Southwest Power Pool

Economic Studies Working Group

January 11, 2018

41st Floor AEP Offices, Suite 4103 – Dallas, TX

• SUMMARY OF ACTIONS TAKEN •

1. Approved a motion to remove sales revenue of wind generation that does not have long-term firm transmission service from the APC benefit calculations as a benefit calculation mitigation of wind resources without firm transmission service.
2. Approved a motion stating that Load serving entities, who either own or have a signed PPA for renewable resources, will get credit for those resources when meeting their Renewable Policy Standards.
3. Approved a methodology for the total energy addition for Future 2 and the allocation of that energy.

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

January 11, 2018

41st Floor AEP Offices, Suite 4103 – Dallas, TX

• MINUTES •

Agenda Item 1 – Administrative Items

Agenda Item 1a - Call to Order, Introductions

Chair Alan Myers (ITC) called the meeting of the Economic Studies Working Group (ESWG) to order at 8:00 a.m., welcomed those in attendance, and asked for introductions.

There were 21 in-person participants and 55 web conference participants, representing 16 of 16 ESWG members. (Attachment 1 –January 11, 2018 Attendance List)

Agenda Item 1b – Receipt of Proxies

Alan Myers (ITC) asked for any proxy statements; five proxies were identified. (Attachment 2 – Proxy Statements)

- Randy Collier (CUS) named Kevin Foflygen (SPRM) as his proxy
- Bennie Weeks (Xcel/SPS) named Ben Elsey (SPS) as her proxy
- Brad Schwarz (Huntpower) named Alan Myers (ITC) as his proxy

Agenda Item 1c – Review of Agenda

Chair Alan Myers (ITC) presented the agenda for review and asked for any additions or corrections. (Attachment 3 – January 11, 2018 ESWG Agenda).

> **Kurt Stradley (LES) made a motion; seconded by Anita Sharma (AEP) to adopt the agenda as amended. The motion was approved unanimously.**

Agenda Item 2 – Review of Past Action Items

Amber Greb (SPP) reviewed the list of past action items and asked for any comments or questions. (Attachment 4 – Past Action Items)

Agenda Item 3 – Consent Agenda

The consent agenda included the following items:

a. Meeting Minutes – November 8th-9th, 2017

b. Meeting Minutes – November 30th, 2017

Alan Myers (ITC Great Plains) asked if any items should be removed from the consent agenda.

Jon Iverson (OPPD) requested that the November 9, 2017 minutes be pulled off the consent agenda. A grammar change occurred during the meeting. (Attachment 5 – November 8-9th, 2017; November 30, 2017 ESWG Minutes)

> **Kurt Stradley (LES) made a motion; seconded by Tim Owens (NPPD) to approve the meeting minutes as amended. The motion was approved unanimously.**

Agenda Item 4 – Member Attendance Educational Session

Amber Greb (SPP) brought to ESWG members attention, the direction provided by the Corporate Governance Committee related to Members attendance and proxy language from SPP bylaws. Amber reviewed the bylaws, explaining the expectations regarding attendance and proxies, as well why the attendance is important for the working group success. (Attachment 6 – Member Attendance)

Agenda Item 5 – Plexos Education Session

Steven Board (Plexos) provided a general Demo of Plexos software to the group. This agenda item is related to the action item 151. At the conclusion of this presentation, ESWG Members asked SPP staff about the next steps to complete this action item. Staff is still analyzing software, it will be a lengthy process that could take up to a year to trigger any changes. (Attachment 7 – PLEXOS General Demo)

Agenda Item 6 – 2019 ITP Items

Agenda Item 6a – 2019 ITP Schedule

Juliano Freitas (SPP) informed the group of the 2019 ITP schedule status and projected hours. Juliano talked about potentially adding additional conference calls and emails approval to meet deadlines. The group expressed interest of having a one through three-month reminder of upcoming milestone approvals. The group suggested providing the upcoming approval items to the point of contact list. (Attachment 8 – 2019 ITP Schedule)

Agenda Item 6b – Generation and Load Review

Nikki Roberts (SPP) provided an update on Load and Generation Review. Nikki reminded the group of final workbook posting. The group asked staff if renewable ownerships has been resolved. Staff informed the group that the issues was resolved. (Attachment 9 - 2019 ITP Load and Generation Review)

Agenda Item 6c – Renewable Resource Expansion Plan Mitigation

Chris Jamieson (SPP) reviewed a presentation on Renewable Resource Expansion Plan Mitigation. Chris continued discussions from a prior meeting. Chris reviewed an example for discussion purposes, demonstrating staff's recommendation. The group continued to discuss modeling changes to remove increased sales revenue to non-firm wind generation from incremental transmission APC benefits. A motion was made stating "SPP Staff will remove sales revenue of non-firm wind generation, from APC benefit calculation mitigation of wind resources without firm transmission service." An amendment proposed to remove the word wind, the amendment was not approved. The current motion assumes future solar and conventional will go out for firm service and wind would not.

> **Leon Howell (OGE) made a motion; seconded by Tim Owens (NPPD) to approve SPP staff will remove sales revenue of wind generation that does not have long-term firm transmission service from the APC benefit calculations as a benefit calculation mitigation of wind resources without firm transmission service. The motion was approved with one abstention: Natasha Henderson (GSEC) and five in opposition: Anita Sharma (AEP); Alan Myers (ITC); John Olsen (Westar); Brad, and Bethany King (EDE)**
>
> **"Westar voted no on the motion to remove sales revenue of wind generation that does not have long-term firm transmission service from the APC benefit calculations for the exclusion of LSE contracted resources from the transmission APC benefits will understate the benefits to customers who ultimately pay the costs for the transmission system. We agree with the exclusion of the increased revenues from the benefits calculation for generators who have neither firm transmission nor a contract with an SPP LSE. - John Olsen (Westar Energy)"**

The group proceeded to discuss how to handle accreditation without firm service and how to assign projected wind. The wind will be allocated to maximize the accreditation. The order of operation for accreditation is as follows: Existing conventional and renewables; Policy solar and wind from RP1; Projected solar; Projected wind and then conventional resources from RP2. The group requested staff to develop presentation on how to assign accreditation. Members stated that non-firm wind resources can be

also utilized for accreditation purposes. (Attachment 10 – 2019 Renewable Resource Expansion Plan Mitigation)

Agenda Item 6g – Renewable Policy Review

Amber Greb (SPP) reviewed a presentation on 2019 ITP Renewable Policy Review. Amber provided Renewable Policy Standards by state and reviewed the ITP Manual language related to this agenda item. (Attachment 11 – 2019 ITP Renewable Policy Review)

Agenda Item 6h – Renewable Resource Plan

Amber Greb (SPP) reviewed a presentation on 2019 ITP Renewable Resource Planning. Amber informed the group of the Renewable Resource plan methodology and renewable additions from external areas. The group also discussed non-firm resources with a PPA being counted towards shortfalls. (Attachment 12 – 2019 ITP Resource Planning)

> **John Olsen (Westar) made a motion; seconded by Bethany King (EDE) to accept SPP staff's recommendation for load serving entities who either own or have a signed PPA for renewable resources, will get credit for those resources when meeting their Renewable Policy Standards. The motion was approved unanimously.**

Agenda Item 6e – Future 2 Energy Increase Implementation

Liz Gephardt (SPP) reviewed a presentation on 2019 ITP Future 2 Increased Energy. Liz covered methodology for Future 2 EV energy penetration dividing the presentations in three parts: 1) How much energy do we add, 2) how do we allocate the energy to the zones, and 3) how do we allocate the energy throughout the year. (Attachment 13 – 2019 ITP Future 2 increase Energy Implementation)

> **Leon Howell (OGE) made a motion; seconded by Natasha Henderson (GSEC) to accept SPP staff's recommendation for Future 2 EV energy penetration methodology. The motion was approved unanimously.**

Agenda Item 6f – OPPD Resource Plan

Item not covered.

Agenda Item 6i – Wind and Solar Profiles

Item not covered.

Agenda Item 6j – Siting

Item not covered.

Closing Items

Chair Alan Myers (ITC) requested other items meriting discussion.

List of action items from the meeting:

1. None

The meeting was adjourned at 2:58 PM

Respectfully Submitted,

Amber Greb

ESWG Secretary

Name	Email	Attendance
Adam McKinnie	MO PSC	In Person
Alan Myers	ITC	In Person
Amber Greb	SPP	In Person
Anita Sharma	AEP	In Person
Bethany King	EDE	In Person
Brian Johnson	AEP	In Person
Calvin Daniels	WFEC	In Person
Jarrod Wolford	NTEC	In Person
Jim Jacoby	AEP	In Person
Jody Holland	SCMCN	In Person
John Olsen	Westar	In Person
Juliano Freitas	SPP	In Person
Kurt Stradley	LES	In Person
Meena Thomas	Texas PUS	In Person
Michael Wegner (ITC)	ITC	In Person
Natasha Henderson	GSEC	In Person
Ryan Yokley	SUNC	In Person
Steve Gaw	Wind Coalition	In Person
Steven Broad	Energy Exemplar	In Person
Tim Owens	NPPD	In Person
Wayne Penrod	SUNC	In Person
Aaron Shipley	ashipley@spp.org	Webex
Aaron Vander Vorst (TWE)	avandervorst@tradewindenergy.c	Webex
Al tamimi	atamimi@sunflower.net	Webex
Antonio Barber - SPP	abarber@spp.org	Webex
Ashley Gibbons (SPS)	ashley.gibbons@xcelenergy.com	Webex
Ben Abing	babing@itctransco.com	Webex
Ben Elsey (SPS)	ben.r.elsey@xcelenergy.com	Webex
Bennie Weeks (Xcel/SPS)	bennie.weeks@xcelenergy.com	Webex
Bill Leung (NPRB)	bleung@bjleung.com	Webex
Blaine Erhardt	berhardt@bepc.com	Webex
Brian Rounds (AESL)	brian.rounds@aeslconsulting.com	Webex
Charles Shue (ITC)	cshue@itctransco.com	Webex
Chris Cranford (SPP)	ccranford@spp.org	Webex
Chris Hagman (ATC)	chagman@atcllc.com	Webex
Chris Nugent	cnugent@tradewindenergy.com	Webex
Clayton Mayfield (SPP)	cmayfield@spp.org	Webex
Colton Kennedy	cmkennedy@oppd.com	Webex
Don Frerking (KCP&L)	don.frerking@kcpl.com	Webex
ed pfeiffer (quanta)	epfeiffer@quanta-technology.com	Webex
Eddie Watson	ewatson@spp.org	Webex
Evan Racine-Johnson (GSEC)	eracine-johnson@gsec.coop	Webex
Gimod Olapurayil	golapurayil@itctransco.com	Webex
James Bailey (SPP)	jbailey@spp.org	Webex
Jason Mazigian	jmazigian@bepc.com	Webex
Jason Shook (GDS/ETEC)	jason.shook@gdsassociates.com	Webex

Jeff Knottek	jeff.knottek@cityutilities.net	Webex
Jeremi Wofford (SPRM)	jeremi.wofford@cityutilities.net	Webex
Jeremy Severson (BEPC)	jseverson@bepc.com	Webex
Joe Fultz - GRDA	jfultz@grda.com	Webex
Joey Schrepel	jschrepel@bepc.com	Webex
John Boshears	john.boshears@cityutilities.net	Webex
John Fernandes	jfernandes@invenergyllc.com	Webex
John Mayhan (OPPD)	jmayhan@oppd.com	Webex
John Tennyson (SPRM)	john.tennyson@cityutilities.net	Webex
Jon Iverson	jiverson@oppd.com	Webex
Josie Daggett	daggett@wapa.gov	Webex
Kelsey Allen	kallen@spp.org	Webex
Kevin Foflygen (SPRM)	kevin.foflygen@cityutilities.net	Webex
Kirk Hall	khall@spp.org	Webex
Lane Sisung	lane@sisung.com	Webex
Leon Howell	howelllc@oge.com	Webex
Liz Gephardt (SPP)	lgephardt@spp.org	Webex
Marisa Choate	mchoate@spp.org	Webex
Michael Watt	mwatt@ompa.com	Webex
Nikki Roberts	nroberts@spp.org	Webex
Pat Hayes	phayes@lspower.com	Webex
Randy Collier (CUS)	randy.collier@cityutilities.net	Webex
Ryan Baysinger	ryan.baysinger@kcpl.com	Webex
Scott Bents (IUB)	scott.bents@iub.iowa.gov	Webex
Shawn Geil (KEPCo)	sgeil@kepco.org	Webex
Sherri Maxey	smaxey@spp.org	Webex
Steve Hohman	shohman@oppd.com	Webex
Tim Hall (Southern Power)	timhall@southernco.com	Webex
Yohan Sutjandra (TEA)	ysutjandra@teainc.org	Webex
Zac Hager	hagerzc@oge.com	Webex

1.

Amber/Alan,
I give my proxy to Kevin Foflygen from 8:00-10:00 for the ESWG meeting on 1/11/18.

Thanks,
Randy Collier
Contract Manager-Electric Supply
O: 417.831.8323

PO Box 551 | Springfield, MO 65801-0551
cityutilities.net

2.

Hey Alan. It's becoming obvious we are probably not going to cover the whole agenda today. I thought we would get to most of the voting items before I have to leave for a PT appointment at 1:45 so I am going to designate Ben Elsey as my proxy beginning at 1:30 today.

Bennie Weeks
Xcel Energy | Responsible By Nature
Mgr., Resource Planning
600 S. Tyler, Suite 29C01 Amarillo, Texas 79101
P: 806.378.2508 C: 806.316.6313
E: Bennie.Weeks@xcelenergy.com
_____
XCELENERGY.COM

3.

Ok. Thanks Brad. We'll note for the minutes.

Thanks,
Alan

From: Brad Schwarz [mailto:bschwarz@huntpower.com]
Sent: Wednesday, January 10, 2018 2:52 PM
To: 'awhite@spp.org' <awhite@spp.org>; Myers, Alan K. <amyers@Itctransco.com>
Subject: [EXT] FW: ESWG 01/11/2018 Agenda & Background Materials posted

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Alan,

I want to give my proxy to you for the 1/11/18 ESWG meeting.

Brad

ECONOMIC STUDIES WORKING GROUP MEETING

January 11th, 2017

41st Floor AEP Offices, Suite 4103 – Dallas, TX

• A G E N D A •

1. Administrative Items
    a. Call to Order, Introductions ..... Alan Myers (5 minutes)
    b. Receipt of Proxies ..... Amber Greb (1 minute)
    c. Review of Agenda[1] ..... Alan Myers (1 minute)
2. Review of Past Action Items[1] ..... Amber Greb (10 minutes)
3. Consent Agenda ..... Alan Myers (1 minute)
    a. Meeting Minutes – November 8-9th, 2017
    b. Meeting Minutes – November 30th, 2017
4. Member Attendance Educational Session ..... Amber Greb (15 Minutes)
5. Plexos Education Session ..... Steven Broad (90 minutes)
6. 2019 ITP Items ..... SPP Staff (200 minutes)
    a. Schedule[1] ..... Juliano Freitas (30 minutes)
    b. Generation and Load Review[1] ..... Nikki Roberts (10 minutes)
    c. Renewable Resource Expansion Plan Mitigation[1](Approval Item) Chris Jamieson (25 minutes)
    d. Renewable Pricing[1] ..... Chris Jamieson (20 minutes)
    e. Future 2 Energy Increase Implementation[1] (Approval Item) ..... Liz Gephardt (30 minutes)
    f. OPPD Resource Plan ..... OPPD/Staff (20 minutes)
    g. Renewable Policy Review[1] ..... Amber Greb (15 minutes)
    h. Renewable Resource Plan[1] (Approval Item) ..... Amber Greb (20 minutes)
    i. Wind and Solar Profiles[1] ..... James Bailey (15 minutes)
    j. Siting[1] ..... Liz Gephardt (15 minutes)
7. Closing Items ..... All (5 minutes)
    a. Summary of Action Items (Amber Greb)
    b. Future Meetings

[1] Background Material Included

i. February 22nd, 2018: OG&E Office, Leadership Square, North Tower 14th Floor
ii. March 15th, 2018: 41st Floor AEP Office, Dallas, TX
iii. April 25th, 2018: KCP&L office in the One Kansas City Place building

Southwest Power Pool, Inc.

