

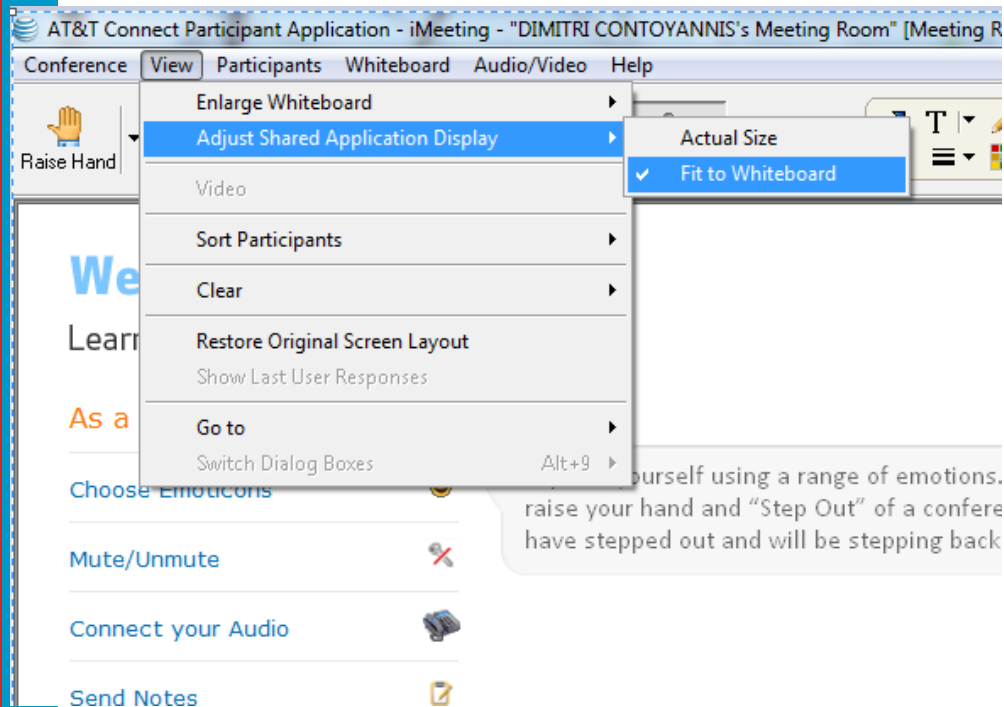
Program Advisory Committee:

California Energy Commission Compliance Software
The SDD Data Model

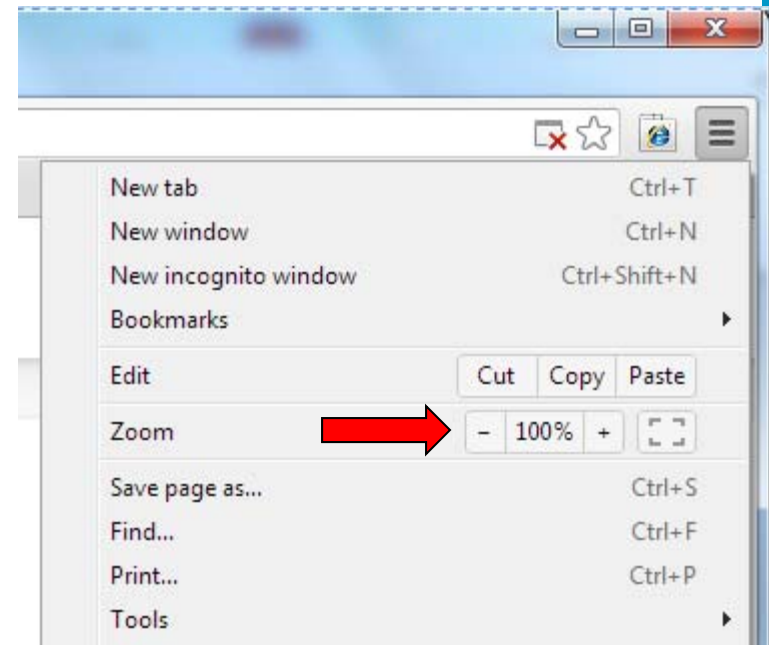


Quick Note

If your screen is cutting off portions of the presentation



Desktop Application
View->adjust...->fit to
whiteboard



Browser Mode
"Zoom Out"
(varies by browser)

Agenda:

- Introductions (1:00pm – 1:10pm)
- Project Overview & Schedule (1:10pm – 1:20pm)
- SDD Overview (1:20pm – 1:30pm)
- SDD – Envelope (1:30pm – 1:45pm)
- SDD – Lighting (1:45pm – 2:00pm)
- SDD – HVAC (2:00pm – 2:15pm)
- Interfacing via SDD XML (2:15pm – 2:25pm)
- Validation of XML files (2:25pm – 2:40pm)
- Q & A (2:40pm – 3:00pm)
- Future Plans & Wrap-up



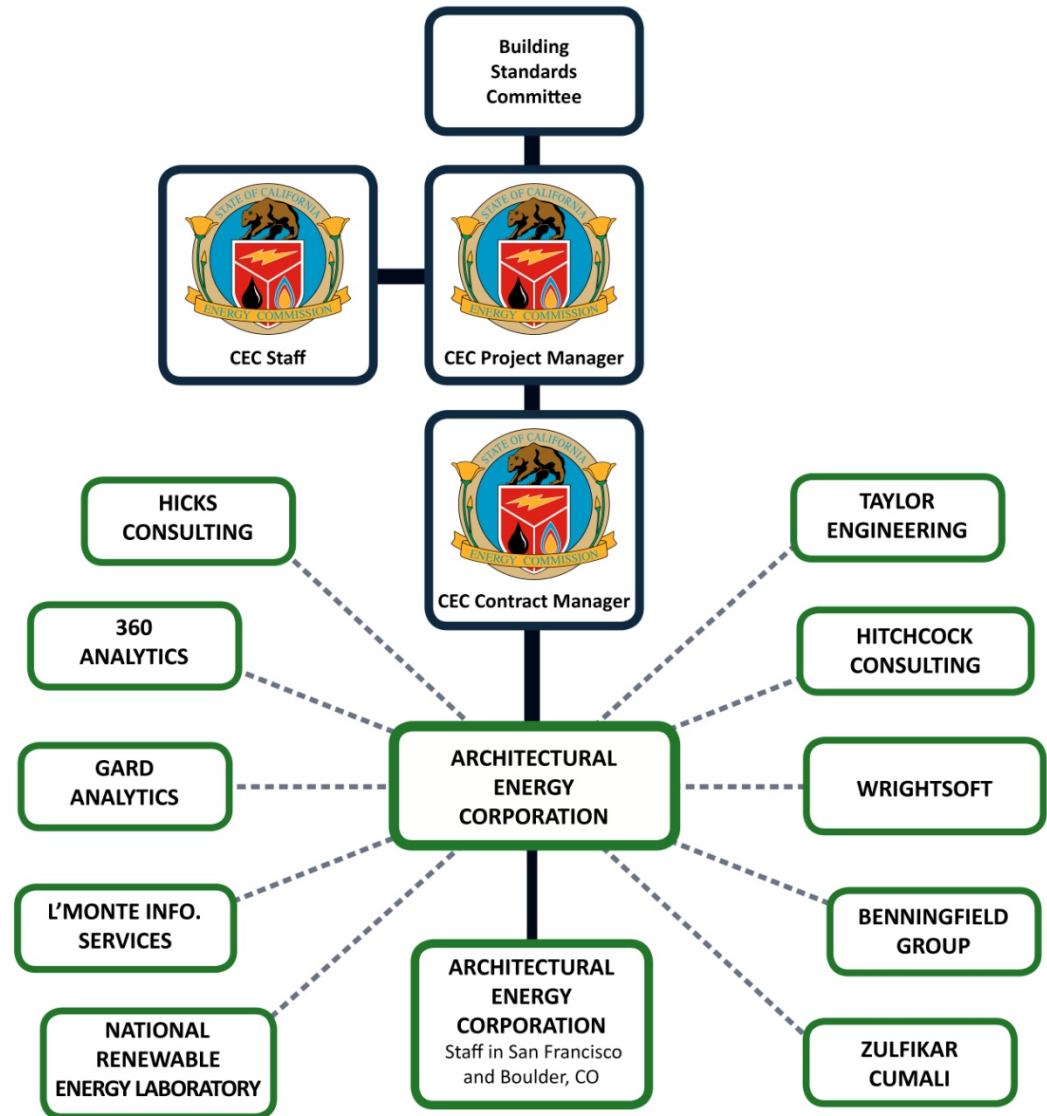
■ Introductions

■ Project Team

➔ CEC

➔ AEC

➔ Subject Matter Experts



