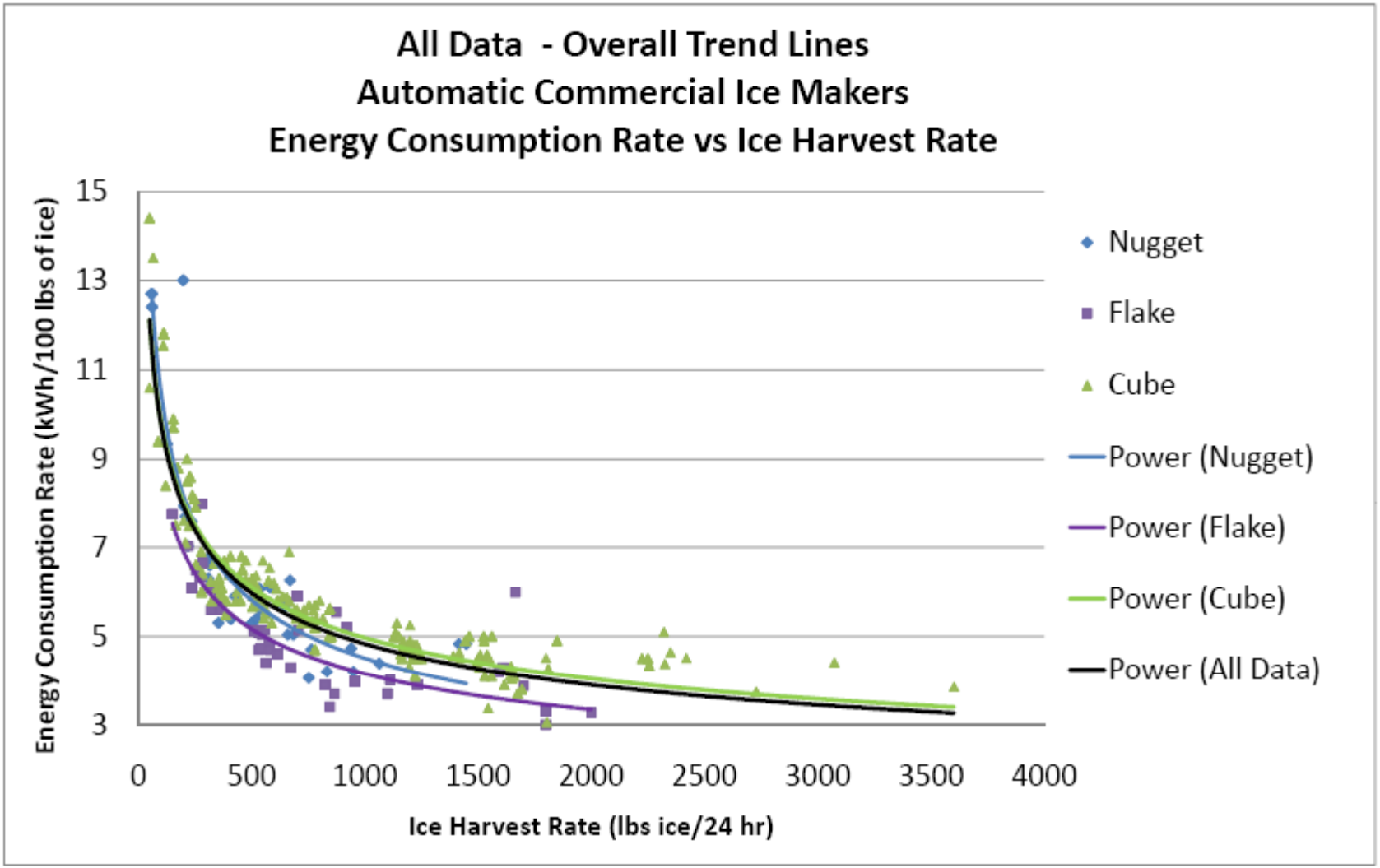
Product Categories

- EPA proposes preserving the IMH, RCU, and SCU categories
  - Systems cannot be easily interchanged based on application, installation needs, the facility, and space.

- EPA proposes excluding RCU w/ remote compressor until a workable test method is developed to account for total energy use