ECONOMIC STUDIES WORKING GROUP

Pending Action Items Status Report

January 11, 2017

	Action Item	Date Originated	Status	Comments
151	SPP staff to look into optional software tools for use in ITP studies.	May 20th, 2015	In Progress SPP Staff	February, 2017: Presentation on EGEAS. Hold on investigation of alternatives until EGEAS and ABB's new Capacity Expansion tool are able to be fully tested and compared.
173	SPP staff to develop a process for annual update of the economic model with vendor data.	June 16th, 2016	In Progress SPP Staff	
183	SPP staff to perform transmission outage analysis in the first part of 2017 to determine the appropriate APC benefit percentage to utilize for the mitigation of transmission outages benefit metric.	September 15th, 2016	In Progress SPP Staff	ESWG Approved the methodology and staff to begin analysis
185	ESWG to continue working on and finalize the Resource Siting Manual	June 29th, 2017	In Progress ESWG	
186	Formalize the economic model data guidelines and submission process	July 20th, 2017	In Progress SPP staff	Replaces action item 160
187	Address the objections raised to the approved renewable VOM modeling detailed in the ITP manual	July 20th, 2017	In Progress SPP staff/ESWG	
189	Discuss mitigation options for concerns with who pays for and who benefits from transmission coming from the ITP process and how it may circumvent the GI and Aggregate study processes	October 4th, 2017	In Progress SPP staff/ESWG	
190	SPP staff to perform a full transmission outage analysis before the next RCAR	October 12th, 2017	SPP Staff	
191	SPP staff create language for the individual project review option for consolidation	October 12th, 2017	Complete	Language was approved with the ITP Scope on January 3rd, 2018

192	SPP Staff to draft an Revision Request to update the ITP Manual language to reflect a $0 or $8/MWH solar and wind VOM price.	December 14th, 2017	In Progress, SPP Staff	

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

November 8-9, 2017

Southwest Power Pool Office Little Rock, AR

• SUMMARY OF ACTIONS TAKEN •

1. Approved an implementation plan for Resource Addition Requests and Waivers.
2. Approved the Economic Operational Needs Solution Evaluation and Reliability Operational Needs Solution Evaluation language for the 2019 ITP Scope.
3. Approved the methodology to be used for natural gas and demand sensitivities in the 2019 ITP Study.
4. Approved a motion to pass on performing additional wind and solar sensitivities.

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

November 8-9, 2017

Southwest Power Pool Office Little Rock, AR

• MINUTES •

Agenda Item 1 – Administrative Items

Agenda Item 1a - Call to Order, Introductions

Chair Alan Myers (ITC) called the meeting of the Economic Studies Working Group (ESWG) to order at 1:00 p.m., welcomed those in attendance, and asked for introductions.

There were 30 in-person participants and 51 web conference participants, representing 16 of 16 ESWG members. (Attachment 1 – November 8, 2017 / November 9, 2017 Attendance List)

Agenda Item 1b – Receipt of Proxies

Alan Myers (ITC) asked for any proxy statements; five proxies were identified. (Attachment 2 – Proxy Statements)

- Brad Schwarz (Hunt) named Alan Myers (ITC) as his proxy
- John Olsen (Westar) named Grant Wilkerson (Westar) as his proxy
- Jon Iverson (OPPD) named Steve Hohman (OPPD) as his proxy
- Leon Howell (OGE) named Zac Hager (OGE) as his proxy
- Natasha Henderson (Golden Spread) named Evan Racine-Johnson (Golden Spread) as her proxy

Agenda Item 1c – Review of Agenda

Chair Alan Myers (ITC) presented the agenda for review and asked for any additions or corrections. (Attachment 3 – November 9, 2017 ESWG Agenda).

Staff Removed Item 5c Stability Assessment from the agenda

> **Kurt Stradley (LES) made a motion; seconded by Tim Owens (NPPD) to adopt the agenda as amended. The motion was approved unanimously.**

Agenda Item 2 – Review of Past Action Items

Amber Greb (SPP) reviewed the list of past action items and asked for any comments or questions. (Attachment 4 – Past Action Items)

Agenda Item 3 – Consent Agenda

The consent agenda included the following items:

a. Meeting Minutes – September 28, 2017

b. Meeting Minutes – October 4, 2017

c. Meeting Minutes – October 12, 2017

Alan Myers (ITC Great Plains) asked if any items should be removed from the consent agenda.

Tim Owens (NPPD) pulled September 28, 2017 minutes off the consent agenda. He requested a change to add clarity, this adjustment was made during the meeting. (Attachment 5 – September 284th, 2017 ESWG Minutes, October 4th, 2017 ESWG Minutes, October 12th, 2017 ESWG Minutes)

> **Kurt Stradley (LES) made a motion; seconded by Tim Owens (NPPD) to approve the meeting minutes as amended. The motion was approved unanimously.**

Agenda Item 4 – 2019 ITP Load and Generation Review

Nikki Roberts (SPP) provided an update on Load and Generation Review. Nikki reminded the group that pass two has been posted and went over the review period and deadlines. (Attachment 6 - 2019 ITP Load and Generation Review)

Agenda Item 4a – Resource Addition Request

Nikki Roberts (SPP) presented RARs and Waivers; providing implementation options. The first option is to only include resources that meet the resource inclusion criteria as outlined in the ITP manual. The second option is to develop levels of inclusion based on the answers provided in the RAR and waiver request forms. The group discussed the pros and cons of each option. (Attachment 6 - 2019 ITP Load and Generation Review)

Zac Hager (OGE) made a motion; seconded by Kurt Stradley (LES) to approve Implementation Option 1 for RARs and Waivers. The motion was approved unanimously.

Agenda Item 5 – 2019 ITP Scope Items

Agenda Item 5a – 2019 ITP Schedule

Juliano Freitas (SPP) informed the ESWG that SPP staff is continuing to work towards finalizing the 2019 ITP schedule. The final schedule will be included in the study scope.

Agenda Item 5b – Consolidation

Juliano Freitas (SPP) reviewed a presentation on the 2019 ITP Portfolio Consolidation. Juliano outlined the steps to get to a final portfolio for each future, before discussing the final portfolio consolidation. Based on stakeholder direction to look at projects on an individual basis, a list of ten proposed consolidation considerations was presented for group discussion. The ESWG went through the list of considerations and discussed how they could be used to judge the merits of each project. Staff was asked to consider using a 20-year benefit calculation instead of the traditional 40-year calculation ~~use have~~ used in the past. This topic will continue being discussed in future meetings as a mitigation plan.

Staff was asked to send out a survey to stakeholders to determine the importance of each of the proposed considerations. This topic will be brought back to the next ESWG meeting. (Attachment 7 – Portfolio Consolidation)

Agenda Item 5c – Operational Project Evaluation

Will Tootle (SPP) provided updated language for Economic Operational Needs Solution Evaluation and Reliability Operational Needs Solution Evaluation. The group has previously reviewed the language and discussion focused on the chart showing the relief tiers for project evaluation. An update was made to clarify what amount of relief is included in each tier. (Attachment 8 – Operational Project Evaluations)

Zac Hager (OGE) made a motion; seconded by Gayle Nansel (WAPA) to approve Operational Project Evaluation. The motion was approved unanimously.

Agenda Item 6 – 2018 ESWG Meeting Schedule

Amber Greb (SPP) reviewed 2018 ESWG Meeting Schedule. The group decided to schedule two half day meetings in May and also in August of 2018. (Attachment 9 – 2018 ESWG Meeting Schedule)

Agenda Item 5d – Sensitivities

Clayton Mayfield (SPP Staff) presented on Sensitivities for the 2019 ITP. Clayton reviewed the approved ~~the~~ ITP manual language. Clayton presented options for the natural gas sensitivity, the group discussed each option. (Attachment 10 – Sensitivities)

Zac Hager (OGE) made a motion; seconded by Anita Sharma (AEP) to approve option three for both high and low natural gas sensitivities. The motion was approved with two

No votes, Grant Wilkerson (Westar) and Evan Racine-Johnson (GSEC). Alan Myers (ITC) abstained from voting on behalf of ITC great Plains and Hunt Transmission.

Evan Racine-Johnson (GSEC) voted No for the following reasons. The current ABB fundamental natural gas forecast is and has repeatedly been unrealistically high. ABB's -2 standard deviation "low" sensitivity is higher than traded NYMEX gas, which effectively ignores valuable price signals from the traded financial market. The NYMEX traded futures along with other fundamental models appropriately incorporate technological shifts (i.e. electric vehicles) and stagnant global gas/LNG demand. This serves to dampen fundamental price drivers, which is evident in the NYMEX traded futures and Bloomberg's forecast among others. To completely ignore the possibility that the market signals are correct is to introduce bias that can lead to non-optimal transmission, and will very likely lead to increased cost to rate payers.

Clayton (SPP) proceeded to provide two options for load sensitivities. Clayton reviewed the process for each option. The group discussed the load forecast values presented for option one. Alex Crawford (SPP) provided an overview of the Load Forecasting Uncertainty methodology used in the 2017 LOLE study. The group was more comfortable with option two, which uses a standard deviation. (Attachment 5d – Sensitivities)

Grant Wilkerson (Westar) made a motion; seconded by Zac Hager (OGE) to approve option two for both high and low demand sensitivities. The motion was approved.

Clayton (SPP) moved onto the Reduced Wind and Solar sensitivities. There was concern about the value of this sensitivity. The group expressed concerns with staff ability to perform sensitivity due to time constraints. The idea of performing only a High or Low Wind sensitivity was proposed, but there was not consensus on which would be more beneficial. The group agreed not to perform Reduced Wind and Solar sensitivity. (Attachment 5d – Sensitivities)

Tim Owens (~~OPPD~~NPPD) made a motion; seconded by Bethany King (Empire) to pass on performing additional Wind and Solar sensitivities. The motion was approved.

Agenda Item 7 – Net Plant Carrying Charge (NPCC)

Charles Locke (SPP) provided an overview of Net Plant Carrying Charge. He reviewed the components of the annual revenue requirement, net plant carrying charge, and the methodology used in the current ITP studies. Golden Spread requested numerical examples for equations in presentation. (Attachment 11 – NPPC)

Closing Items

Chair Alan Myers (ITC) requested other items meriting discussion.

List of action items from the meeting:

1. None

The meeting was adjourned at 11:20 A.M.

Respectfully Submitted,

Amber Greb

ESWG Secretary

Southwest Power Pool

TRANSMISSION/ECONOMIC STUDIES WORKING GROUP MEETING

November 30, 2017

Net Conference

• Summary of Action Items •

1. Approved the meeting agenda
2. Approved the 2019 ITP Voltage Stability Scope
3. Approved Resource Addition Requests

Southwest Power Pool

TRANSMISSION/ECONOMIC STUDIES WORKING GROUP MEETING

November 30, 2017

Net Conference

• M I N U T E S •

Agenda Item 1 – Administrative Items

Call to Order

TWG Chair Travis Hyde called the meeting to order at 8:05 am. The following members were in attendance (Attachment 1a – Attendance):

TWG

Travis Hyde (Chair), Oklahoma Gas & Electric
Daniel Benedict, City of Independence
Scott Benson, Lincoln Electric System
John Boshears, City Utilities of Springfield
John Fulton, Southwestern Public Service Company
Joe Fultz, Grand River Dam Authority (Phone)
James Ging, Kansas Power Pool
Kalun Kelley, Western Farmers' Electric Cooperative
John Knofczynski, East River Electric Power Cooperative
Dan Lenihan, Omaha Public Power District
Randy Lindstrom, Nebraska Public Power District
Jim McAvoy, Oklahoma Gas & Electric
Matt McGee, American Electric Power
Nathan McNeil, Midwest Energy Inc.
Michael Mueller, Arkansas Electric Cooperative Corporation
Alan Myers, ITC Great Plains
Jason Shook, GDS Associates representing ETEC
Matthew Stoltz, Basin Electric Power Cooperative
Harold Wyble, Kansas City Power & Light

ESWG

Alan Myers (Chair), ITC Great Plains
Randy Collier, City Utilities of Springfield
Natasha Henderson, Golden Spread Electric Cooperative
Jon Iverson, Omaha Public Power District
Bethany King, Empire District Electric
John Olsen, Westar Energy, Inc.
Tim Owens, Nebraska Public Power District
Jeremy Severson, Basin Electric Power Cooperative
Anita Sharma, American Electric Power
Kurt Stradley, Lincoln Electric System
Michael Watt, Oklahoma Municipal Power Authority
Bennie Weeks, Southwestern Public Service Company

Proxies

The following proxies (Attachment 1b – Proxy) were provided prior to the meeting for both the TWG and ESWG.

- Josie Daggett (WAPA) from Gayle Nansel (WAPA) – TWG/ESWG
- Wayne Penrod (Sunflower) from Al Tamimi (Sunflower) – ESWG

Kirk Hall and Amber Greb, SPP staff, informed their respective chair that the groups had achieved a quorum.

Agenda Review
Alan asked the ESWG members for any changes to the agenda (Attachment 1c – November 30, 2017 TWG Meeting Agenda). ESWG members had none.

> **ESWG Motion: Kurt Stradley made a motion to accept the agenda seconded by Tim Owens. The motion passed with no opposition.**

Travis asked the TWG members for any changes to the meeting agenda. TWG had no changes.

> **TWG Motion: Alan Myers made a motion to approve the agenda. Jason Shook seconded the motion. The motion passed unanimously.**

Agenda Item 2 – Consent Agenda (TWG-only item)

2019 ITP Voltage Stability Scope
Dan Lenihan had some questions related to the Voltage Stability Scope (Attachment 2 – 2019 ITP Voltage Stability Assessment Scope) and asked some discussion prior to voting. The group agreed to revisions being made to Section A of the document.

> **TWG Motion: Joe Fultz made a motion to approve the modified scope document. Daniel Benedict seconded the motion. The motion passed unanimously.**

Agenda Item 3 – 2019 ITP

Consolidation
Amber presented staff's consolidation proposal (Attachment 3a – 2019 ITP Portfolio Consolidation) for a systematic approach to consolidation. Staff asked the TWG and ESWG for specific feedback related to the points possible for each consideration, thresholds for point calculations, and the minimum score requirement for instances when a project is not competing against a separate project selected in the opposite future. After some discussion on each item, the group took straw polls to identify whether the majority of the members felt staff's initial proposal was sufficient or if it should be modified. Based on the results of two straw polls, a majority of both the TWG and ESWG agreed with staff's recommendations for the points possible for APC and the thresholds for receiving points. Additionally, the TWG and ESWG voted to remove consideration of a solution's ability to address ARR Feasibility concerns and the solutions ability to rebuild existing infrastructure with a limited useful life (Considerations 7 and 8 in the meeting materials). Even though a majority of the members agreed with the concept of the systematic approach, they were not ready to approve until a calculation method for awarding points for APC had been developed and reviewed.

> **Action Item: Staff to send out 3 options discussed during the meeting for the systematic approach to allow stakeholders to select their preference prior to the next joint meeting, and develop the formula for awarding points for the APC consideration.**

Resource Addition Requests

Tim Hall from Southern Power Company presented a Resource Addition Request (Attachment 3b – Southern Power Waiver Request). The TWG and ESWG requested some additional information from Tim and asked staff's recommendation for whether the resource should be included.

> **ESWG Motion: Randy Collier made a motion to approve staff's recommendation. Jeremy Severson seconded the motion. The motion passed with 5 abstentions from Anita Sharma, Tim Owens, Bennie Weeks, Natasha Henderson, and John Olsen.**
>
> **TWG Motion: John Boshears made a motion to approve staff's recommendation. Harold Wyble seconded the motion. The motion passed with one abstention from Randy Lindstrom.**

After the meeting Randy Lindstrom provided the following reasoning for his abstention:

> *The reason that I abstained on this RAR was that this wind project did not have an executed GIA, it did not have an executed PPA, and it did not provide any significant construction progress to date. Therefore, this project did not meet the minimum requirements for a RAR waiver request from my perspective.*

Respectfully Submitted,

Kirk Hall
TWG Secretary

Amber Greb
ESWG Secretary


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SPP Southwest Power Pool

Member Attendance Education

Amber Greb

January 11, 2018

Background

- Corporate Governance Committee has directed SPP working groups to review the *Attendance & Proxy* language from the SPP bylaws

What do the Bylaws say?