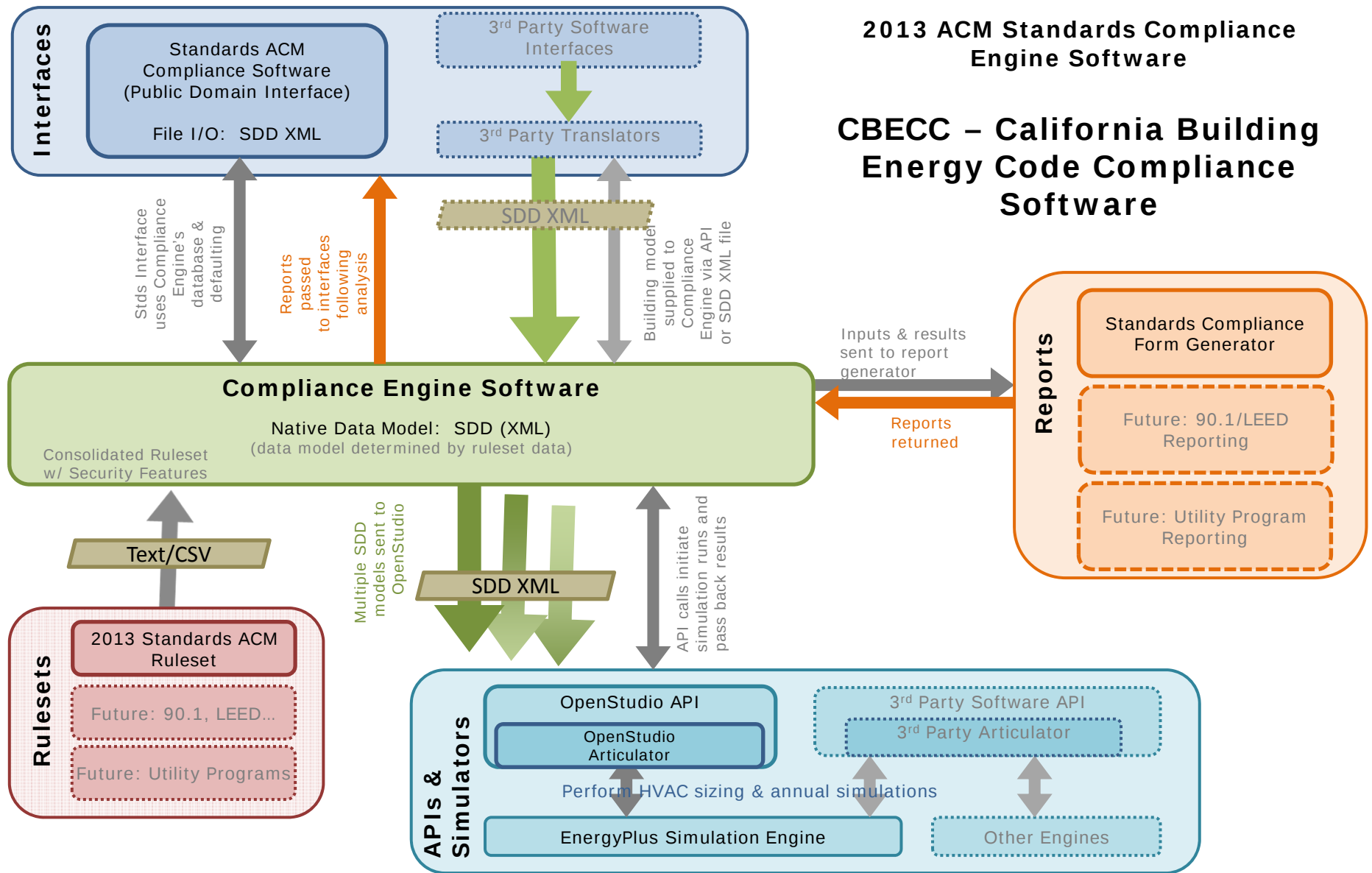
Project Review

- Quick recap of project
- Standards Data Dictionary (SDD) Data Model is the underlying framework for model inputs and rules processing



2013 ACM Standards Compliance Engine Software

CBECC – California Building Energy Code Compliance Software



Project Schedule

- Alpha Release – March 19
- Beta Release – Mid April
- v1 Release – end of May
- ---Reference Method Testing---
- Software Certification - June