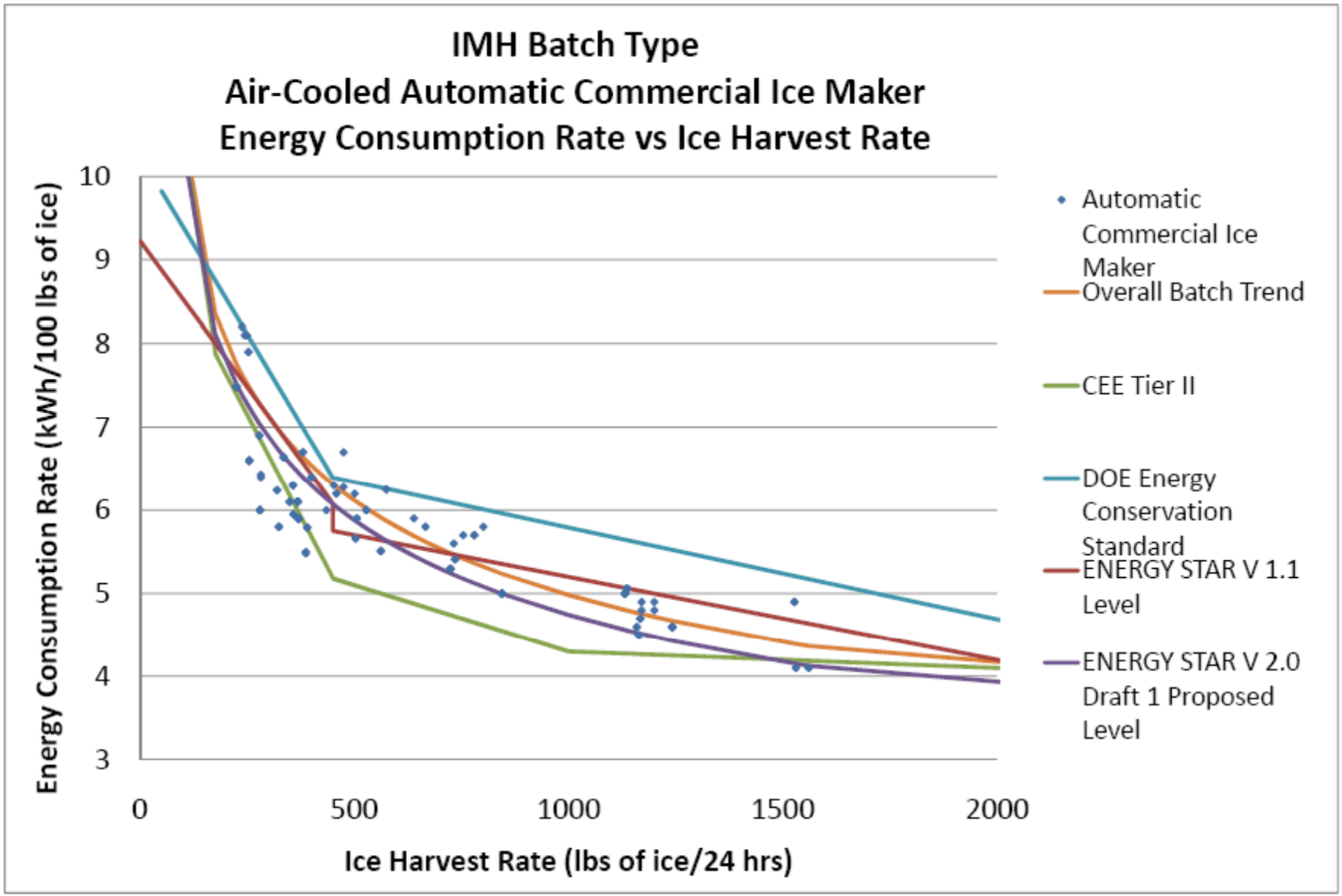
EPA Data Set and Methodology

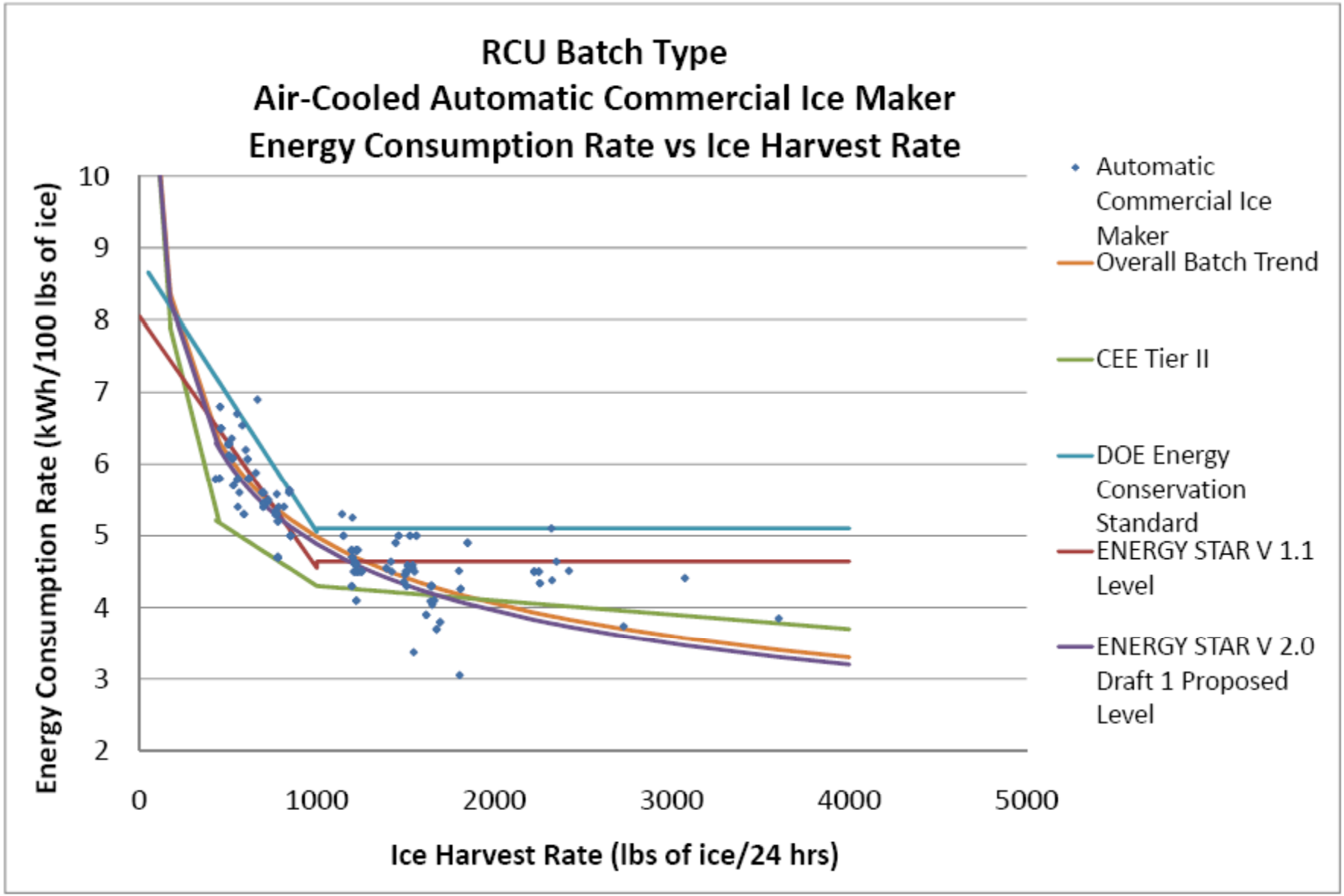
- Data set combines
  - Non-ENERGY STAR models listed in the AHRI Certified Product Directory
  - Models on ENERGY STAR QP list
  - Flake and nugget models provided by manufacturers
- Utilized a 25% qualification rate goal as well as other ENERGY STAR guiding principles
- Developed power curves for setting energy consumption rate levels and removed harvest bin categories