3.2 Structure

- Member input on decision-making shall be accomplished primarily through Membership participation in Organizational Groups. Members are expected to provide representation to Organizational Groups as requested. Unless otherwise provided in these Bylaws, Organizational Group representation will be appointed by the Board of Directors, who shall consider the various types and expertise of Members and their geographic locations, to achieve a widespread and effective representation of the Membership. **Organizational Group representation will be reviewed annually for compliance with the Bylaws by the Corporate Governance Committee.** The Chair of any Organizational Group may appoint any ad hoc task forces as necessary to fulfill its mission. Task force appointments shall be made with due consideration of the various types and expertise of Members and their geographic locations. Criteria for serving on an Organizational Group will be determined in the group's scope. Except for any full representation group, **an appointment to an Organizational Group is for an individual, not a corporate entity**. Participation in certain sessions of Organizational Group meetings where market sensitive issues are discussed may be restricted to persons representing entities that have executed ERO's Confidentiality Agreement. Representatives on all Organizational Groups will be documented in the SPP directory maintained by the Staff. Organizational Group vacancies will be filled on an interim basis by appointment of the President unless otherwise provided for in these Bylaws.

What do the bylaws say?

3.2 Attendance and Proxy

- Except for the MOPC, **if a representative does not attend three consecutive Organizational Group meetings, he/she will be considered to have resigned from the group**, absent express waiver of this requirement by the chair of the group. Any appeal of removal from the roster of an Organizational Group should be directed to the Corporate Secretary. … If a representative is unable to attend an Organizational Group meeting, he/she may in writing appoint a substitute representative who shall have such rights to participate and vote as the representative specifies. The substitute representative may be another member of the Organizational Group or another person who has the authority to act on behalf of the representative. A representative **may not grant a proxy for more than three consecutive meetings without the express consent of the chair** of the Organizational Group. If a representative exceeds the proxy limit, he/she will be considered to have resigned from the Organizational Group and the vacancy will be filled in accordance with these Bylaws; except, in the case of any full representation Organizational Group, in which case a new representative will be solicited from the member company. A proxy provided to another representative of the Organizational Group will not be recorded as attendance at the meeting and will not serve to meet or maintain the quorum requirements. A proxy provided to another person with the authority to act on behalf of the representative will be recorded as attendance at a meeting for the purpose of meeting or maintaining the quorum requirements.

Why is attendance important?

- Discussions can be repeated, disrupted or diverted due to a member's inconsistent attendance
- Some working groups are adding voting positions, rather than more effectively utilizing the existing positions with active participants

Southwest Power Pool

ESWG Meeting
11 January 2018

Contents

INTRODUCTION TO ENERGY EXEMPLAR

Energy Exemplar

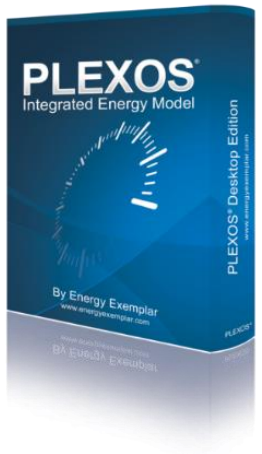
Penetration in the Current Market

- >1,050 PLEXOS licenses, >200 sites, >48 countries

PLEXOS Integrated Energy Model

- Uses mathematical programming, optimisation and stochastic techniques

- Used by:
  - ✓ Energy Producers, Traders and Retailers
  - ✓ Gas Producers and Retailers
  - ✓ Transmission System/Market Operators
  - ✓ Energy Regulators/Commissions
  - ✓ Consultants, Analysts and Research Institutions
  - ✓ Power Plant Manufacturers and Construction companies



- "The savings generated after investing in PLEXOS are many hundreds more than the initial outlay. It's a no brainer." – Razib Dawood, Electricity Commission of Malaysia

PLEXOS Licensing Options

- Local
  - Usable by a single machine only
- USB
  - Allows PLEXOS to run on any workstation that has the dongle plugged into it
- Connect Server
  - Requires network connection to use PLEXOS
  - Accessed in any network-connected machine with PLEXOS
- Energy Exemplar offers one-month trial of PLEXOS

ENERGY EXEMPLAR SUPPORT TEAM

Energy Exemplar

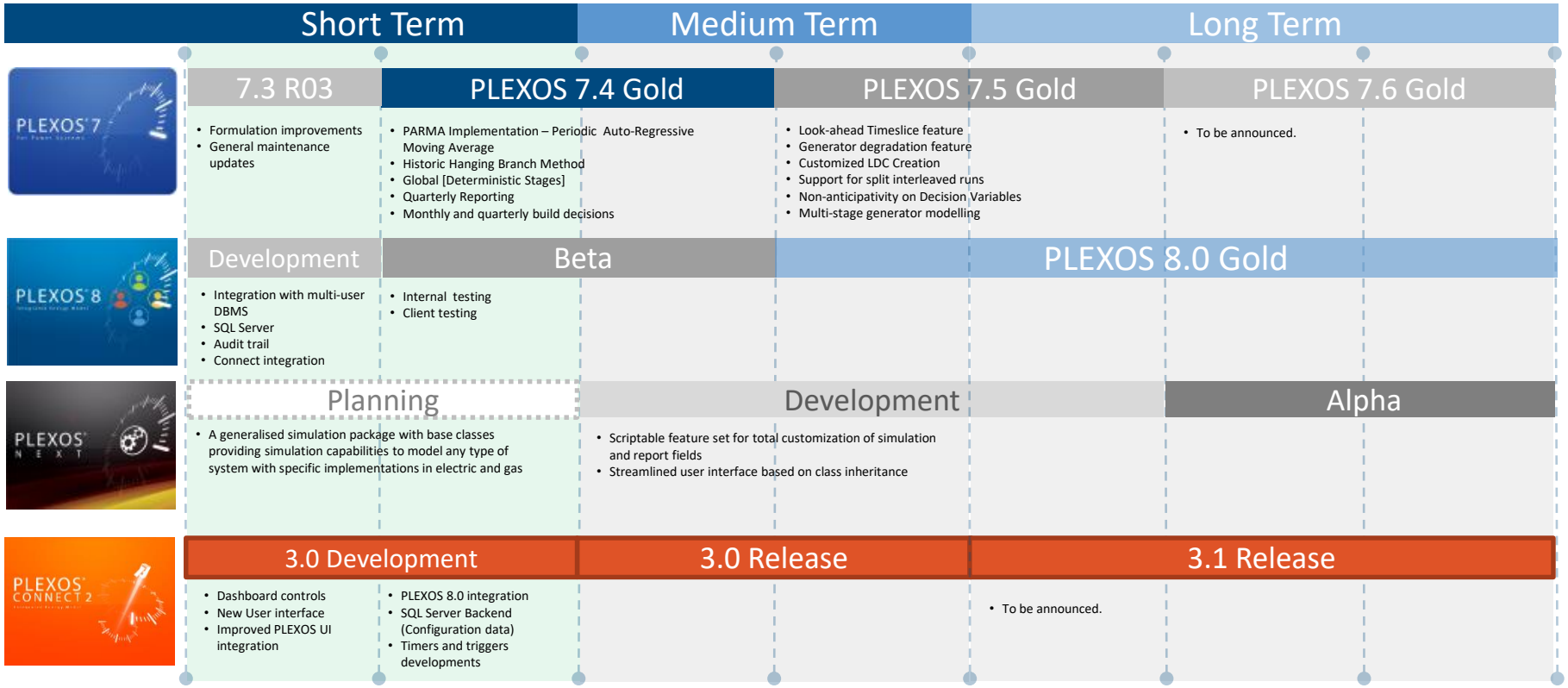
Energy Exemplar Philosophy

- Energy Exemplar is the market leader in the technology of optimisation-based energy market modelling
- Energy Exemplar continues to ‘push the envelope’ with the latest advances in mathematical programming and energy market simulation theory
- Client support is our #1 priority

INNOVATION IN THE PIPELINE

Energy Exemplar

PLEXOS Evolution and Innovation



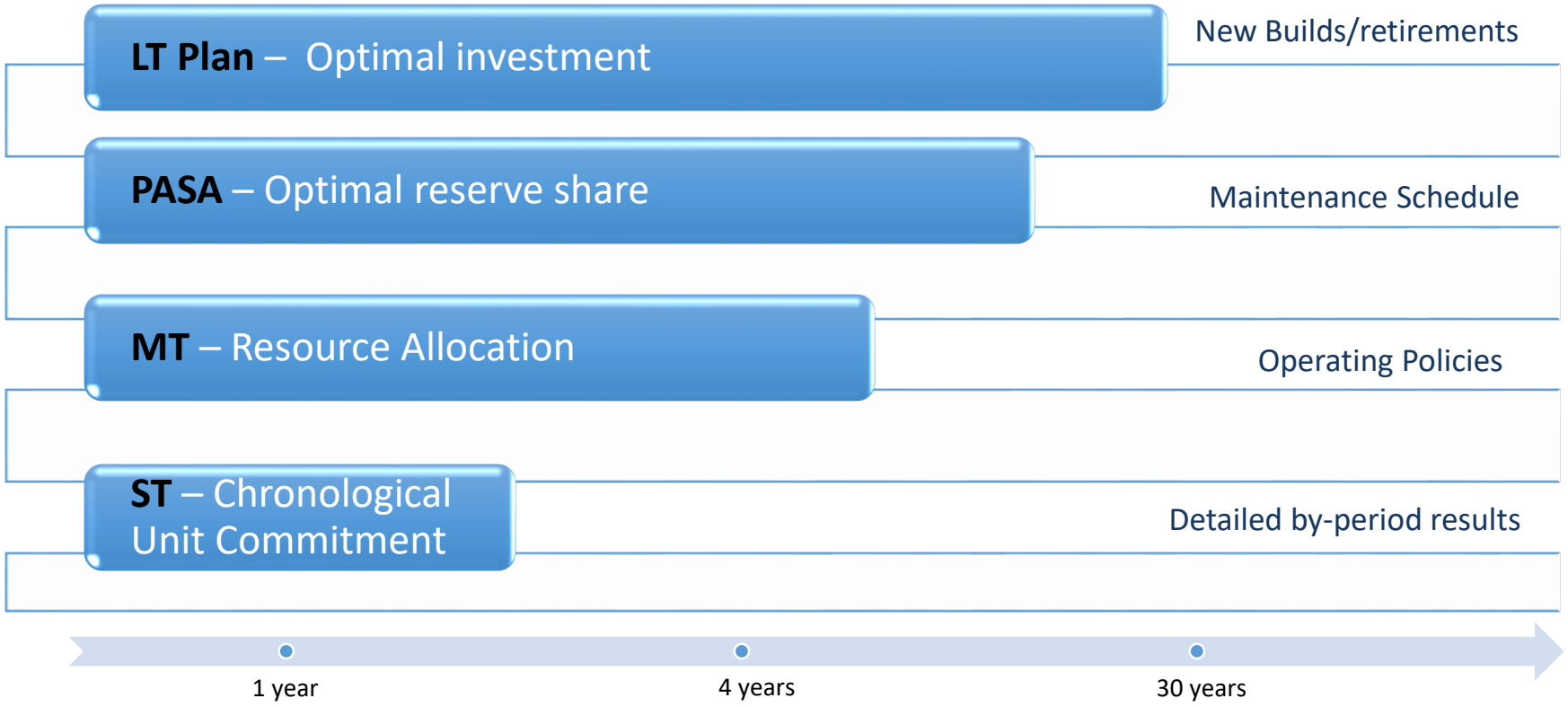
Energy Exemplar

PLEXOS OVERVIEW

Energy Exemplar

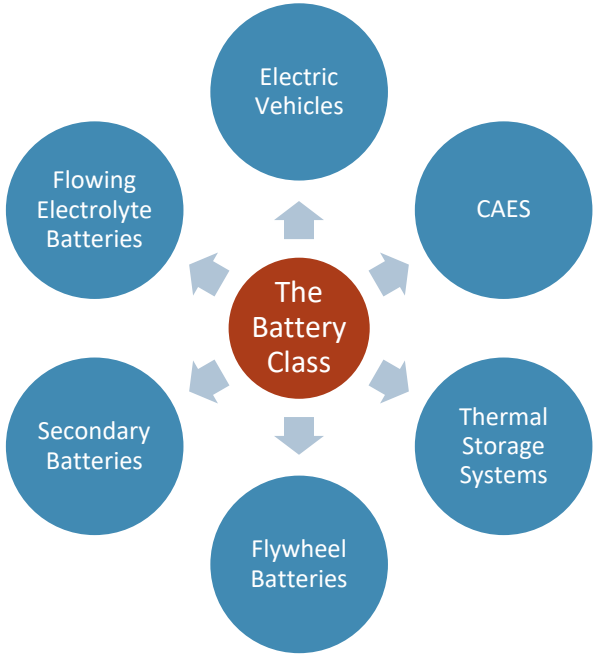
Why use PLEXOS for Electricity

Simulation Phases in PLEXOS



Battery Class

PLEXOS is capable of representing all types of energy storage technology:



Battery Class applications in PLEXOS

- Ancillary Services Modelling
- Impact on Capacity Expansion Planning
- Reduced Transmission Congestion
- Renewable Energy Smoothing
- Peak-shaving & Load optimisation

PLEXOS BY ENERGY EXEMPLAR

Modeling System Benefits for Batteries

- ST: Renewable energy balancing
- ST: Flexible ramping
- ST: Grid stabilization
- ST: Transmission Loss Reduction
- LT: Transmission Build-out Deferral

PLEXOS BY ENERGY EXEMPLAR

Modeling Project Benefits for Batteries

- ST: Energy (DA/RT)
- ST: Ancillary services (Reg, Spin, NonSpin)
- ST: Resource Adequacy Capacity
- LT: Capacity Market Revenue
- ST: Peak-shaving (Consumer)

PLEXOS BY ENERGY EXEMPLAR

RENEWABLE MODELLING

Renewable Generation in the Early 2000's

- Solar and wind were expensive and not viewed as viable alternatives
- Few predicted the rapid rise of renewable generation
- Simulation software focused on fossil fuelled and centralised generation

Easy Renewables Modelling with PLEXOS Architecture

Sub-hourly Optimisation Technology

Fully customisable, sub-hourly steps down to 1 minute

Multi-Commodity Co-optimisation

Accounts for back-up generation needed to cover intermittent generation

Technical Constraints

Real-life details captured in sub-hourly modelling

PLEXOS Power Illustrated in Sub-hourly modelling

- Sub-hourly modelling is important
  - ✓ During the run-up and down period the generator is completely inflexible
  - ✓ No spinning or regulation reserve response can be provided in hourly modelling
  - ✓ Sudden changes in wind can only be covered by flexible units
    - ✓ Subject to their real-life operational limits