Overview of the SDD

- SDD: Standards Data Dictionary
 - A controlled vocabulary that covers the union of these knowledge domains:
 - Building Models
 - Building Energy Efficiency Standards
 - Energy Simulation
 - Each term in the SDD has:
 - Name:
 - Full term – one or more words using pascal casing, e.g. ControlSystemType
 - Short form uses documented abbreviations and acronyms e.g. CtrlSysType
 - Data definitions:
 - Data type: e.g. boolean, date, decimal, enumerated list, integer, reference, string
 - Units: e.g. Btu, Btu per ft2, ft3 per min, W per ft2
 - Enumerations: controlled list of values for a property
e.g. Fenestration AssemblyContext: FieldFabricated, Manufactured, SiteBuilt
 - Definitions and examples from the Standards
 - Structure and Relationships:
 - Object and its properties
 - Parent/Child relationships: e.g. Wall/Window
 - References to library objects: Wall.ConstructAssemblyReference



Overview of the SDD

- SDD Development – a collaborative effort using SharePoint platform to
 - Add, modify and delete SDD terms
 - Customize specific versions of the SDD using special columns and views
 - Version control and user email alert system
 - Collect and make available SDD related materials in a document library
- Developed and used by several Standards development projects
 - PIER funded Building Energy Standards Modeler (BESM) project
 - Developed SharePoint SDD structure and initial terms, maintains the site.
 - This project - 2013 NR Compliance Software
 - 2013 Residential Compliance Documents XML schema project



Overview of the SDD

- NR SDD Data Model, based on the SDD is used consistently in
 - Compliance engine
 - Rule sets
 - Generated XML instance files
- NR SDD Workbook -
 - Portable Documentation of the SDD
 - Excel workbook generated directly from the SharePoint lists
 - Using Excel macro capability developed and shared by the BESM project
 - NR SDD Workbook Organization:
 - Look at the Excel SDD workbook
 - (or Screen shots of the NR SDD workbook...)



2013NR_SDD_20130220.xlsx

1	2	3	4	5	6	7	8	A	B	C	D	E	F	G	H	I
	1	NR ACM SDD Outline														Properties or Array[]
	2	Project														HVACAutoSizing; Name; PermitDay; PermitMonth; PermitScope; PermitYear; SiteFuelType; BldgTerrain; ClzZn; ClzZnCity; ClzZnCounty; Elevation; Lat; Long; TimeZn; AvgDBTemp; MoAvgTempMaxDiff; DD[varies]
	3	Building														AboveGrdStoryCnt; FuncClassMthd; CoinDsgnClgLd; CoinDsgnHtgLd; ConsPhase; CtrlSysType; NonCoinDsgnClgLd; NonCoinDsgnHtgLd; NonResFlrArea; TotCondFlrArea; TotCondVol; TotFlrArea; TotStoryCnt; CompleteBldgOccClass; ClgUnmetLdHrs; HtgUnmetLdHrs; Name; ResFlrArea; Status; CompleteBldgFunc; CBCOccGrp; RelocPubSchoolBldg
	4	BuildingStory														Name; Status