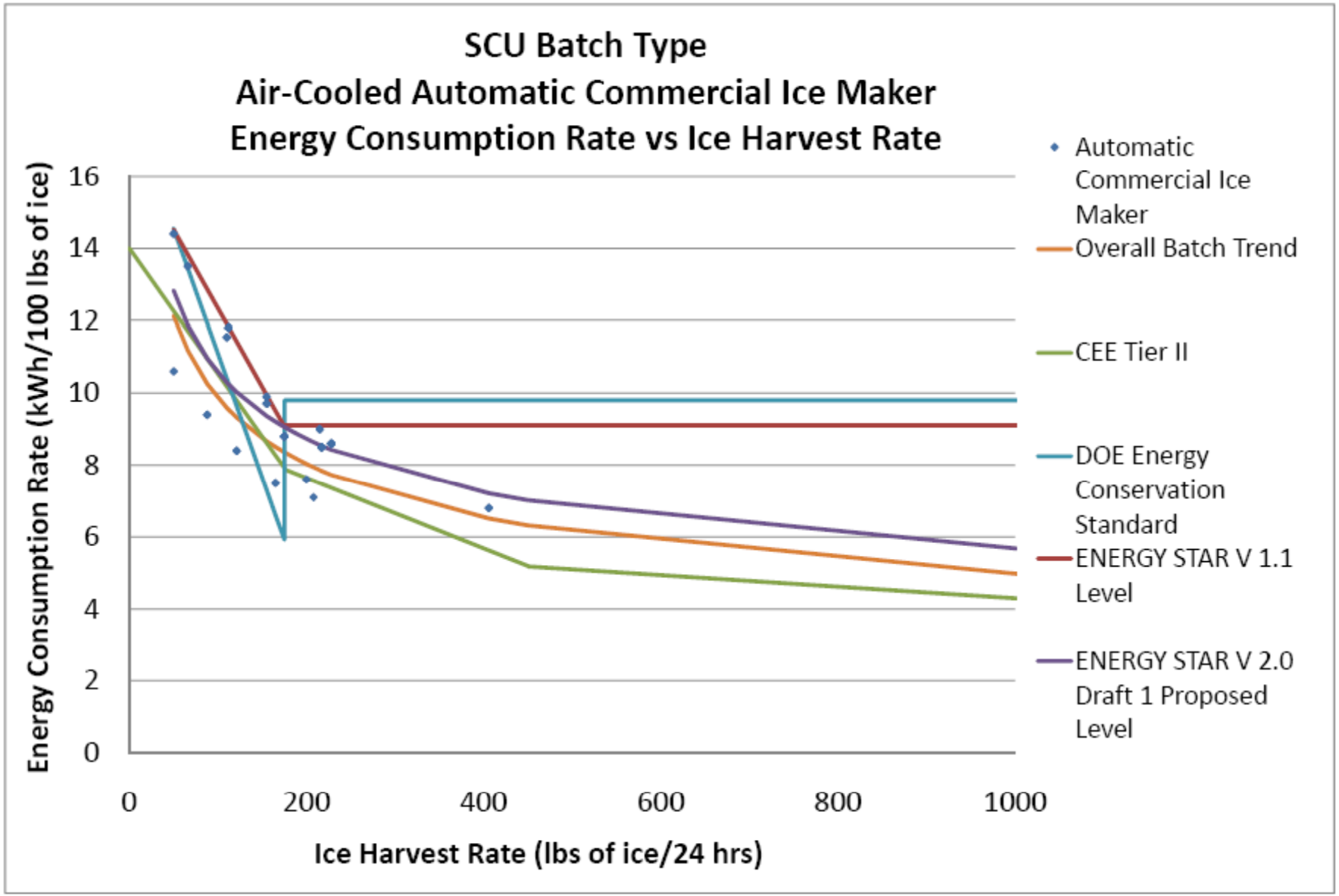

All Data - Overall Trend Lines
Automatic Commercial Ice Makers
Energy Consumption Rate vs Ice Harvest Rate
Energy Consumption Rate (kWh/100 lbs of ice)
15
13
11
9
7
5
3
0
500
1000
1500
2000
2500
3000
3500
4000
Ice Harvest Rate (lbs ice/24 hr)
Nugget
Flake
Cube
Power (Nugget)
Power (Flake)
Power (Cube)
Power (All Data)

Air-Cooled Batch Type
V 2.0 Proposed Levels

	Version 1.1			Version 2.0	
Equipment Type	**Harvest Rate, H (lbs ice/day)**	**Energy Use Limit (kWh/100 lbs ice)**	**Potable Water Use Limit (gal/100 lbs ice)**	**Energy Use Limit (kWh/100 lbs ice)**	**Potable Water Use Limit (gal/100 lbs ice)**
IMH	< 450	9.23 – 0.0077**H**	<= 25	≤ 38.76 X **H**$^{-0.297}$ – 0.24	≤ 20.0
	>= 450	6.20 – 0.0010**H**	<= 25		
RCU (without remote compressor)	< 1000	8.05 – 0.0035**H**	<= 25	≤ 38.76 X **H**$^{-0.297}$ – 0.01	≤ 20.0
	>= 1000	4.64	<= 25		
RCU (with remote compressor)	< 934	8.05 – 0.0035**H**	<= 25		
	>= 934	4.82	<= 25		
SCU	< 175	16.7 – 0.0436**H**	<= 35	< 38.76 * **H**$^{-0.297}$ + 0.70 *Correction to the specification	≤ 25.0
	>= 175	9.11	<= 35		


IMH Batch Type
Air-Cooled Automatic Commercial Ice Maker
Energy Consumption Rate vs Ice Harvest Rate
Energy Consumption Rate (kWh/100 lbs of ice)
10
9
8
7
6
5
4
3
0
500
1000
1500
2000
Ice Harvest Rate (lbs of ice/24 hrs)
Automatic Commercial Ice Maker
Overall Batch Trend
CEE Tier II
DOE Energy Conservation Standard
ENERGY STAR V 1.1 Level
ENERGY STAR V 2.0 Draft 1 Proposed Level


RCU Batch Type
Air-Cooled Automatic Commercial Ice Maker
Energy Consumption Rate vs Ice Harvest Rate
Energy Consumption Rate (kWh/100 lbs of ice)
10
9
8
7
6
5
4
3
2
0
1000
2000
3000
4000
5000
Ice Harvest Rate (lbs of ice/24 hrs)
Automatic Commercial Ice Maker
Overall Batch Trend
CEE Tier II
DOE Energy Conservation Standard
ENERGY STAR V 1.1 Level
ENERGY STAR V 2.0 Draft 1 Proposed Level


SCU Batch Type
Air-Cooled Automatic Commercial Ice Maker
Energy Consumption Rate vs Ice Harvest Rate
Energy Consumption Rate (kWh/100 lbs of ice)
16
14
12
10
8
6
4
2
0
0
200
400
600
800
1000
Ice Harvest Rate (lbs of ice/24 hrs)
Automatic Commercial Ice Maker
Overall Batch Trend
CEE Tier II
DOE Energy Conservation Standard
ENERGY STAR V 1.1 Level
ENERGY STAR V 2.0 Draft 1 Proposed Level