PLEXOS BY ENERGY EXEMPLAR

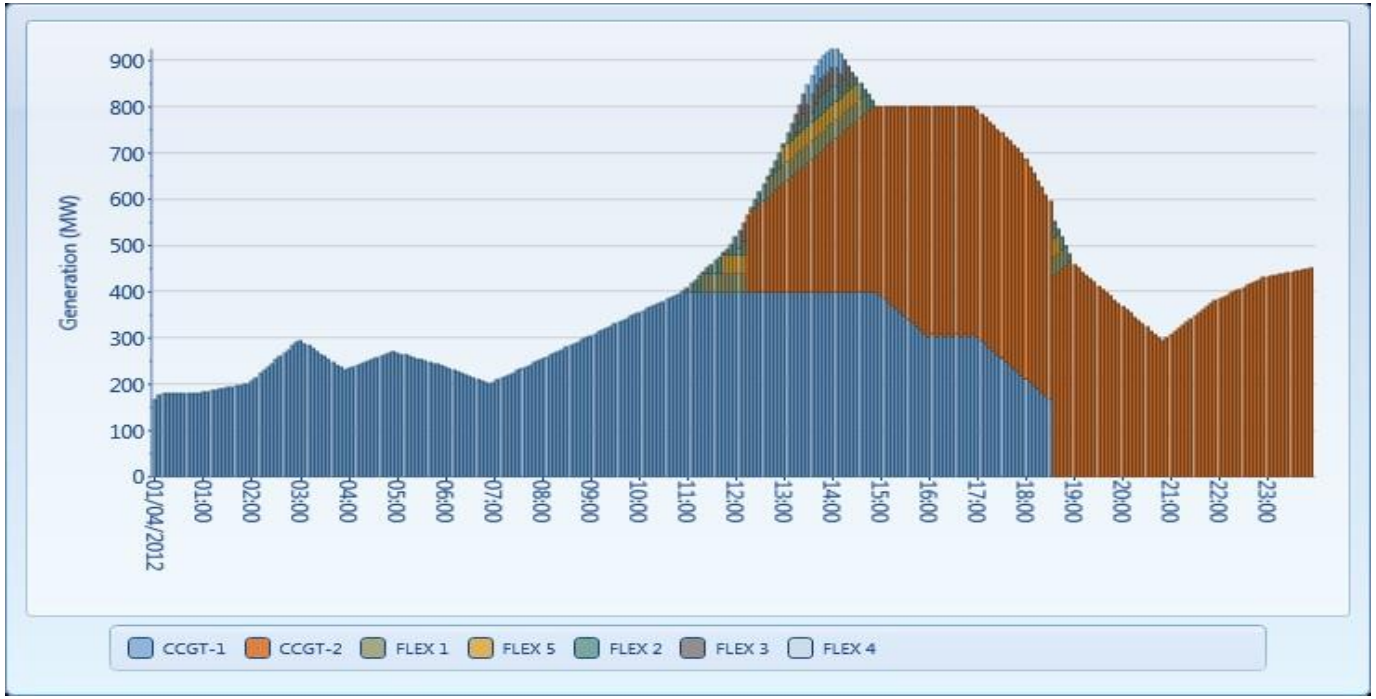
1 Hour v 5 Minute Simulation

Generation Dispatch: Hourly

PLEXOS BY ENERGY EXEMPLAR

1 Hour v 5 Minute Simulation

Generation Dispatch: 5 minute basis

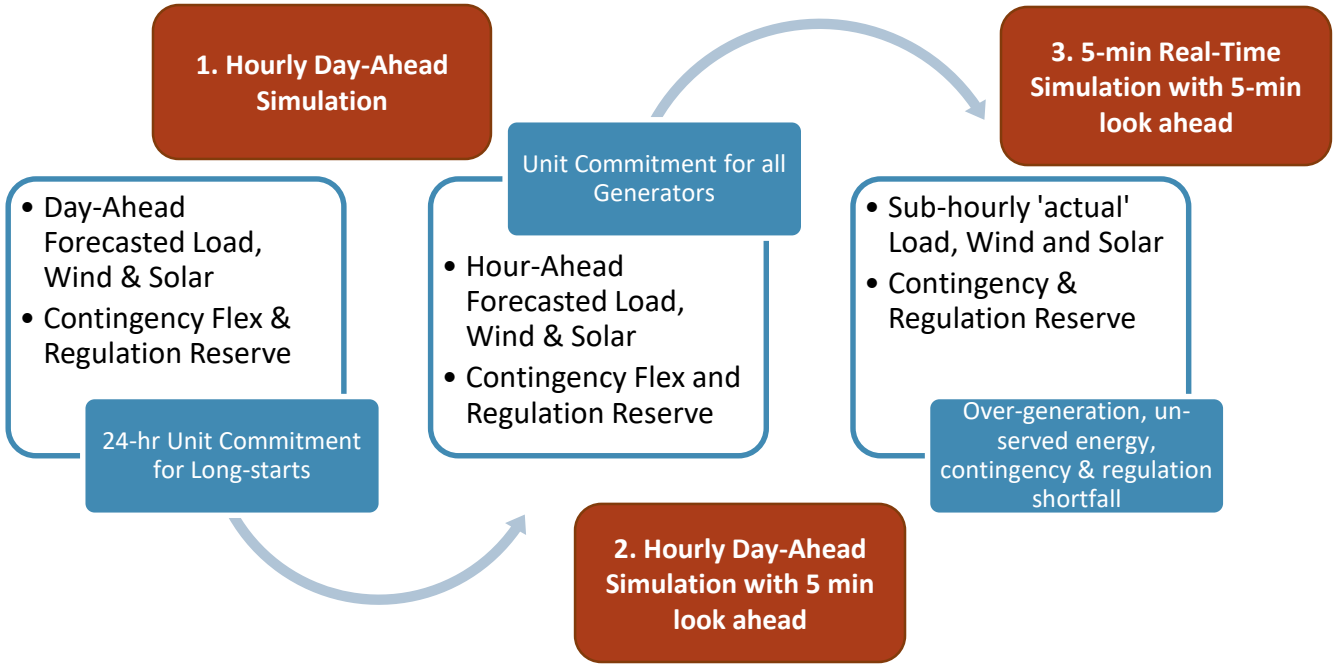


PLEXOS BY ENERGY EXEMPLAR

Flexible Modelling Options

- Deterministic or Stochastic
- Energy, wind-speed based or other dispatch options
- Known or new generation intelligently planted by PLEXOS
- Detailed chronological or simplified duration curve approach

Multi-stage Simulation Approach



Renewables Stochastic Modelling

Monte-Carlo

- Wind speed & power curve to obtain wind production samples
- Autoregressive, mean-reversion and Box-Jenkins ARIMA models

Stochastic Optimisation

- Simulates impact of wind forecast error on UC, reserves & costs
- Optimises UC & reserve requirements based on uncertainty

PLEXOS BY ENERGY EXEMPLAR

PLEXOS Will Continue to Evolve

- Renewables penetration has led to new challenges in planning and control
- First-to-market features for planning & scheduling of large-scale energy storage
- Comprehensive approach to Smart Grids, DER Management etc.
- PLEXOS will seamlessly evolve in concert with a rapidly changing world.

ANCILLARY SERVICES MODELLING

PLEXOS
BY ENERGY EXEMPLAR

What are Ancillary Services (AS) ?

- Ancillary services (AS) products address short-term imbalances in electricity markets
  - By dispatching resources within seconds or minutes

- Utilities and TSOs must always be ready for contingencies
  - Power plants or transmission line outages
  - Unforeseen increases or decreases in demand.

- Renewable generation uncertainty adds additional complexity

All Ancillary Services are Captured in PLEXOS

- **A variety of system reserves exist as part of AS**
  - Coordinated system operation
  - Frequency regulation
  - Energy balance
  - Voltage support
  - Generation reserves

- **PLEXOS is a flexible tool and allows users to model any type of AS, including**
  - Operational non-spinning
  - Replacement non-spinning
  - Regulation Lower
  - Regulation Raise
  - Lower spinning
  - Raise spinning

How ‘AS’ is Modelled in PLEXOS

PLEXOS has a reserve class which can in accurate detail:

- Model minute by minute interaction of plant start, ramp up/down & reserve requirement
- Optimise given the uptake of renewables
- Ensure provision of reserves in short term dispatch as well as long term planning
- Calculate the cost to the system and affect on energy prices of extra reserve requirements
- Calculate expected ancillary service prices
- Test any new ancillary service provision framework (e.g. **ERCOT**)
  - Static Risk defines a megawatt reserve requirement
  - By creating contingencies lists for lines and generators the risk calculation for each class of reserve becomes dynamic

Thermal Unit Commitment

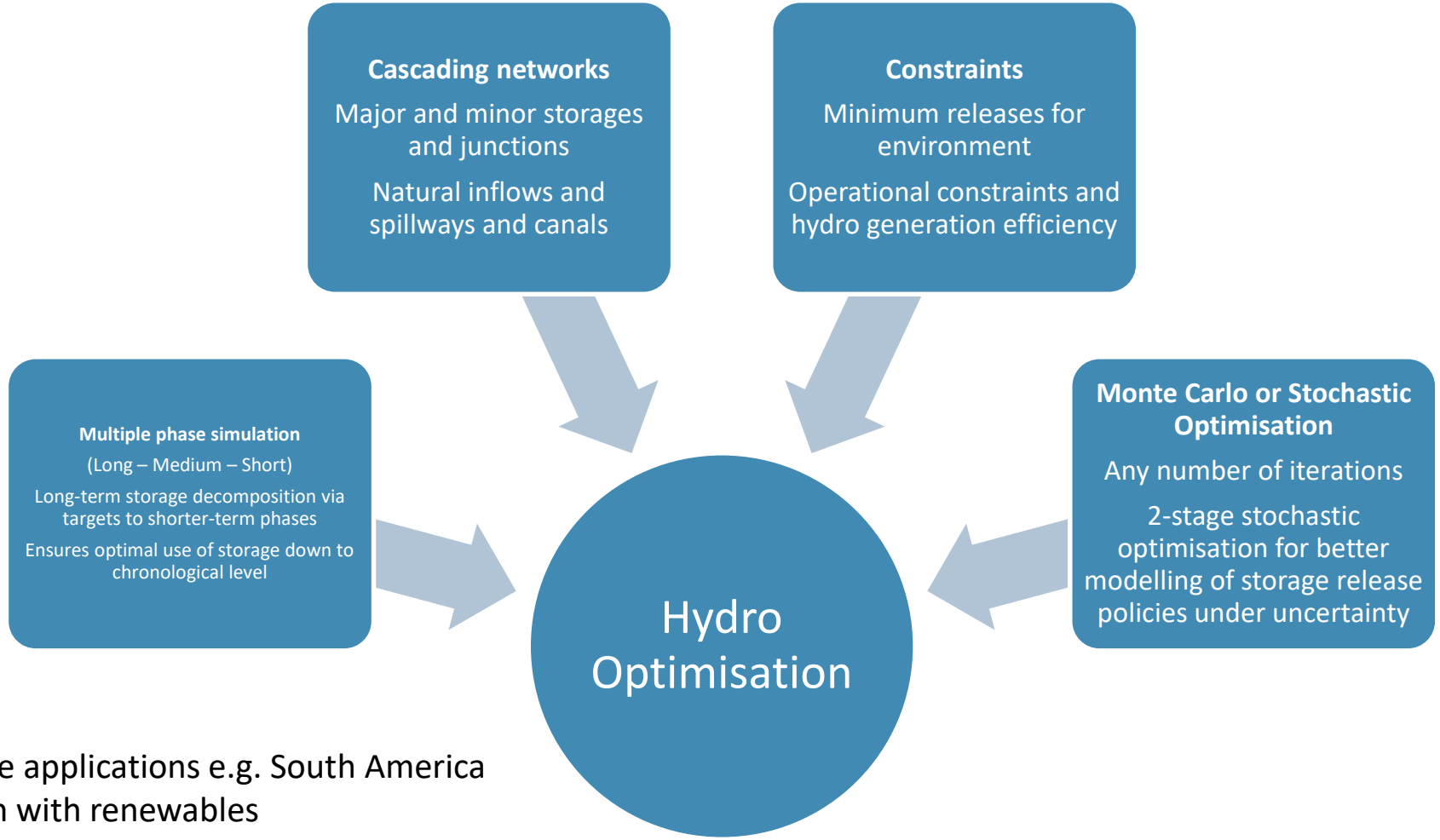
- Minimum stable generation
- Heat Rate: Polynomial or Step function
- Min up and down times
- Ramping constraints
- Start costs variable by cooling state
- Start up / Shut down profiles & costs
- Rough running zones

Generation Dispatch

- Generation can be dispatched based on:
  - Costs
  - Historical Profiles
  - Constraints / rules (must run with ACF or rating factor limits etc.)
  - Bids
  - Stochastic samples
  - A game-theoretic approach based on fundamentals

Energy Exemplar

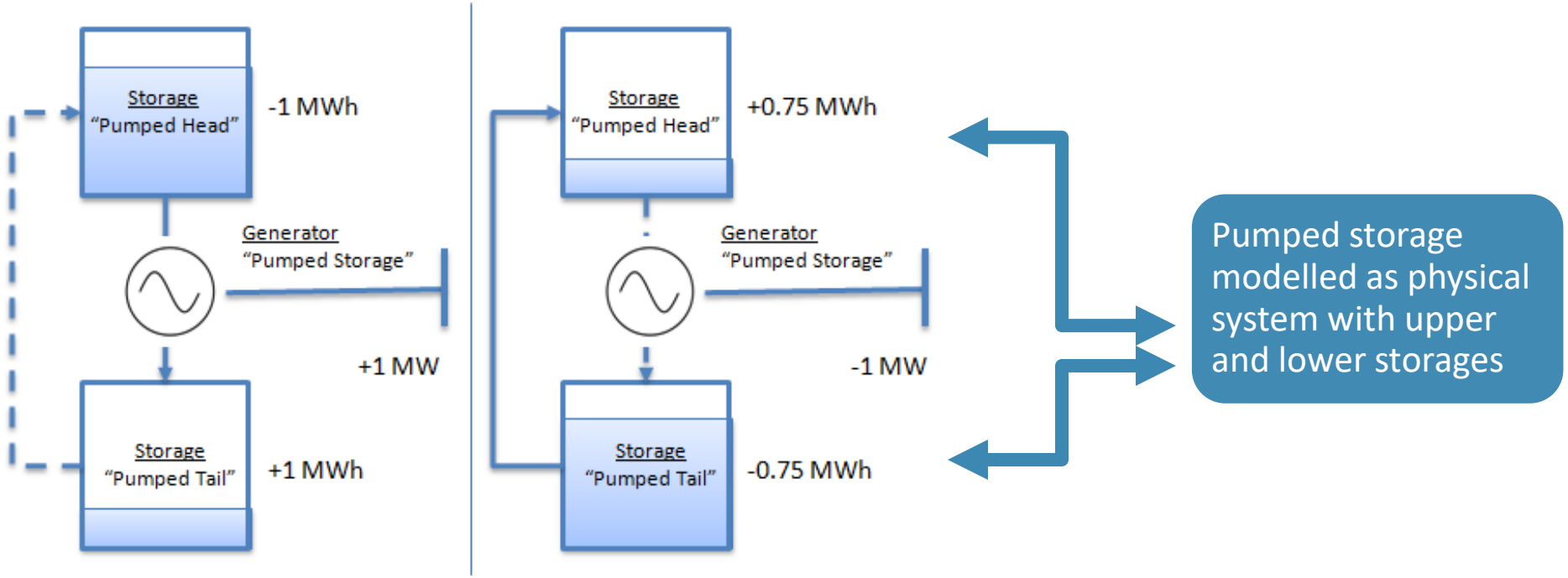
Hydro



World wide applications e.g. South America
Integration with renewables

Pumped Storage

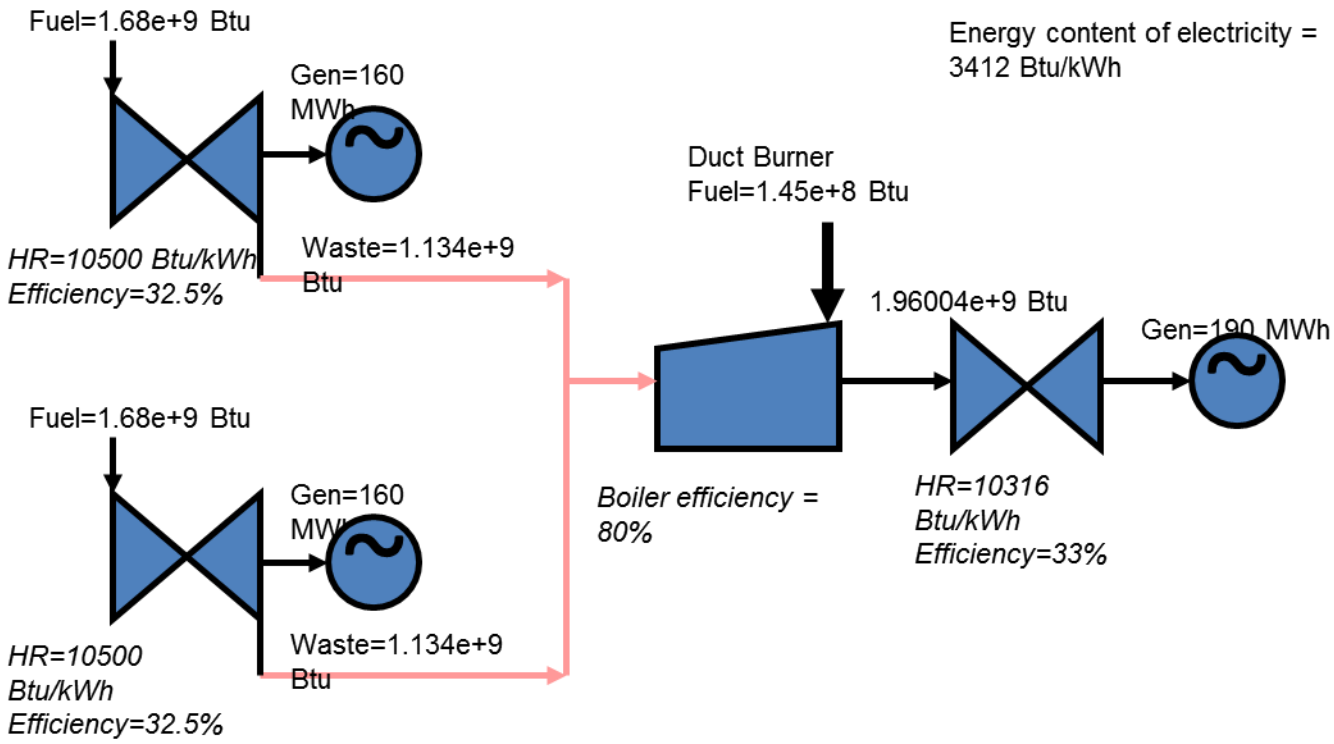
Genuine optimisation of generation and pumping operations