	5	Space														CommRfrgFracLost; CommRfrgRemCndsrFrac; DsgnInfRt; FlrArea; FlrToCeilingHgt; InfMthd; InfModelCoefA; InfModelCoefB; InfModelCoefC; InfModelCoefD; InfSchRef; IntLtgNonRegHtGnRadFrac; IntLtgNonRegHtGnSpcFrac; IntLtgNonRegSchRef; IntLPDNonReg; IntLPDReg; IntLtgRegHtGnRadFrac; IntLtgRegHtGnSpcFrac; IntLtgRegSchRef; Name; OccClass; PlenumSpcRef; FuncSchGrp; CondgType; DsgnNaturalVentRt; ElevCnt; ElevEscalPwr; ElevPwr; EscalCnt; EscalPwr; IntLtgSpecMthd; NaturalVentilationMethod; NaturalVentSchRef; SpcFunc; SpcFuncDefaultsRef; CommRfrgEqpCOP; CommRfrgEPD; CommRfrgEqpSchRef; ElevEscalSchRef; HotWtrHtgRt; HotWtrHtgSchRef; OccDens; OccLatHtRt; OccSchRef; OccSensHtRt; ProcElecLatHtRt; ProcElecPwrDens; ProcElecSchRef; ProcElecSensHtRt; ProcGasPwrDens; ProcGasRadFac; ProcGasSchRef; RecptPwrDens; RecptSchRef; VentRt; Vol
	6	Ceiling														Area; ConsType; Name; ExtSolAbs; ExtThrmIAbs; ExtVisAbs; IntSolAbs; IntThrmIAbs; IntVisAbs; AdjacentSpcRef; ConsAssmRef; Name; Status
	8	DaylitZone														CtrlLtgPwr; DayltCtrlType; DayltSimMthd; FlrArea; IllumSetPt; AdjustmentFactorPrimary; AdjustmentFactorSecondary; MinDimLightFrac; MinDimPwrFrac; Type; Name
	13	ExteriorFloor														Area; ExtRoughness; ExtSolAbs; ExtThrmIAbs; ExtVisAbs; IntSolAbs; IntThrmIAbs; IntVisAbs; Status; ConsAssmRef; Name; Az; Tilt
	15	ExteriorWall														Area; ExtRoughness; ExtSolAbs; ExtThrmIAbs; ExtVisAbs; DisplayPerim; Name; IntSolAbs; IntThrmIAbs; IntVisAbs; Status; ConsAssmRef; Name; Az; Tilt
	16	Door														Area; Oper; DrConsRef; Name
	17	PolyLoop														CartesianPt[varies]
	18	PolyLoop														CartesianPt[varies]
	19	Window														Area; FenConsRef; Name; Status
	20	ExternalShadingObje														Area; ConsAssmRef; Name; ShdgCoef; ShdgType
	21	PolyLoop														CartesianPt[varies]
	22	InteriorShadingDevic														Name
	23	PolyLoop														CartesianPt[varies]
	24	InteriorFloor														AdjacentSpcRef; ConsAssmRef; IntSolAbs; IntThrmIAbs; IntVisAbs; Status; Name
	26	InteriorLightingSystem														AllowBoardWd; AreaCatAllowType; HtGnRadFrac; HtGnSpcFrac; NonRegExclusion; PAF; PAF CredType; PwrReg; SchRef; Pwr; LumMntgHgt; Name; TailoredMthdAllowType; VeryValDisplayCaseArea; WallDisplayLen; WorkPlaneHgt; Lum[5]; Cnt[5]
	27	InteriorWall														ExtSolAbs; ExtThrmIAbs; ExtVisAbs; IntSolAbs; IntThrmIAbs; IntVisAbs; AdjacentSpcRef; ConsAssmRef; Name; Status
	31	PolyLoop														CartesianPt[varies]
	32	Roof														ExtRoughness; ExtSolAbs; ExtThrmIAbs; ExtVisAbs; IntSolAbs; IntThrmIAbs; IntVisAbs; ConsAssmRef; Name; Status; Az; Tilt
	40	UndergroundFloor														IntSolAbs; IntThrmIAbs; IntVisAbs; PerimExposed; ConsAssmRef; Name; Status