Air-Cooled Batch Type
V 2.0 Qualification Rate Analysis

	Potable Water Use	Energy Use Qual %	Potable Water Use Qual %	ENERGY STAR Qual %	Units Qual	Manuf Qual %	Manuf Qual	Total Manuf
IMH	20	46%	55%	23%	30/131	60%	3	5
RCU	20	39%	59%	25%	43/173	100%	6	6
SCU	25	45%	45%	32%	15/47	33%	2	6

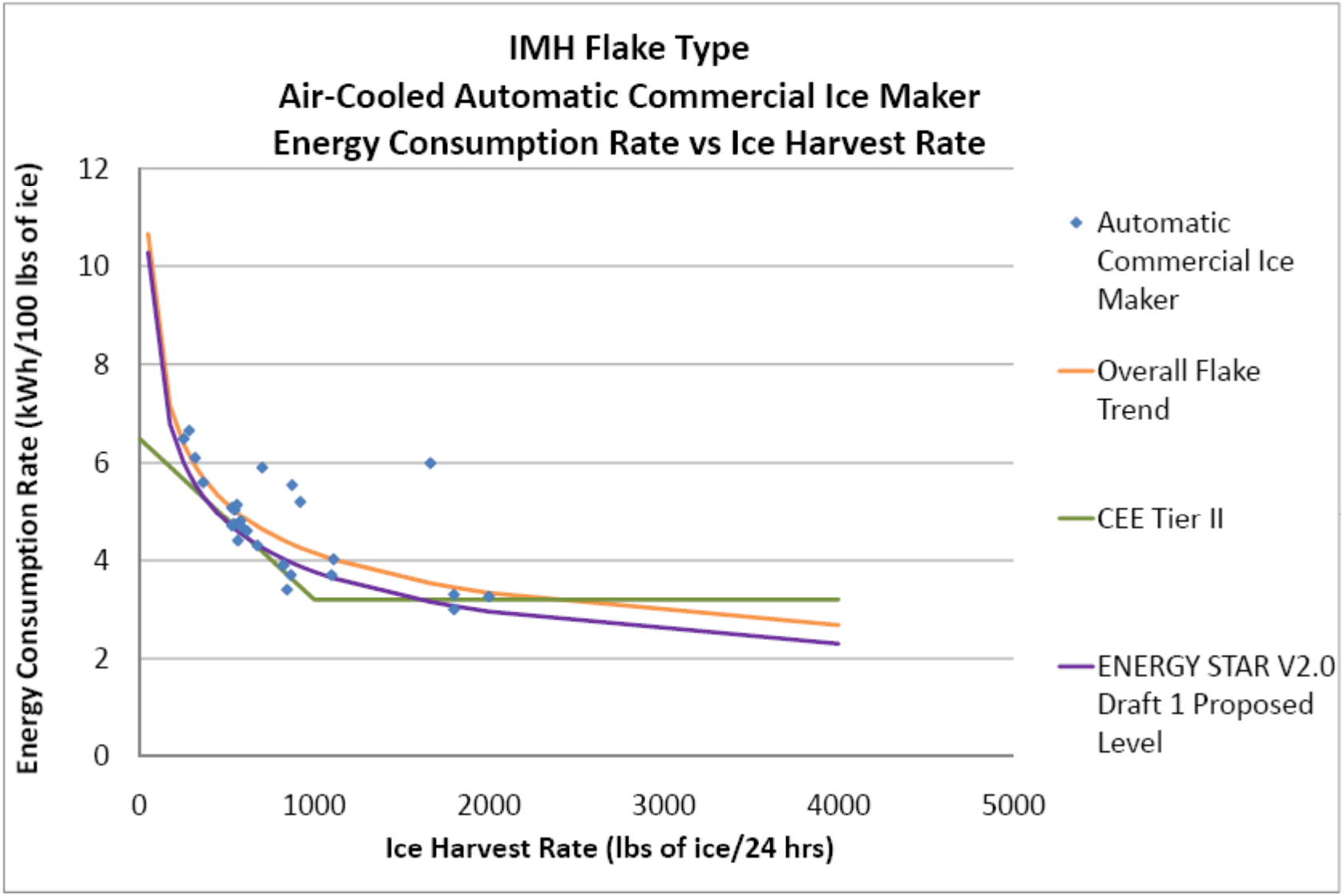
Air-Cooled Batch Type
Cost Effectiveness Analysis