Combined Cycle Modeling

- Component modeled individually
  - Combustion Turbine (CT)
  - Heat Recovery Steam Turbine (HRSG)
  - Steam Turbine (ST)
  - Duct Firing
  - Thermal load (cogeneration)
- Components tied together through linear or piecewise linear constraints
  - Comprehensive CCGT operational constraints can be modeled
- Components optimized simultaneously with MIP algorithm

Combined Cycle Modeling, continued



Fuel and Emission Modeling

Fuel

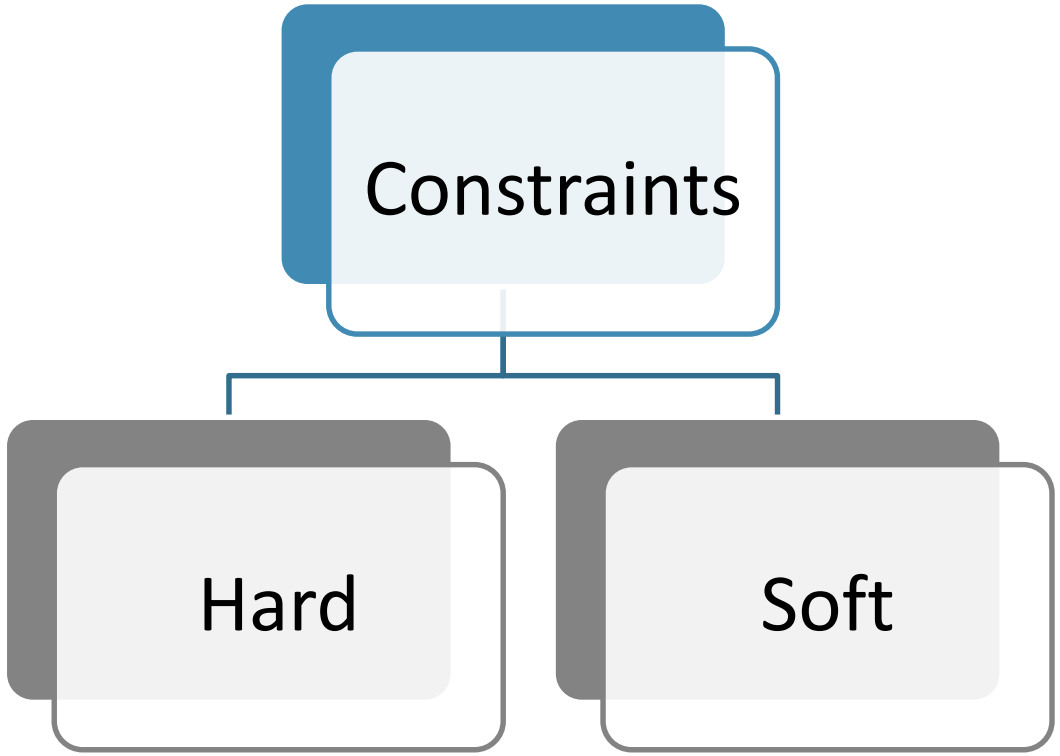
- Hourly fuel dispatch prices versus fuel accounting prices
- Tax by fuel
- Transport charge by generator
- Hourly / daily / weekly / monthly /annual fuel lower and upper limits
- Take-or-pay fuel contracts with take-or-pay price
- User-defined pipeline limits (using user-defined Constraints) and hourly burner tip lim
- Trade with fuel markets

Emission

- Emission rate by fuel or by generation or both
  - Emission rate by generation for multiple loading points
- Emission dispatch price versus emission accounting price
  - Dispatch price is automatically included in generator dispatch cost
  - Accounting price is used for production costing
- Hourly / daily / weekly / monthly /annual emission cap (using user-defined Constraints)
- Emission cap by (sub-)region y (sub-)fleet
- Trade with emission markets or hard cap or both

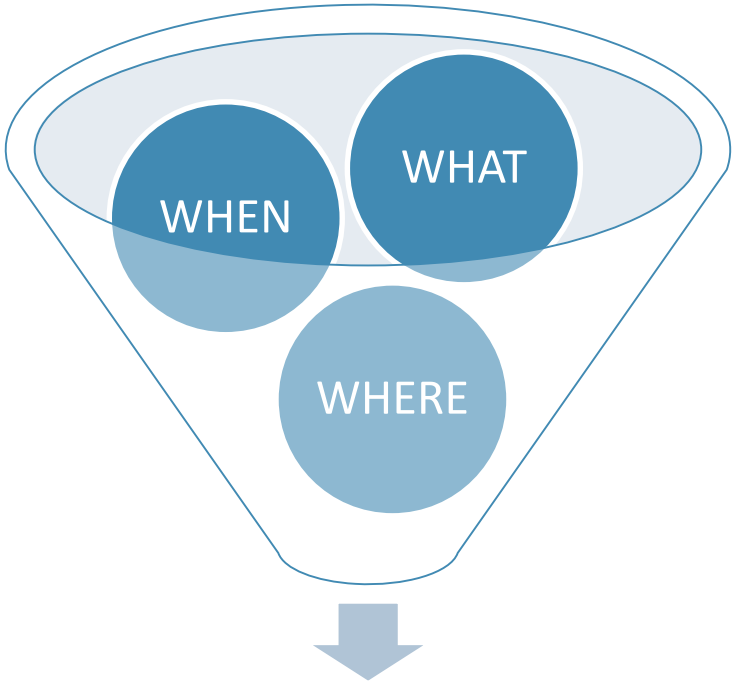
PLEXOS BY ENERGY EXEMPLAR

Constraints



Why use PLEXOS for Gas

Power System Expansion Problem



Energy & Policy Makers Question

Cost Function and New Addition/Retirement Candidates

- Minimise total system costs
  - Capital C(x) and Production P(x)
- Subject to:
  - Reliability and security of supply criteria
  - Fuel or energy mix constraints
    - Renewable energy targets
  - Normal operating constraints

- Resource additions and retirements
  - Hydro
  - Wind /Solar
  - Geothermal
  - Fossil
  - Transactions
  - Demand side participation
  - Transmission augmentations
  - Retrofits

PLEXOS BY ENERGY EXEMPLAR

Long-term Optimisation

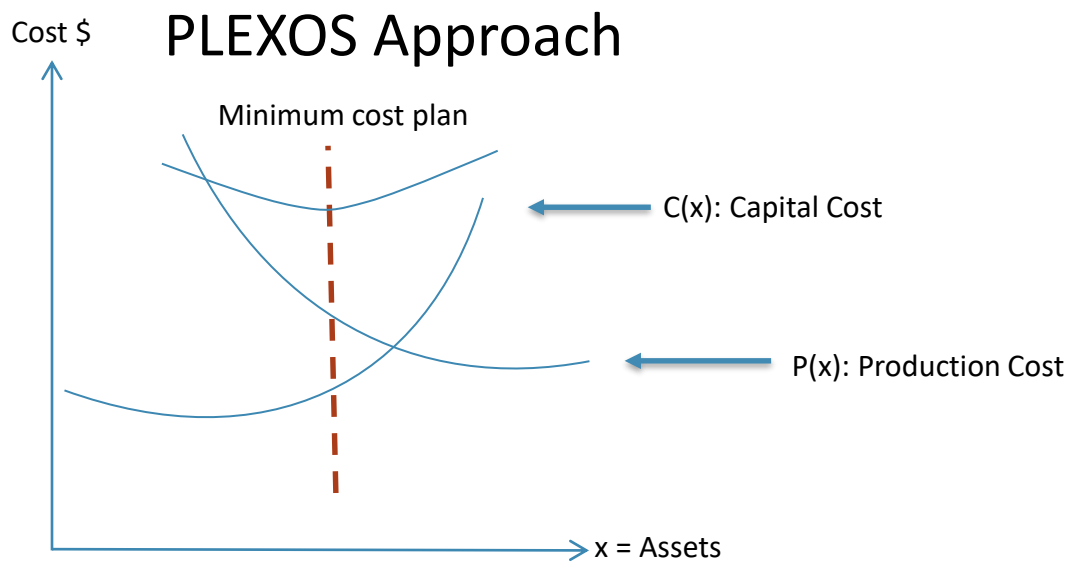
Traditional Approaches

- Heuristic methods/solutions
- Decoupling investment and production models

Drawbacks

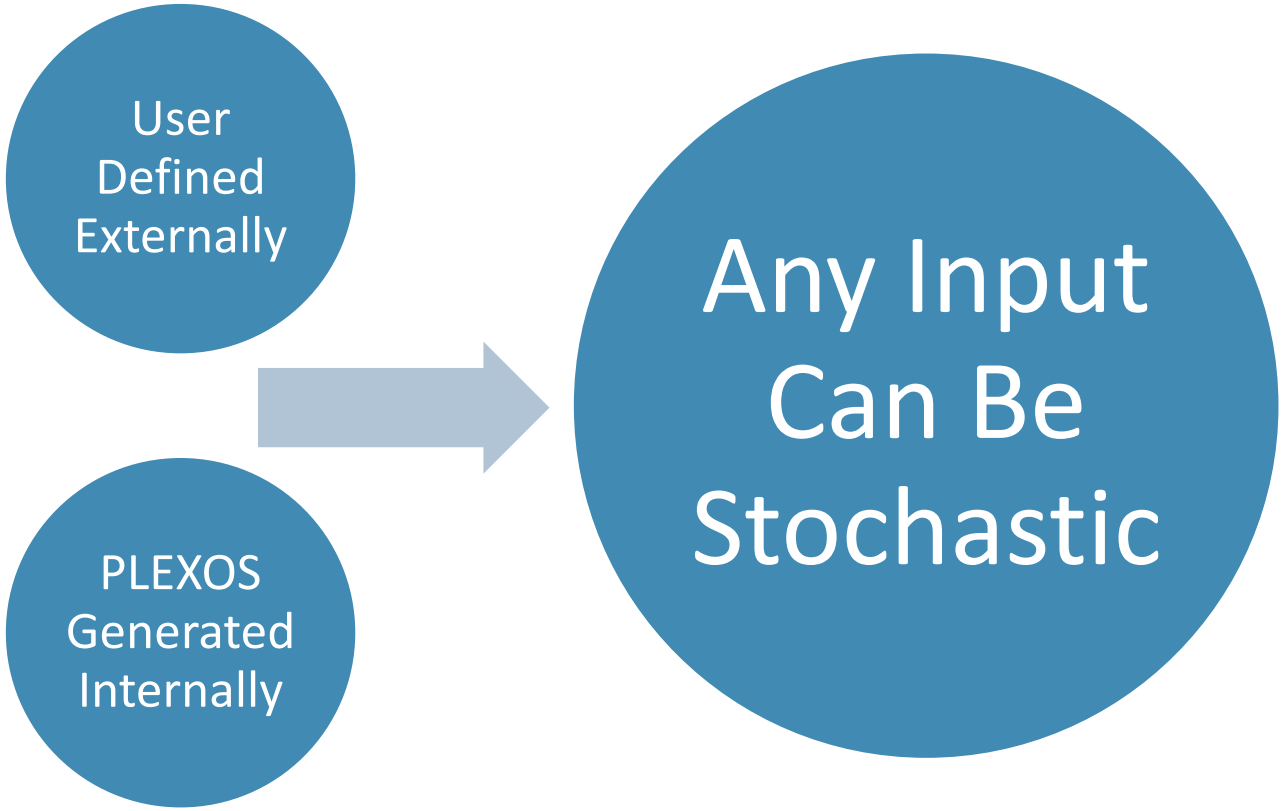
- Sub-optimal solutions
- System-specific - hard to modify and implement

Long-term Optimisation

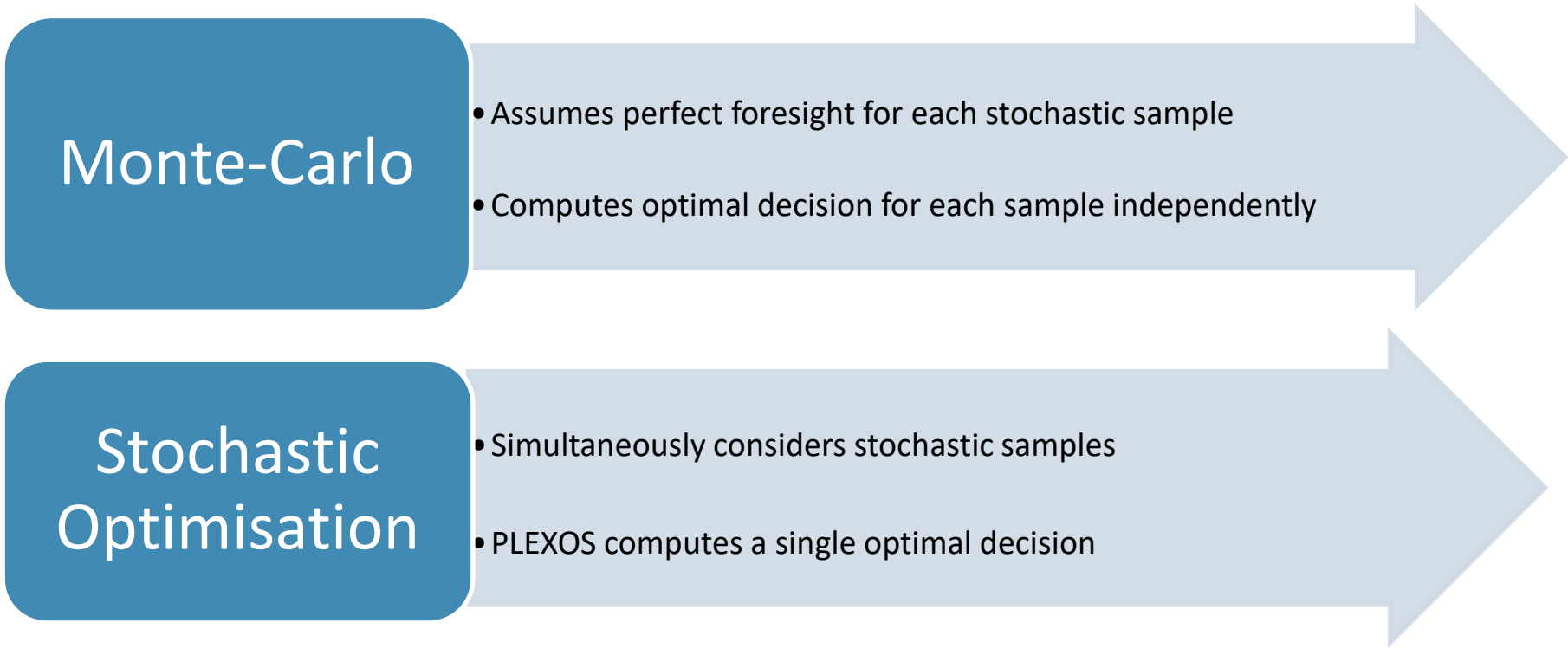


Objective: Minimise NPV of capital & production costs formulated as Mixed-Integer Problem