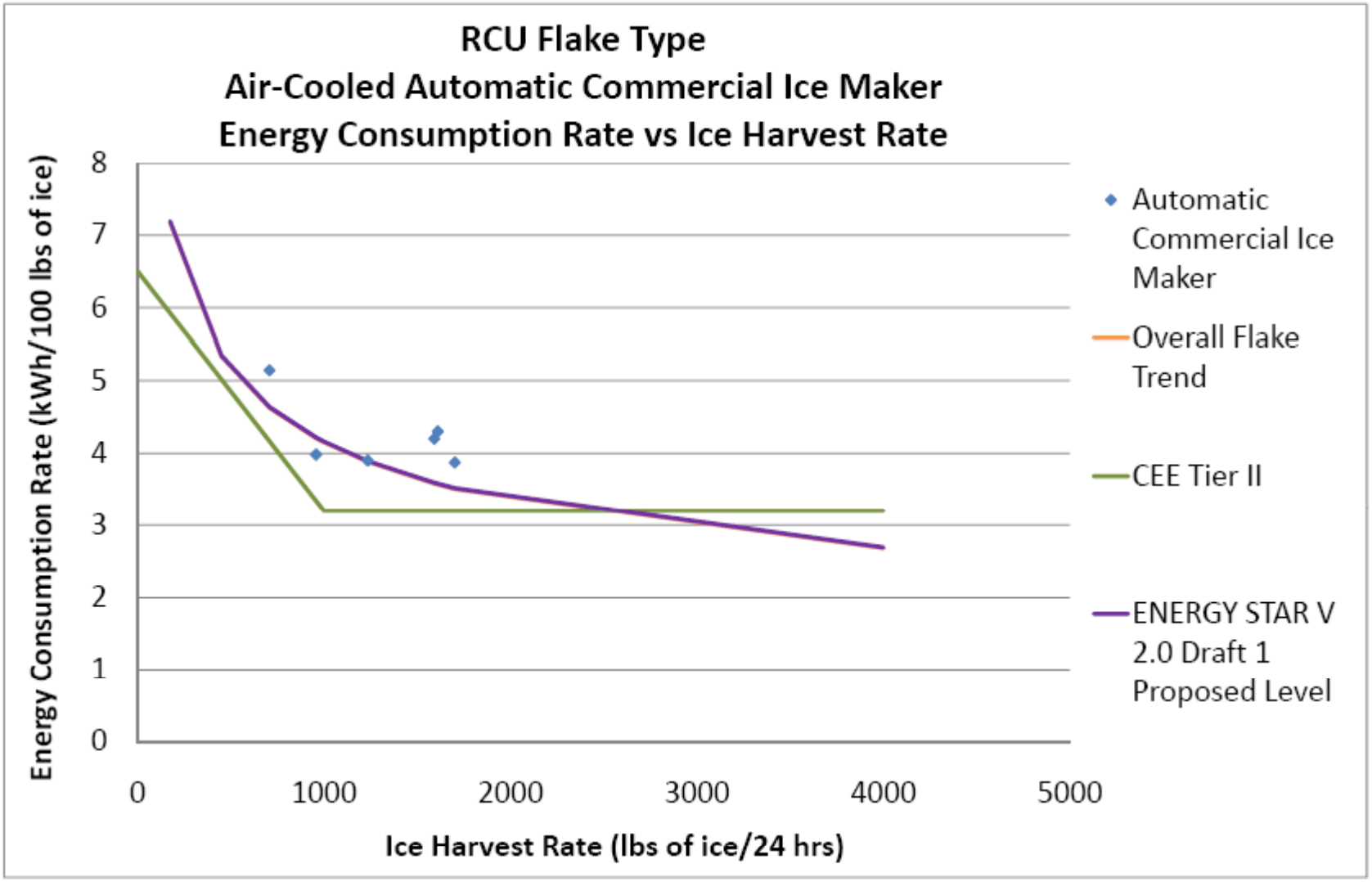
	Incr. Cost	Harvest Rate (lbs ice/day)	Energy Use (kWh/100 lbs ice)	Potable Water Use (gal/100 lbs ice)	Annual Energy Savings (kWh/year)	Annual Water Savings (gallons/ year)	Annual Savings ($)	Simple Payback
IMH	$(265.00)	503	5.66	19.7	379	7,780	**$99.62**	**0**
IMH	$(777.00)	1530	4.1	17.0	3310	9,475	**$431.57**	**0**
RCU	$(300.00)	1197	4.3	16.0	1650	11,478	**$265.82**	**0**
SCU	$(147.00)	50	10.6	20.6	520	1,834	**$70.40**	**0**
SCU	$(406.00)	121	8.4	17.8	1418	8,318	**$216.84**	**0**

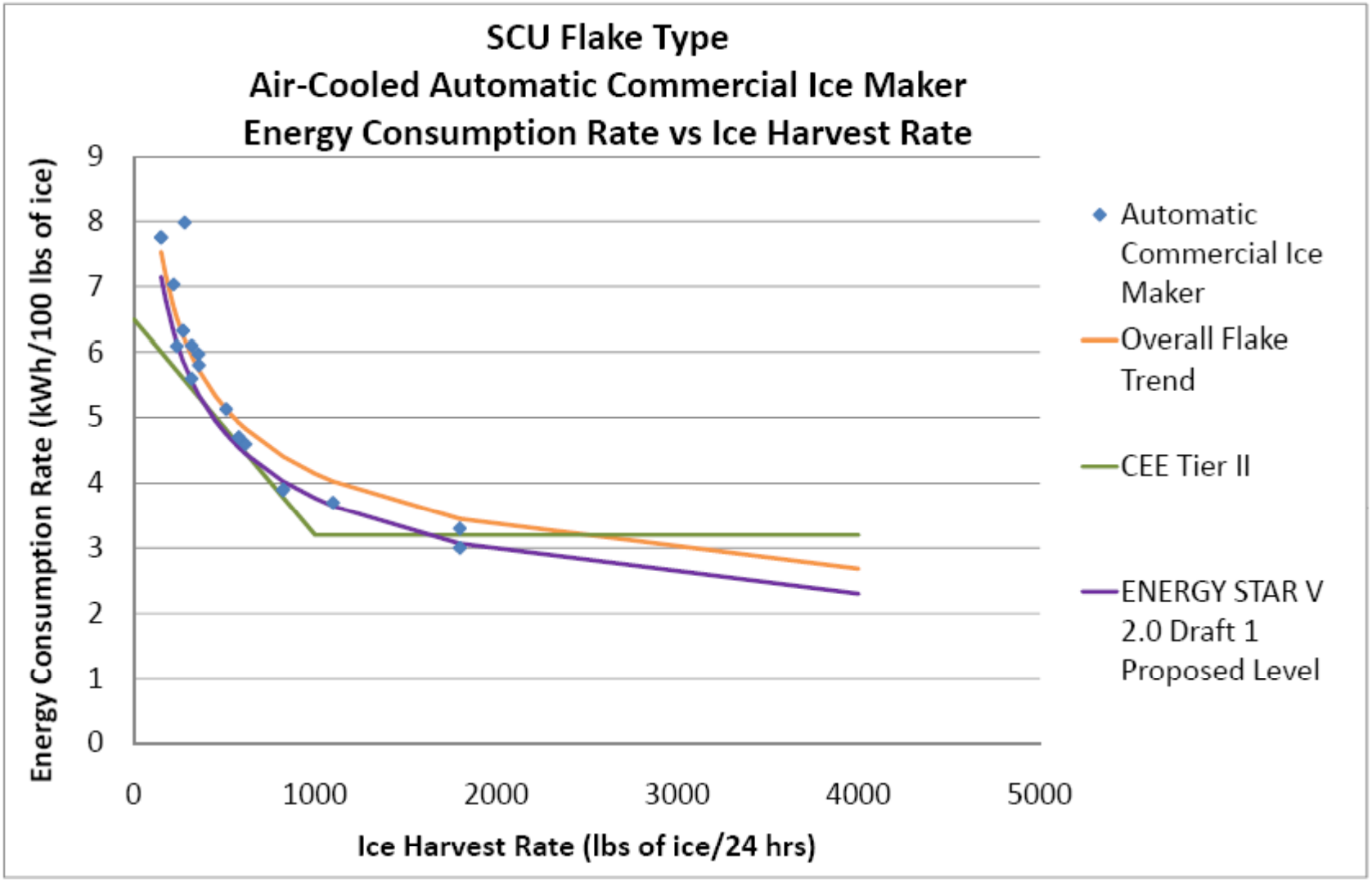
*Systems of similar harvest rate were selected for the cost comparison

Air Cooled Continuous – Flake
V 2.0 Proposed Levels

Type	Energy Consumption Rates (kWh/100 lbs ice)	Potable Water Use (Gal/100 lbs ice)
IMH	$< 36.55 * H^{-0.315} - 0.38$	$\leq$ 12.0
RCU	$< 36.55 * H^{-0.315} + 0.01$	$\leq$ 12.0
SCU	$< 36.55 * H^{-0.315} - 0.38$	$\leq$ 12.0


IMH Flake Type
Air-Cooled Automatic Commercial Ice Maker
Energy Consumption Rate vs Ice Harvest Rate
Energy Consumption Rate (kWh/100 lbs of ice)
12
10
8
6
4
2
0
0
1000
2000
3000
4000
5000
Ice Harvest Rate (lbs of ice/24 hrs)
Automatic Commercial Ice Maker
Overall Flake Trend
CEE Tier II
ENERGY STAR V2.0 Draft 1 Proposed Level


RCU Flake Type
Air-Cooled Automatic Commercial Ice Maker
Energy Consumption Rate vs Ice Harvest Rate
Energy Consumption Rate (kWh/100 lbs of ice)
0
1
2
3
4
5
6
7
8
0
1000
2000
3000
4000
5000
Ice Harvest Rate (lbs of ice/24 hrs)
Automatic Commercial Ice Maker
Overall Flake Trend
CEE Tier II
ENERGY STAR V 2.0 Draft 1 Proposed Level


SCU Flake Type
Air-Cooled Automatic Commercial Ice Maker
Energy Consumption Rate vs Ice Harvest Rate
Energy Consumption Rate (kWh/100 lbs of ice)
0
1
2
3
4
5
6
7
8
9
0
1000
2000
3000
4000
5000
Ice Harvest Rate (lbs of ice/24 hrs)
Automatic Commercial Ice Maker
Overall Flake Trend
CEE Tier II
ENERGY STAR V 2.0 Draft 1 Proposed Level

Air Cooled Continuous – Flake Qualification Rate Analysis

	Potable Water Use	Energy Use Qual %	Potable Water Use Qual %	ENERGY STAR Qual %	Units Qual	Manuf Qual %	Manuf Qual	Total Manuf
IMH	12	25%	100%	25%	7/28	75%	3	4
RCU	12	17%	100%	17%	1/6	50%	1	2
SCU	12	20%	100%	20%	4/20	50%	2	4

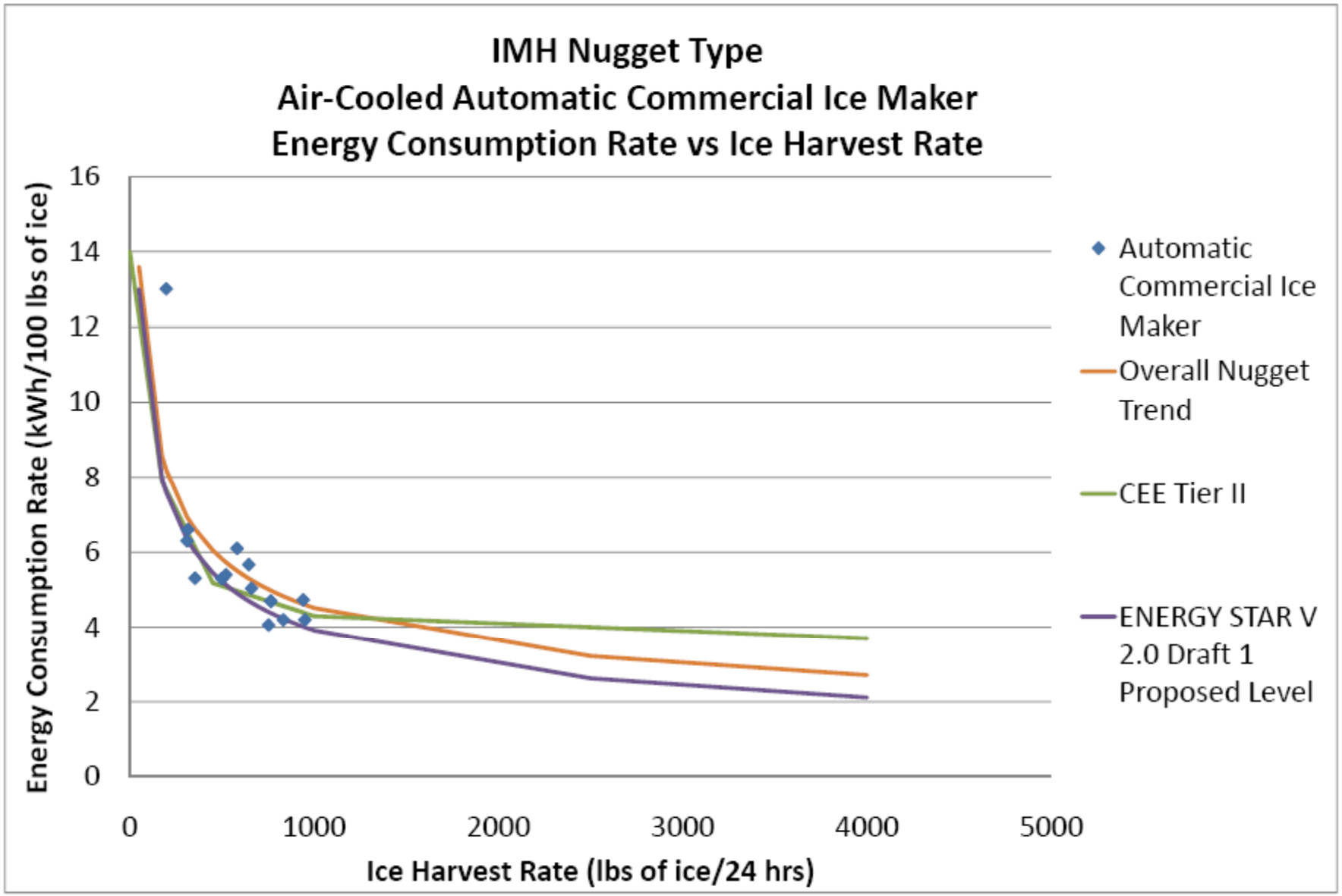
Air-Cooled Continuous – Flake Cost Effectiveness Analysis