Stochastic Modelling

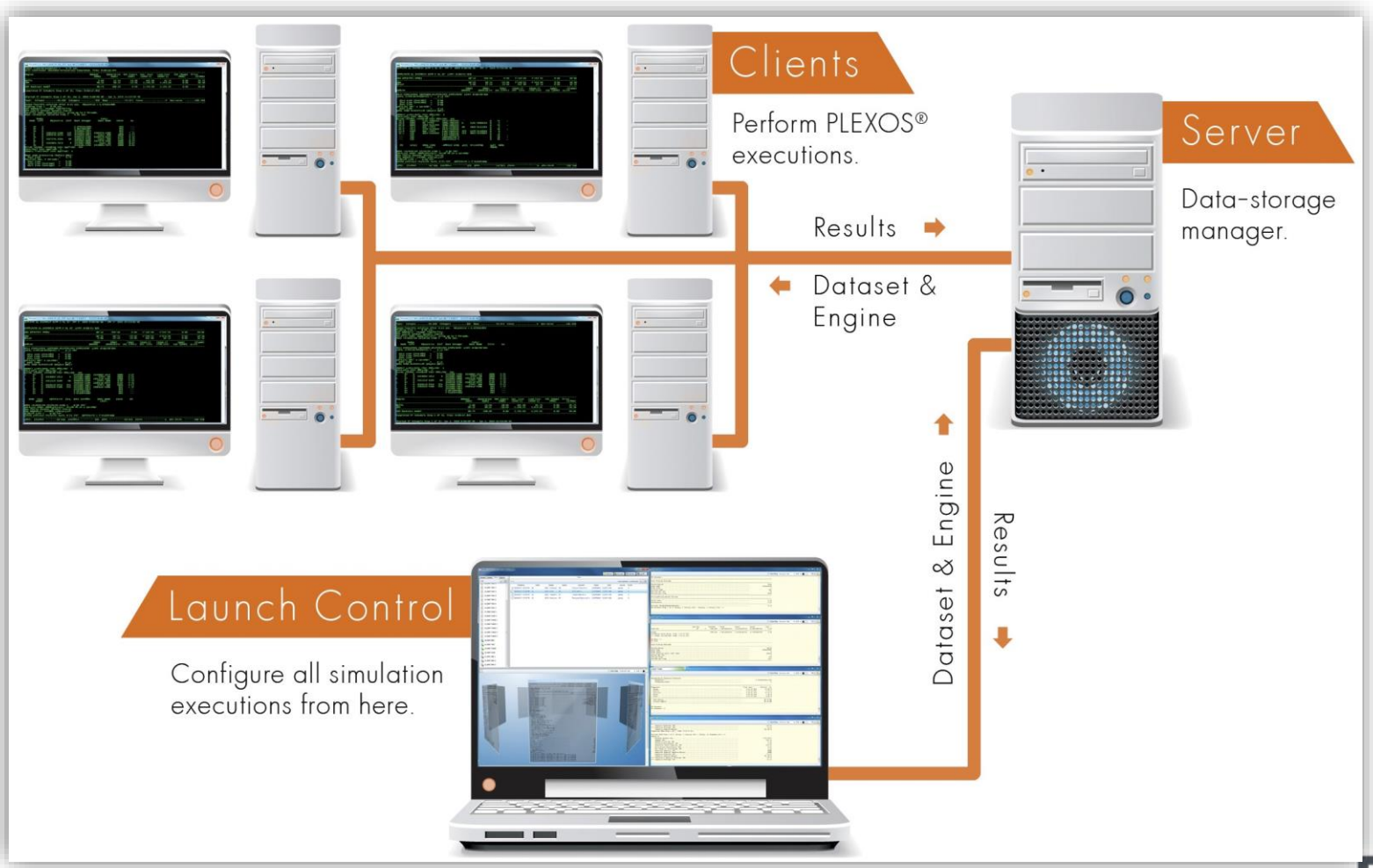


Stochastic Modelling



PLEXOS CONNECT

Functional Diagram of PLEXOS Connect



RECENT DEVELOPMENT

Energy Exemplar

Recent leading-edge features

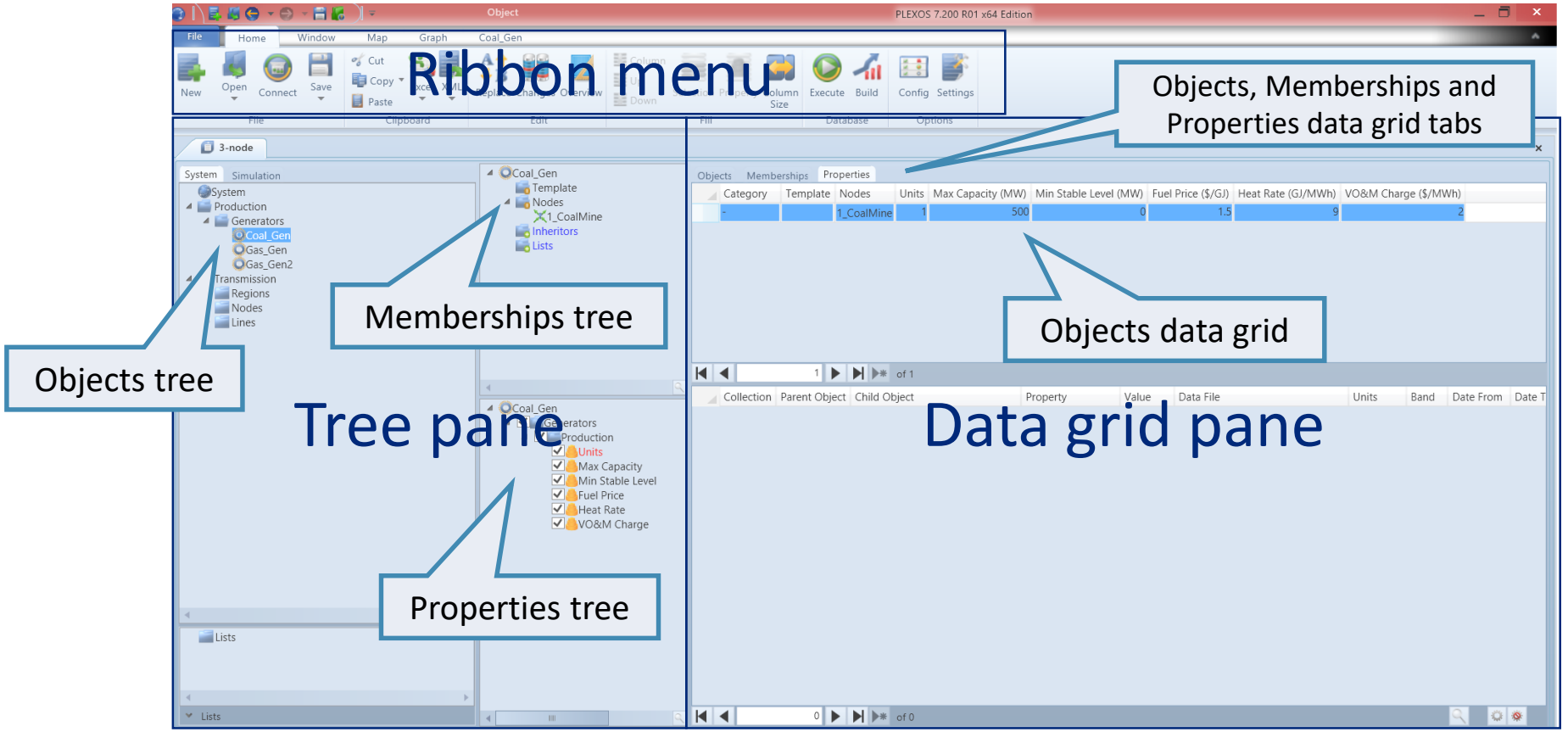
- Stochastic hydro optimisation improvements
- Battery Class and Flow Control Class
  - For smart grid and energy storage modelling: batteries, line flow control devices, line switching
- Maintenance Class: Value-based reliability (VBR) for optimal maintenance timing
- New cloud friendly PLEXOS version
- Decision Variable Class:
  - Add generic decision variables to your formulation and link to existing or generic constraints
    - Example: Stochastic and Calculated values with respect to temperature dependency