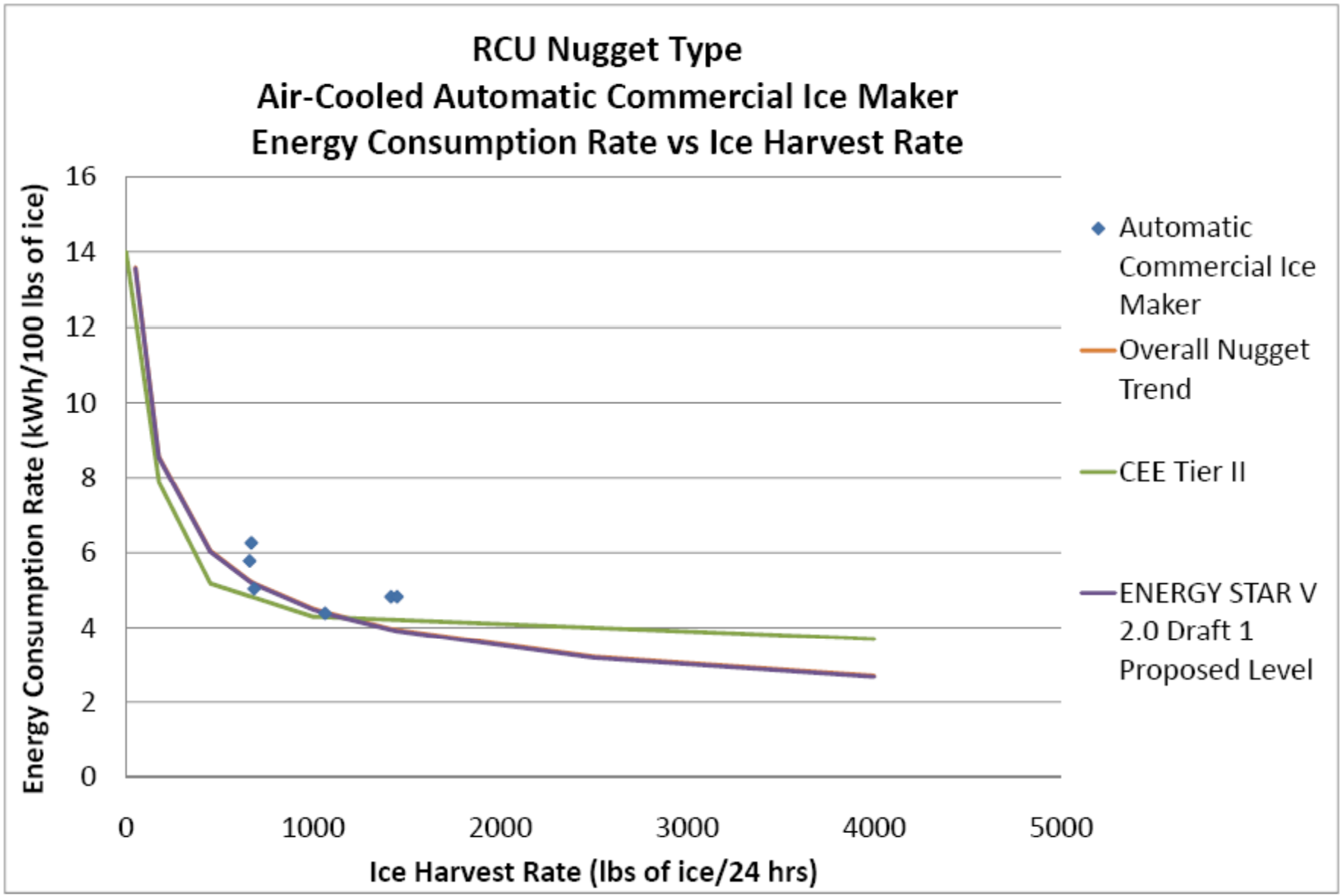
	Incr. Cost	Harvest Rate (lbs ice/day)	Energy Use (kWh/100 lbs ice)	Potable Water Use (gal/100 lbs ice)	Annual Energy Savings (kWh/year)	Annual Water Savings (gallons/ year)	Annual Savings ($)	Simple Payback
IMH	$ 100.00	564	4.4	12.0	811	483	**$91.95**	**1.1**
SCU	$(301.00)	238	6.09	12.0	761	1,154	**$91.54**	**0**

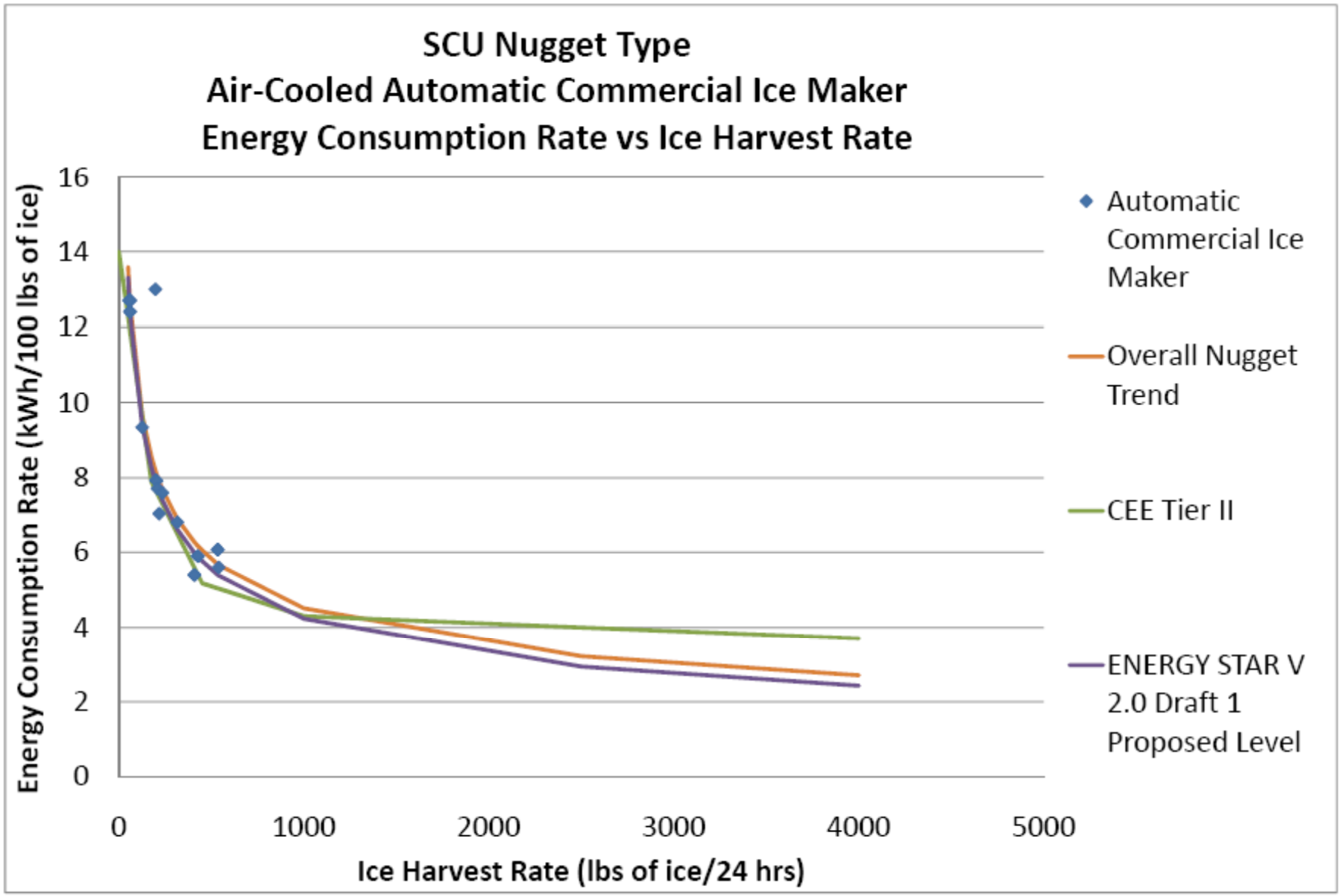
*Systems of similar harvest rate were selected for the cost comparison