Energy Exemplar

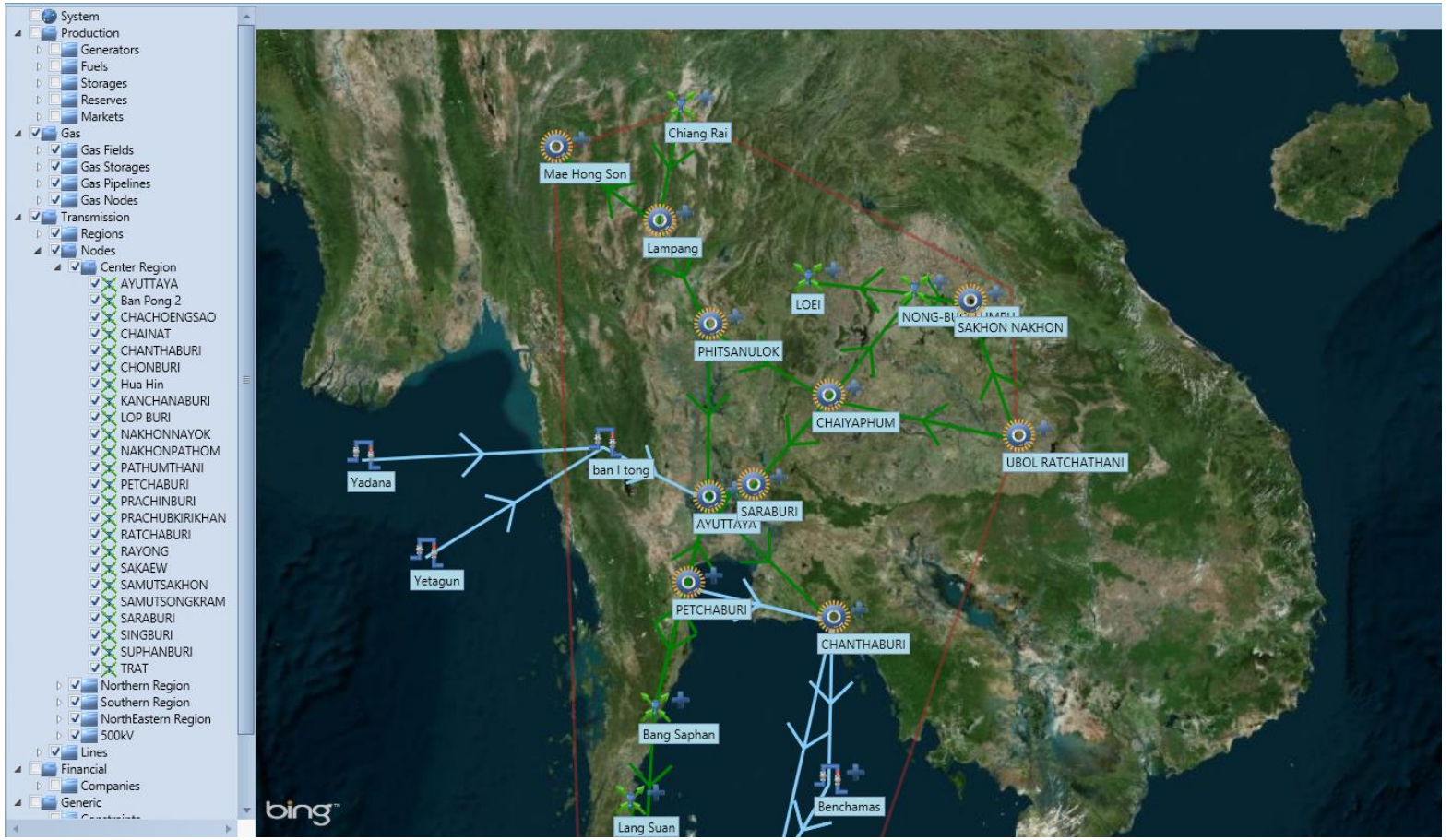
PLEXOS SCREENSHOTS AND FUNCTIONALITY

Energy Exemplar

Elements of PLEXOS Input Interface

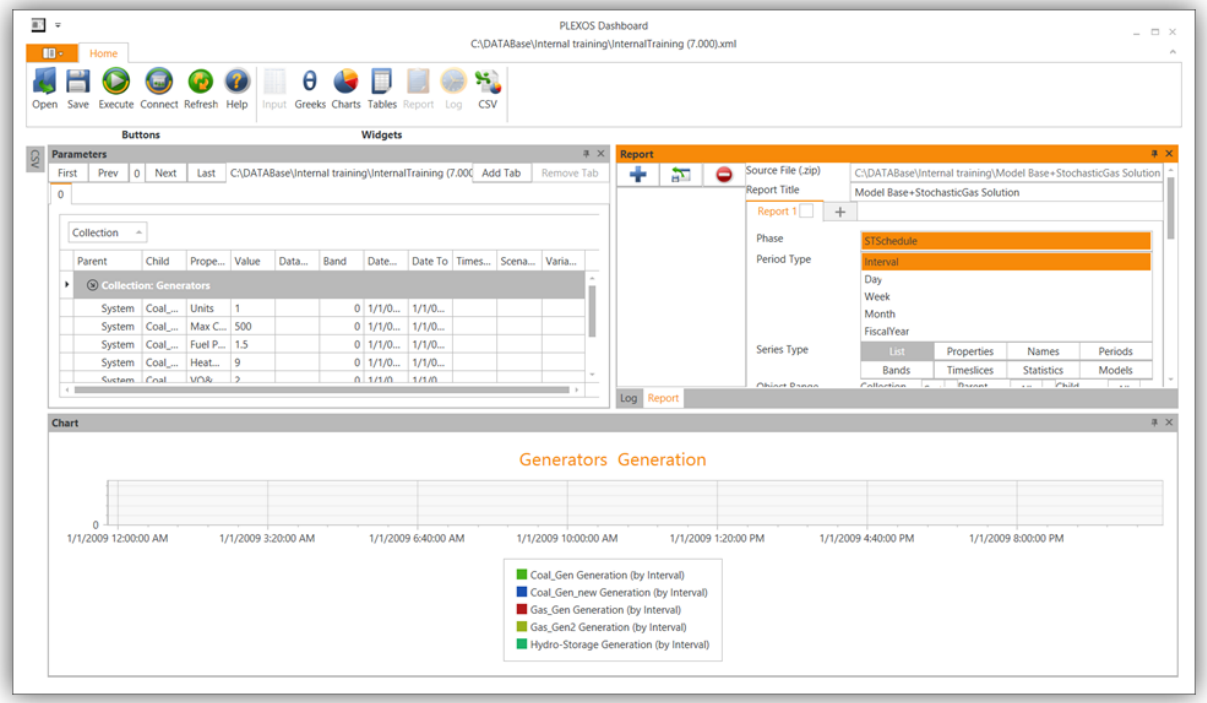


Visualisation Features PLEXOS 7

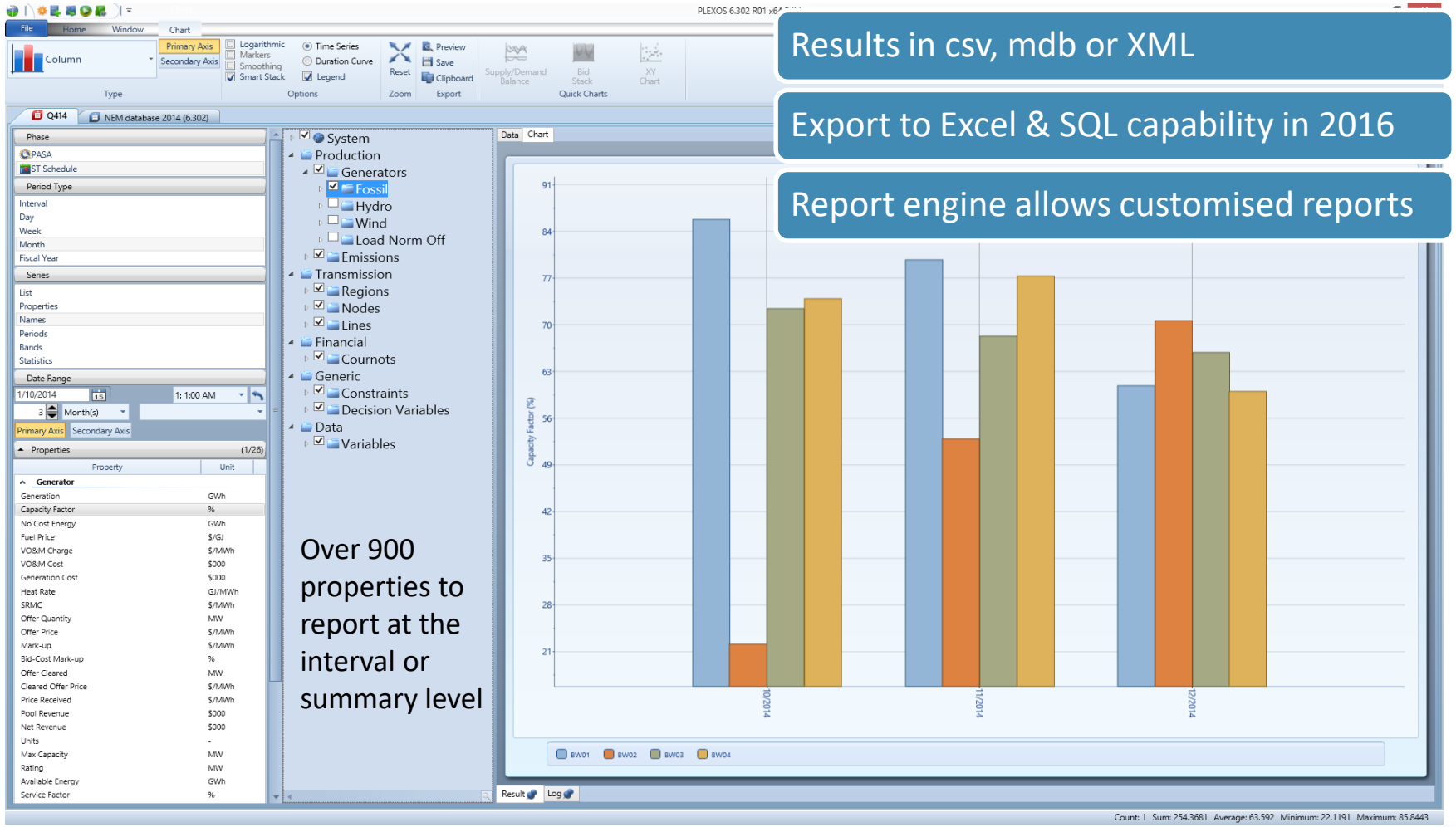


PLEXOS Dashboard

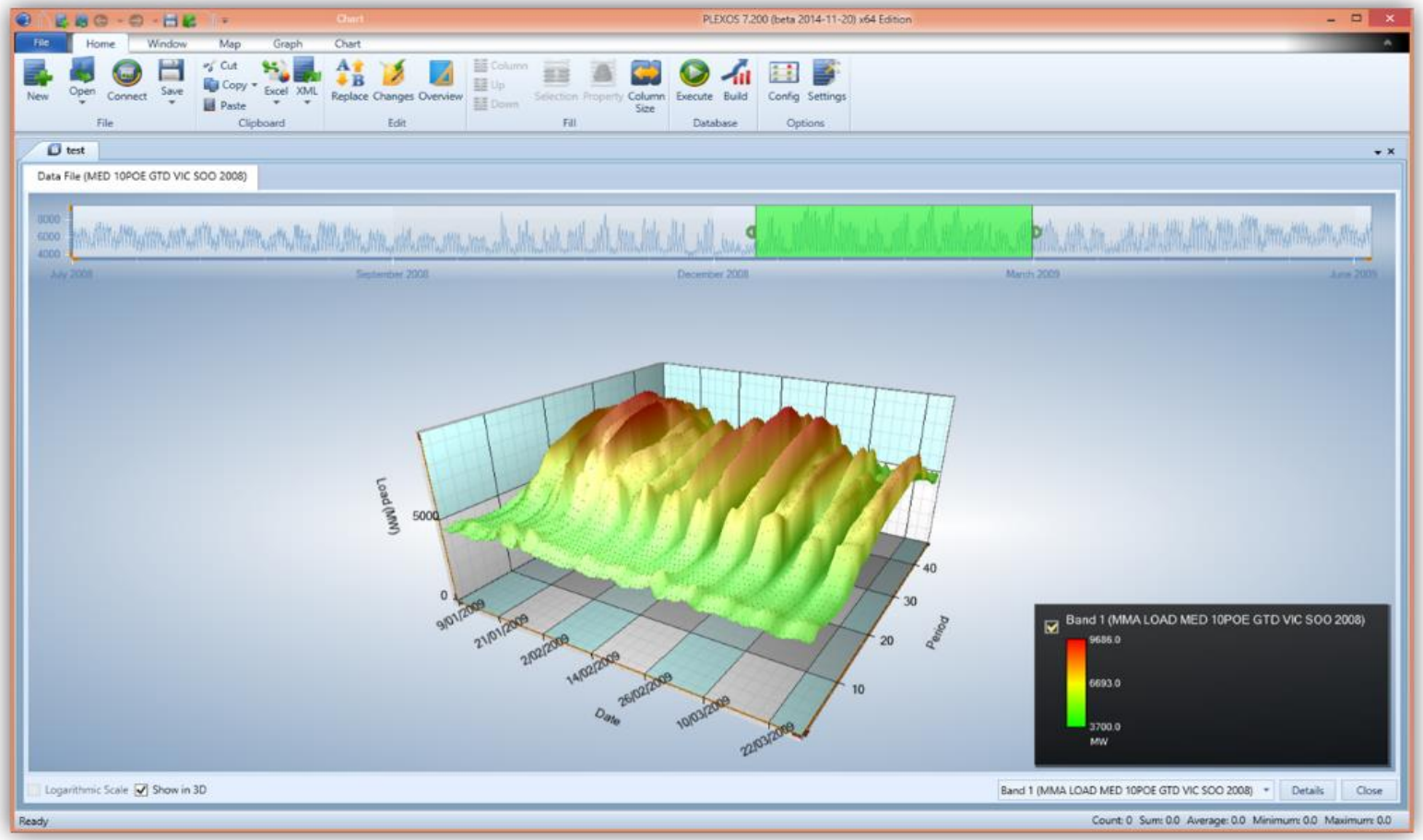
- PLEXOS Dashboard simplifies modelling
- Widgets area provides access to specialised controls for data handling



PLEXOS Integrated Output Viewer



PLEXOS Integrated 3D Output Viewer



END

Energy Exemplar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TO KEEP THE LIGHTS ON... TODAY AND IN THE FUTURE.

2019 ITP Schedule

Juliano Freitas

January 11, 2018

General Information

- Projected Amount of Hours: 28,000
- Number of Milestones: 53
- Working Groups Involved: ESWG, TWG and MDWG
- Finishing Date: October 2019

Scope Development

- Start: 7/3/2017
- End: 1/3/2018 (Member's Final Approval)
  - MOPC Approval: 1/16/2018
- Member Review Time:
  - 12/15/2017 – 12/27/2017 (8 days)
- Staff Leader: Amber Greb (agreb@spp.org)
- Working Group Approvals: ESWG and TWG

Powerflow Model

- Start: 7/17/2017
- End: 3/1/2018 (Final Approval)
- Member Review Time:
  - Pass 0 – Trial 1: 7/21/2017 – 8/4/2017 (10 days)
  - Pass 0 – Trial 2: 8/11/2017 – 8/25/2017 (10 days)
  - Pass 0 – Trial 3: 9/1/2017 – 9/15/2017 (10 days)
  - Pass 1 – Trial 1: 9/22/2017 – 10/6/2017 (10 days)
  - Pass 1 – Trial 2: 10/13/2017 – 10/20/2017 (5 days)
  - Pass 2: 11/7/2017 – 11/20/2017 (9 days)
  - Pass 3: 12/5/2017 – 12/22/2017 (13 days)
  - Pass 4: 1/19/2018 – 2/1/2018 (10 days)
  - Pass 5: 2/23/2018 – 3/1/2018 (5 days)
- Staff Leader: Anthony Cook (acook@spp.org)
- Working Group Approval: TWG and MDWG

Short Circuit Model

- Start: 11/20/2017
- End: 3/9/2018
- Member Review Time:
  - Pass 1: 12/8/2017 – 12/29/2017 (15 days)
  - Pass 2: 11/7/2017 – 11/17/2017 (9 days)
  - Pass 3: 12/3/2017 – 12/19/2017 (12 days)
- Staff Leader: Zack Bearden (zbearden@spp.org)
- Working Group Approval: TWG and MDWG

Load Review

- Start: 7/17/2017
- End: 1/18/2018 (Member's Final Approval)
- Member Review Time:
  - Load Pass 1: 9/1/2017 – 10/2/17 (21 days)
  - Load Pass 2: 11/3/2017 – 12/1/2017 (20 days)
  - Powerflow Pass 1 – Trial 1: 9/22/2017 – 10/6/2017 (10 days)
  - Powerflow Pass 1 – Trial 2: 10/13/2017 – 10/20/2017 (5 days)
  - Powerflow Pass 2: 11/7/2017 – 11/20/2017 (9 days)
  - Powerflow Pass 3: 12/5/2017 – 12/22/2017 (13 days)
  - Final Posting and Review: 1/12/2018 (7 days)
- Staff Leader: Nikki Roberts (nroberts@spp.org)
- Working Group Approval: TWG and ESWG

Generation Review

- Start: 7/17/2017
- End: 1/18/2018 (Member's Final Approval)
- Member Review Time:
  - Load Pass 1: 9/1/2017 – 10/2/17 (21 days)
  - Load Pass 2: 11/3/2017 – 12/1/2017 (20 days)
  - Powerflow Pass 1 – Trial 1: 9/22/2017 – 10/6/2017 (10 days)
  - Powerflow Pass 1 – Trial 2: 10/13/2017 – 10/20/2017 (5 days)
  - Powerflow Pass 2: 11/7/2017 – 11/20/2017 (9 days)
  - Powerflow Pass 3: 12/5/2017 – 12/22/2017 (13 days)
  - Final Posting and Review: 1/12/2018 (7 days)
- Staff Leader: Nikki Roberts (nroberts@spp.org)
- Working Group Approval: TWG and ESWG

Renewable Policy Review

- Start: 1/15/2018
- End: 2/6/2018 (Member's Final Approval)
- Member Review Time:
  - 1/30/2018 – 2/6/2018 (6 days)
- Staff Leader: Amber Greb (agreb@spp.org)
- Working Group Approval: ESWG

Renewable Resource Plan – Phase I

- Start: 1/22/2017
- End: 3/6/2018 (Member's Final Approval)
- Member Review Time:
  - 2/27/2018 – 3/6/2018 (6 days)
- Staff Leader: Amber Greb (agreb@spp.org)
- Working Group Approval: ESWG

Conventional Resource Plan – Phase II

- Start: 2/6/2018
- End: 5/23/2018 (Member's Final Approval)
- Member Review Time:
  - 5/15/2018 – 5/23/2018 (7 days)
- Staff Leader: Amber Greb (agreb@spp.org)
- Working Group Approval: ESWG

Siting Plan

- Start: 12/1/2017
- End: 7/2/2018 (Member's Final Approval)
- Member Review Time:
  - Site Prioritization: 4/9/2018 – 4/13/2018 (5 days)
  - Site Prioritization: 4/20/2018 – 4/27/2018 (6 days)
  - Site Assignment Renewable: 5/18/2018 – 5/24/2018 (5 days)
  - Site Assignment Renewable: 5/31/2018 – 6/7/2018 (6 days)
  - Site Assignment Conventional: 6/12/2018 – 6/18/2018 (5 days)
  - Site Assignment Conventional: 6/25/2018 – 7/2/2018 (6 days)
- Staff Leader: Liz Gephardt (lgephardt@spp.org)
- Working Group Approval: ESWG

Generator Outlet Facilities

- Start: 4/30/2018
- End: 7/25/2018 (Member's Final Approval)
- Member Review Time:
  - 7/18/2018 – 7/25/2018 (6 days)
- Staff Leader: Kirk Hall (khall@spp.org)
- Working Group Approval: TWG

Economic Model Building

- Start: 7/3/2017
- End: 9/28/2018 (Member's Final Approval)
- Member Review Time:
  - Post 1: 2/12/2018 – 2/23/2018 (10 days)
  - Post 2: 8/8/2018 – 8/14/2018 (5 days)
  - Post 3: 9/17/2018 – 9/21/2018 (5 days)
- Staff Leader: Clayton Mayfield (cmayfield@spp.org)
- Working Group Approval: ESWG

Benchmarking

- Start: 12/8/2017
- End: 4/25/2018 (Member's Final Approval)
- Member Review Time:
  - Pass 1: 3/8/2018 – 3/15/2018 (6 days)
  - Pass 2: 4/18/2018 – 4/25/2018 (6 days)
- Staff Leader: Clayton Mayfield (cmayfield@spp.org)
- Working Group Approval: ESWG

Model Topology Updates

- Start: 3/1/2018
- End: 8/6/2018 (Member's Final Approval)
- Member Review Time:
  - Topology Lockdown: 5/1/2018
  - NTC/Re-Evals: 8/6/2018
- Staff Leader: Moses Rotich (mrotich@spp.org)
- Working Group Approval: TWG

Constraint Assessment

- Start: 8/2/18
- End: 9/27/2018 (Member's Final Approval)
- Member Review Time:
  - 8/31/2018 – 9/6/2018 (5 days)
  - 9/17/2018 – 9/21/2018 (5 days)
- Staff Leader: Chris Jamieson (cjamieson@spp.org)
- Working Group Approval: TWG

DC-to-AC Conversion

- Start: 8/2/2018
- End: 10/10/2018 (Member's Final Approval)
- Member Review Time:
  - 10/3/2018 – 10/9/2018 (5 days)
- Staff Leader: Moses Rotich (mrotich@spp.org)
- Working Group Approval: TWG

Base Reliability Needs Assessment

- Start: 8/2/2018
- End: 11/5/2018
- Staff Leader: Jason Speer (jspeer@spp.org)

BA Reliability Needs Assessment

- Start: 9/27/2018
- End: 1/7/2019
- Staff Leader: Jason Speer (jspeer@spp.org)

Economic Needs Assessment

- Start: 11/1/2018
- End: 1/7/2019
- Staff Leader: Nikki Roberts (nroberts@spp.org)

Policy Needs Assessment

- Start: 11/1/2018
- End: 1/7/2019
- Staff Leader: Nikki Roberts (nroberts@spp.org)

Operational Needs Assessment

- Start: 11/1/2018
- End: 1/7/2019
- Staff Leader: Will Tootle (wtootle@spp.org)

Short Circuit Needs Assessment

- Start: 11/1/2018
- End: 1/7/2019
- Staff Leader: Jason Terhune (jterhune@spp.org)

DPP Window

- Start: 1/8/2019
- End: 2/6/2019
- Member Review Time:
  - Transmission-planning response window (30 calendar days)
- Staff Leader: Ellen Bailey (ebailey@spp.org)

Staff Solutions Development

- Start: 1/8/2019
- End: 3/20/2019
- Staff Leaders:
  - Reliability: Kelsey Allen (kallen@spp.org)
  - Economic: Nikki Roberts (nroberts@spp.org)
  - Policy: Nikki Roberts (nroberts@spp.org)
  - Operational: Will Tootle (wtootle@spp.org)
  - Short Circuit: Jason Terhune (jterhune@spp.org)

DPP Evaluations

- Start: 1/8/2019
- End: 3/20/2019
- Staff Leaders:
  - Reliability: Kelsey Allen (kallen@spp.org)
  - Economic: Liz Gephardt (lgephardt@spp.org)
  - Policy: Nikki Roberts (nroberts@spp.org)
  - Operational: Will Tootle (wtootle@spp.org)
  - Short Circuit: Jason Terhune (jterhune@spp.org)

Initial Reliability Portfolio Development

- Start: 2/7/2019
- End: 3/20/2019
- Staff Leader: Kelsey Allen (kallen@spp.org)

Project Grouping – Phase 1
(Conceptual Cost Estimate)

- Start: 1/18/2019
- End: 4/23/2019
- Staff Leader: Clayton Mayfield (cmayfield@spp.org)

Study Cost Estimates – Round 1

- Start: 4/24/2019
- End: 5/16/2019
- Member Response Time:
  - 4/24/2019 – 5/16/2019 (16 days)
- Staff Leader: John O'Dell (jodell@spp.org)

Project Grouping – Phase 2
(Study Cost Estimate – Re-rank)

- Start: 5/15/2019
- End: 5/16/2019
- Staff Leader: Clayton Mayfield (cmayfield@spp.org)

Planning Summit

- Start: 5/17/2019
- End: 6/4/2019
- Member Review Time:
  - Summit Materials (7 days prior to meeting)
- Staff Leader: Ellen Bailey (ebailey@spp.org)

Project Grouping – Phase 3
(Conceptual + Study Cost Estimates using Summit Feedback)

- Start: 6/5/2019
- End: 6/19/2019
- Staff Leader: Clayton Mayfield (cmayfield@spp.org)

Study Cost Estimates – Round 2

- Start: 6/20/2019
- End: 6/26/2019
- Member Response Time:
  - 6/20/2019 – 6/26/2018 (5 days)
- Staff Leader: John O'Dell (jodell@spp.org)

Final Reliability Portfolios Development

- Start: 6/26/2019
- End: 8/5/2019
- Staff Leader: Kelsey Allen (kallen@spp.org)

Project Grouping – Phase 4
(Study Cost Estimate II – Final Re-rank)

- Start: 6/27/2019
- End: 7/8/2019
- Staff Leader: Clayton Mayfield (cmayfield@spp.org)

Project Grouping – Final Determination

- Start: 6/28/2019
- End: 7/8/2019
- Staff Leader: Clayton Mayfield (cmayfield@spp.org)

Optimization

- Start: 7/9/2019
- End: 7/17/2019
- Staff Leader: James Bailey (jbailey@spp.org)

Portfolio Consolidation

- Start: 7/18/2019
- End: 8/2/2019
- Staff Leader: James Bailey (jbailey@spp.org)

Staging

- Start: 8/5/2019
- End: 8/15/2019
- Staff Leader: Kirk Hall (khall@spp.org)

Benefit Metrics Calculation

- Start: 8/2/2019
- End: 8/26/2019
- Staff Leader: Antonio Barber (abarber@spp.org)

Stability Analysis

- Start: 8/5/2019
- End: 8/26/2019
- Staff Leader: Chris Jamieson (cjamieson@spp.org)

Sensitivity Analysis

- Start: 8/5/2019
- End: 8/26/2019
- Member Review Time:
  - 8/19/2019 – 8/23/2019 (5 days)
- Staff Leader: Clayton Mayfield (cmayfield@spp.org)

Final Reliability Assessment

- Start: 8/5/2019
- End: 8/27/2019
- Staff Leader: Dee Edmondson (dedmondson@spp.org)

Rate Impacts/ATRR

- Start: 8/15/2019
- End: 8/28/2019
- Staff Leader: Antonio Barber (abarber@spp.org)

Final Report

- Start: 8/1/2019
- End: 9/18/2019
- Staff Leader: Ellen Bailey (ebailey@spp.org)

TWG/ESWG Final Approvals

- Start: 9/26/2019
- End: 10/3/2019
- Member Review Time:
  - 9/26/2019 – 10/3/2019 (5 days)
- Staff Leaders:
  - TWG – Kirk Hall (khall@spp.org)
  - ESWG – Amber Greb (agreb@spp.org)

MOPC and SPP Board

- Start: 9/6/2019
- End: 10/29/2019
- Member Review Time:
  - MOPC: 10/7/2019 – 10/15/2019 (7 days)
  - SPP Board: 10/22/2019 – 10/29/2019 (5 days)


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2019 ITP Load and Generation Review

Nikki Roberts

January 11, 2018

Load and Gen Review Update

- Final workbooks will be posted January 12th for review and approval
  - Need Load and Generation Review approved by 1/19/2018
  - Will need an email approval


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Renewable Resource Expansion Plan Mitigation

Chris Jamieson

ESWG January 11th, 2018

Objective

Goals for today:

- Vet ESWG Action Item 189 recommendation
- Review renewable resource plan mitigation recommendation example
- Approve renewable resource plan mitigation recommendation

Renewable Resource Expansion Plan Mitigation Background

- ESWG Action Item 189
  - Discuss mitigation options for concerns with who pays for and who benefits from transmission coming from the ITP process and how it may circumvent the GI and Aggregate study processes
- Staff recommended option:
  - Modeling changes to remove increased sales revenue to non-firm wind generation from incremental transmission APC benefits
- Other considerations:
  - GOF assessment
    - No changes to approved ITP Manual processes recommended
  - Increasing B/C thresholds
    - No changes to approved ITP Manual processes recommended

Transmission Service Trends, Recommendation, and Rationale

- Significant merchant wind resources are participating in the SPP Integrated Market without acquiring long-term firm transmission service
  - Recommendation is to exclude any increased sales revenue of these existing resources that do not have firm service from transmission APC benefit
  - Rationale is that APC benefit due to increase sales revenue to non-firm merchant resources does not directly benefit who pays for incremental transmission costs
- Some Network Integration Transmission Service (NITS) and Point-to-Point (PTP) Load Serving Customers are not pursuing long-term firm transmission service for long-term purchased wind resources
  - Recommendation is to exclude any increased sales revenue of these existing resources that do not have firm service from transmission APC benefit
  - Rationale is equitable treatment of non-firm resources, consistent with APC benefit metric, and acknowledges safe harbor limit for regional cost allocation of Network Upgrades requirements for designating wind as a Network Resource
- Given these trends and uncertainty surrounding who benefits from sales revenues of projected wind resources versus who pays for incremental transmission costs
  - Recommendation is to exclude increased sales revenue of projected wind resources from transmission APC benefit

$175 Million Transmission Project Evaluation Example for Discussion Purposes

	1 year APC Benefit ($M) of Project	
	2020	2025
SPP Pricing Zone's Total APC Benefit	16	26
Other SPP modeled zones with load:		
KACY Zone	0	0
SWPA Zone	1	0
Total SPP Regional APC Benefit	17	27
1-Year Project Cost ($M)	30	34
1-Year APC B/C (Total SPP Regional APC Benefit divided by 1-Year Project Cost)	0.6	0.8
SPP Other Zone's APC Benefit	8	6
1-Year APC B/C with SPP Other Zone's APC Benefits (Total SPP Regional APC Benefit plus SPP Other Zone's APC Benefit divided by 1-Year Project Cost)	0.8	1.0

- 2017 ITP10 Future 3 Economic Model
  - SPP Pricing Zones, KACY, and SWPA Zones include ~17 GW wind
  - SPP Other Zone includes ~9 GW wind similar to 2019 ITP F1 2024 projections
  - 40 year B/C ~ 1.6 using Total SPP Regional APC Benefit without SPP Other Zone APC Benefit

Conventional and Solar Assignment Recommendation

- Conventional additions
  - Assign conventional additions consistent with the ITP Manual which will be added for capacity purposes, therefore firm service will be acquired
- Solar additions
  - Assign solar additions to result in an equal percentage of nameplate capacity to load for each zone
  - Acknowledges stakeholder expectation that solar will be added for capacity purposes, therefore firm service will be acquired

Appendix

APC and Transmission Service Assumptions

- Benefit Metric Manual Section 2.2.3 posted at https://www.spp.org/Documents/44031/Benefit%20Metrics%20Manual.doc)
  - The calculation of APC is based on a number of simplifying assumptions regarding the extent to which congestion costs can be hedged through auction revenue rights (ARRs) in a day 2 market environment. For example, it assumes congestion between owned generations and load can be fully hedged while none of market-based purchases would be hedged.
- Current trends show a decline in firm service acquisition for wind generation by load serving customers
- Recommendation is treat non-firm wind and projected wind as market-based purchases versus owned or purchased generation
- Owned or purchased assumes firm service which is not consistent with current transmission service trends

SPP's APC Zones

Pricing Zones (SPPMAIN)

- AEPW
- CUS
- EMDE
- GMO
- GRDA
- IS
- KCPL
- LES
- MIDW
- MKEC
- NPPD
- OKGE
- OPPD
- SUNC
- SWPS
- WFEC
- WRI

Other Zones with Load

- KACY
- SWPA

SPP Other Zone with no Load

- Exclude from SPP's Regional APC
- Zonal APC = 100% production cost minus sales to other zones (revenue)

$$\text{SPP Regional APC}_{\text{SPP TOTAL}} = \sum \text{APC}_{\text{SPPMAIN}} + \sum \text{APC}_{\text{KACY}} + \sum \text{APC}_{\text{SWPA}}$$

APC Examples

- Background material include spreadsheet with two APC examples
- APC Example 1 considers two zones for a single hour. Zone B is assigned 150 MW of firm wind consistent with APC Benefit metric assumption with 50 MW curtailed in the Base Case. The Change Case considers a transmission addition that eliminates the 50 MW wind curtailment.
- APC Example 2 considers three zones for a single hour. Zone B is not assigned 150 MW non-firm wind consistent with APC Benefit metric assumption. Zone C has 150 MW of non-firm wind assigned with 50 MW curtailed in the Base Case. The Change Case considers a transmission addition that eliminates the 50 MW wind curtailment.
- Example Comparison Observations
  - No change in dispatch between examples
  - APC Benefits are lower in Example 2 by assigning non-firm wind to Zone C and excluding the Zone C APC Benefit (increased sales revenue)
  - Zone A is a purchaser in both examples and the APC Benefit of Zone A remains unchanged
  - Zone A APC Benefit is driven by increased purchases at a lower Load-Weighted LMP
  - Zone B changes from a seller of firm wind to a purchaser of non-firm wind assigned to Zone C
  - Zone B APC Benefit reduces from $1,500 due to increased sales revenues at a higher Gen-Weighted LMP in Example 1 to $300 due to purchases at a lower Load-Weighted LMP in Example 2
  - Zone C is a seller
  - Zone C APC Benefit is $1,500 driven by increased sales revenue at a higher Gen-Weighted LMP

Motion

- SPP staff will remove sales revenue of wind generation that does not have long-term firm transmission service from the APC benefit calculations as a benefit calculation mitigation of wind resources without firm transmission service-Carries
- *Assign new solar generation based on a load ratio share.*
- *Assign the new wind renewables to the deficient zones to maximize the available accreditation up to 12% of zonal load, prior to the addition of new conventional generation.*
- *-these were not motions*


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2019 ITP Renewable Policy Review

Amber Greb

January 11, 2018

Objective

- Kick off the Renewable Policy Review milestone

ITP Manual

- The ITP Manual standardized the calculation of mandates and goals for utilities within the SPP footprint
- Mandates and goals will be calculated for utilities residing in states that have a Renewable Policy Standard (RPS)
  - Based on the finalized load & gen forecast

Renewable Policy Standards

State	RPS Type	Generation Type	Capacity- or Energy- Based	Year 2 %	Year 5 %	Year 10 %
Kansas	Goal	Both	Capacity	20	20	20
Minnesota	Mandate	Both	Energy	20	20	25
Missouri	Mandate	Both	Energy	15	15	15
Montana	Mandate	Both	Energy	15	15	15
North Dakota	Goal	Both	Energy	10	10	10
New Mexico	Mandate	Wind	Energy	15	15	15
New Mexico	Mandate	Solar	Energy	4	4	4
South Dakota	Goal	Both	Energy	10	10	10
Texas	Mandate	Both	Capacity	5	5	5

- States within SPP not included in this table are presumed to have no RPS requirement
- A generation type of "both" indicates that it can be met by wind and/or solar


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SPP Southwest Power Pool

2019 ITP Renewable Resource Plan

Amber Greb

January 11, 2018

Objective

- Inform the ESWG of Renewable Resource plan methodology
- Vetting of non-firm renewables

Renewable Resource Plan

Renewable Resource Plan

- Resource additions will be included to meet renewable policy standards
  - Required capacity and energy will be calculated during the renewable policy review for mandates and goals

Existing Generation + Gen Inclusion requests ≥ Renewable Requirements

Renewable Additions – External

- MISO, TVA, SaskPower, Manitoba
  - use renewable resource additions from the MTEP18 model (future-specific)
- AECI
  - actively participates in the SPP model development process
  - Additions will be vetted with the ESWG

Non-Firm Renewables

- Should non-firm renewables count towards meeting mandates and goals?
  - Historically has not been an issue
- 1.8 GW Non-Firm Wind affiliated with NITS or PTP Load Serving Customers
  - Utilities with a signed PPA should get credit for the wind

Recommendation

- Load serving entities who either own or have a signed PPA for renewable resources, will get credit for those resources when meeting their Renewable Policy Standards


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2019 ITP Future 2 Increased Energy

Liz Gephardt

January 11, 2018

Objective

- Vetting of Future 2 EV energy penetration methodology

Background

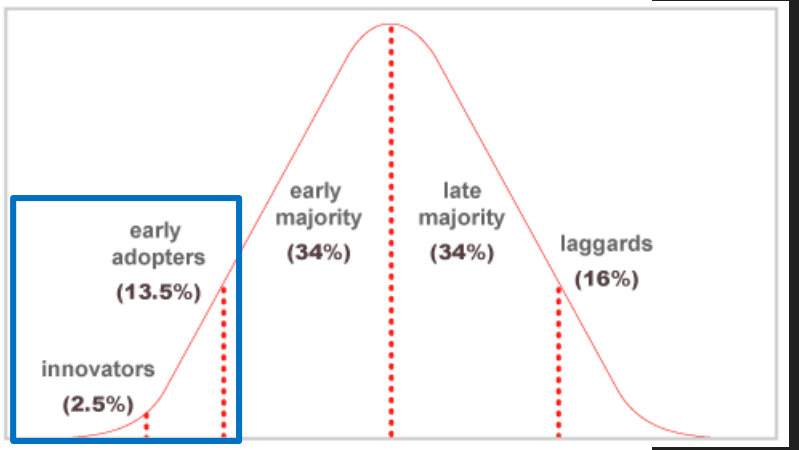
- 2019 ITP Future 2 includes increased energy growth rates due to an increase in electric vehicle (EV) penetration

Three-Part Methodology

- How much energy do we add?
- How do we allocate the energy to the zones?
- How do we allocate the energy throughout the year?

How much energy do we add?

- Assuming:
  - 2016 SPP population: ~17.5M
  - Average U.S. annual population growth: 0.7%
  - 0.79 cars/person
  - EV conversion rate
    - 9% in 2024
    - 16% in 2029
  - 13,476 miles per year per person
  - 0.34 kWh per mile



- Total Energy Addition
  - 6,028 GWh in 2024 (~2.0%* of SPP energy)
  - 11,097 GWh in 2029 (~3.5%* of SPP energy)

*Subject to change based on load review results

How do we allocate the energy to the zones?

- Load-ratio share basis
  - EV adoption could generally be correlated to population/load density, allocate accordingly
  - Charging stations in rural areas

How do we allocate the energy throughout the year?

- 50/50 peak load amounts in Future 2
- Options
  1. Apply EV energy amounts to existing demand group structure with valley fill[1] load shape adjustment
     - Less granular approach
     - Loads driving needs will be investigated during needs assessment and portfolio development
  2. Create EV demand group per pricing zone
     - More granular approach
     - Significantly more SPP staff work and ESWG vetting
     - Many unknowns with methodology

[1]Valley fill: Peak and minimum hour preserved with adjustment distribution toward low loads

Recommendation

SPP staff recommends

1. Utilizing the methodologies presented for the total energy addition and the zonal allocation of that energy
2. Using option 1 presented for allocation of the energy throughout the year

Next Steps

- Economic Model Build
  - December 2017-September 2018
- Renewable Policy Review
  - January-February 2018
- Resource Plan
  - February-May 2018