Air Cooled Continuous – Nugget
V 2.0 Proposed Levels

Type	Energy Consumption Rates (kWh/100 lbs ice)	Potable Water Use (Gal/100 lbs ice)
IMH	$< 57.346 * H^{-0.368} - 0.60$	≤ 12.0
RCU	$< 57.346 * H^{-0.368} - 0.03$	≤ 12.0
SCU	$< 57.346 * H^{-0.368} - 0.28$	≤ 12.0


IMH Nugget Type
Air-Cooled Automatic Commercial Ice Maker
Energy Consumption Rate vs Ice Harvest Rate
Energy Consumption Rate (kWh/100 lbs of ice)
16
14
12
10
8
6
4
2
0
0
1000
2000
3000
4000
5000
Ice Harvest Rate (lbs of ice/24 hrs)
Automatic Commercial Ice Maker
Overall Nugget Trend
CEE Tier II
ENERGY STAR V 2.0 Draft 1 Proposed Level


RCU Nugget Type
Air-Cooled Automatic Commercial Ice Maker
Energy Consumption Rate vs Ice Harvest Rate
Energy Consumption Rate (kWh/100 lbs of ice)
16
14
12
10
8
6
4
2
0
0
1000
2000
3000
4000
5000
Ice Harvest Rate (lbs of ice/24 hrs)
Automatic Commercial Ice Maker
Overall Nugget Trend
CEE Tier II
ENERGY STAR V 2.0 Draft 1 Proposed Level


SCU Nugget Type
Air-Cooled Automatic Commercial Ice Maker
Energy Consumption Rate vs Ice Harvest Rate
Energy Consumption Rate (kWh/100 lbs of ice)
16
14
12
10
8
6
4
2
0
0
1000
2000
3000
4000
5000
Ice Harvest Rate (lbs of ice/24 hrs)
Automatic Commercial Ice Maker
Overall Nugget Trend
CEE Tier II
ENERGY STAR V 2.0 Draft 1 Proposed Level

Air Cooled Continuous – Nugget Qualification Rate Analysis

	Potable Water Use	Energy Use Qual %	Potable Water Use Qual %	ENERGY STAR Qual %	Units Qual	Manuf Qual %	Manuf Qual	Total Manuf
IMH	12	25%	94%	25%	4/16	67%	2	3
RCU	12	17%	100%	17%	1/6	100%	1	1
SCU	12	24%	100%	24%	5/21	100%	3	3

Air-Cooled Continuous Nugget Cost Effectiveness Analysis

	Incr. Cost	Harvest Rate (lbs ice/day)	Energy Use (kWh/100 lbs ice)	Potable Water Use (gal/100 lbs ice)	Annual Energy Savings (kWh/year)	Annual Water Savings (gallons/ year)	Annual Savings ($)	Simple Payback
IMH	$194.00	310	6.30	12.0	352	177	**$ 39.68**	**4.9**
RCU	$(700.00)	684	5.04	12.0	2040	(468)	**$ 218.67**	**0**
SCU	$(363.00)	219	7.03	12.0	700	582	**$ 80.61**	**0**

*Systems of similar harvest rate were selected for the cost comparison

Additional V2.0 Discussion Topics

- DOE Energy Conservation Standard is under revision
  - Test procedure should be finalized Winter 2011
    - Once published ENERGY STAR will reference the final TP
  - DOE proposed developing a test method to account for total energy used for RCU w/ remote rack compressor
    - EPA proposes excluding a test method is developed

V2.0 Discussion Topics

- Ice Hardness
  - EPA requests comments and data on
    - Normalizing continuous type ice maker energy and water use by ice hardness utilizing the equation proposed by DOE TP NOPR
    - EPA received a limited ice hardness data set, and requests more data in order to set levels.

V2.0 Discussion Topics

- EPA seeks more information on the effect of purge settings on potable water use
  - AHRI 810-2007 requires testing at the setting specified by the manufacturer's instruction
  - What is the feasibility of additional testing at the highest purge setting (worst case water use)?

V2.0 Discussion Topics

- EPA seeks more information on modulating capacity systems.
  - What is the market availability of the systems?
  - What is the feasibility of testing at each harvest rate and requiring energy requirements be met at each?

Revision Timeline

- **July**- Draft 2 released for review and comment
  - Early Aug - Comments due to EPA
- **October**- Final Draft released
  - Late October - Comments due to EPA
- **November 1, 2011** - Specification finalized

- **August 1, 2012 - V 2.0 becomes effective**
  - **Continuous systems may qualify as soon as spec is final**

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- Erica Porras, ICF International
  eporras@icfi.com, 703-225-2487

Corrections

As of the 5/23 stakeholder meeting, corrections were made to ensure the accuracy of the information presented as per stakeholder input during and after the meeting:

1. Added a “less than or equal to” sign for flake potable water use V 2.0 levels
2. Highlighted the V 2.0 energy use equation for SCU Batch as a correction to the specification, and not RCU Batch.
3. Corrected the flake plots to show correct CEE Tier 2 level lines.
4. Removed the negative paybacks and indicated zero to reflect immediate payback.