Outline

Objects

ObjProps

Properties

Enumerations

HvacObjects

HvacObjProps

HvacProperties

HvacEnumerations

Abbreviations

[Outline](#)
[Objects](#)
[ObjProps](#)
[Properties](#)
[Enumerations](#)
[HvacObjects](#)
[HvacObjProps](#)
[HvacProperties](#)
[HvacEnumerations](#)
[Abbreviations](#)

	A	B	C	D	E	F	G
1	NR ACM Term	NR ACM Term Short Form	DataType	Units	Enumerations	Compliance Use	Simulation Use
145	CoincidentWetBulb	CoinWB	decimal	F		Required	Required
146	CommercialRefrigerationEPD	CommRfrgEPD	decimal	W per ft2		Optional	Optional
147	CommercialRefrigerationEquipmentCOP	CommRfrgEqpCOP	decimal	none		Optional	NotSimulated
148	CommercialRefrigerationEquipmentScheduleReference	CommRfrgEqpSchRef	reference	none		Optional	Optional
149	CommercialRefrigerationFractionLost	CommRfrgFracLost	decimal	none			
150	CommercialRefrigerationRemoteCondenserFraction	CommRfrgRemCndsrFrac	decimal	none			
151	CompatibleSurfaceType	CompatibleSurfType	enumerated list	none	Ceiling ExteriorFloor ExteriorWall InteriorFloor InteriorWall Roof UndergroundFloor UndergroundWall	Required	Required
152							
153							
154							
155							
156							
157							
158							
159	CompleteBuildingFunction	CompleteBldgFunc	enumerated list	none	AllOthersBuildings AuditoriumBuilding ClassroomBuilding CommercialIndustrialStorageBuilding ConventionCenterBuilding DataCenterBuilding FinancialInstitutionBuilding GeneralCommercialIndustrialWorkBuilding GroceryStoreBuilding LibraryBuilding MedicalBuildingClinicBuilding OfficeBuilding ParkingGarageBuilding ReligiousFacilityBuilding RestaurantBuilding SchoolBuilding TheaterBuilding	Required	NotSimulated
160							
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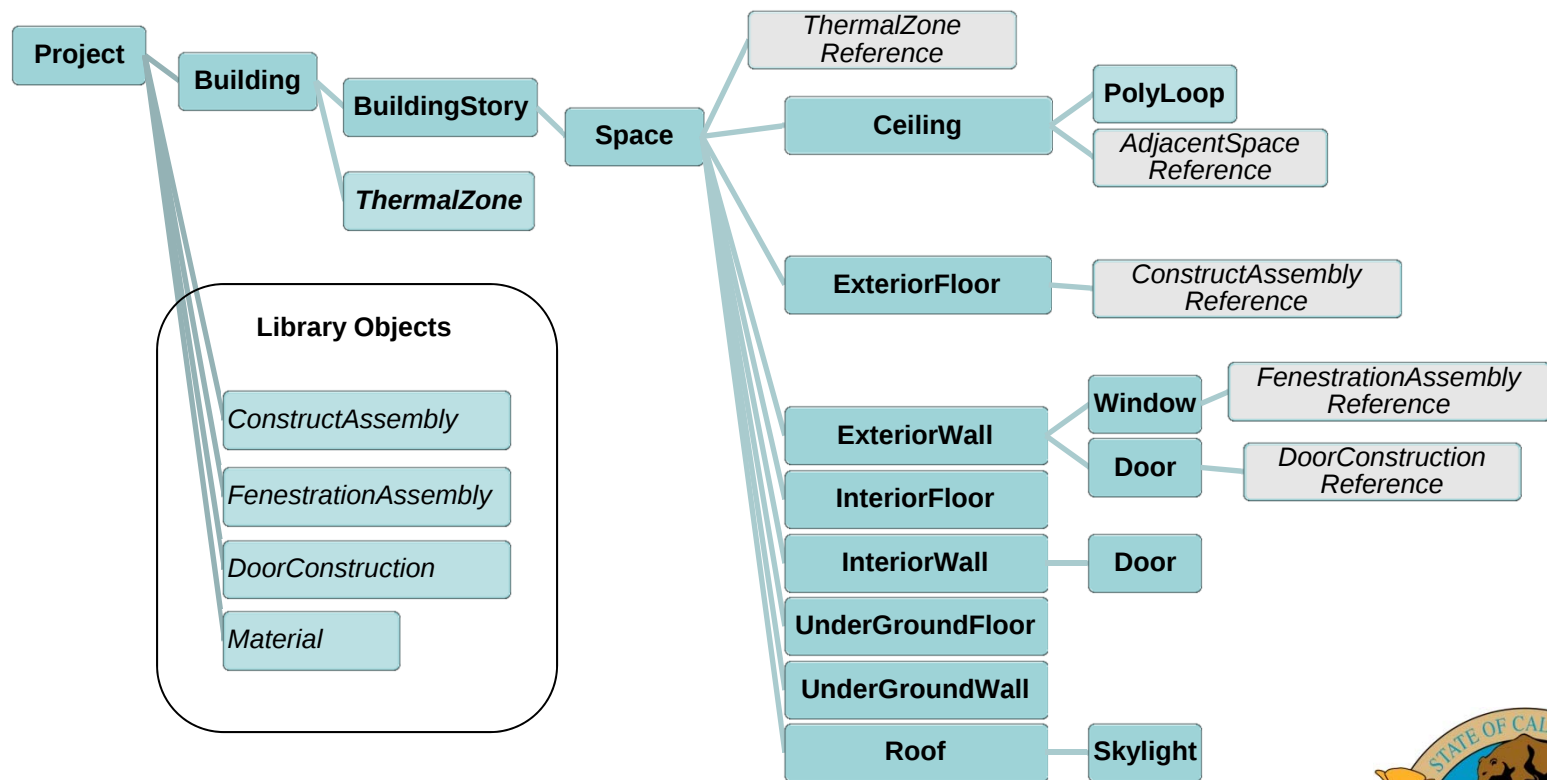
Overview of the SDD

- XML file format
 - Generated by the compliance software, the elements in the XML files are based on the SDD data model. The terms, data types, enumeration values, container and referencing relationships match what is defined in the SDD.
 - Illustrative example files
 - XML instance files representing common nonresidential building types that illustrate what information is required in an input building file.



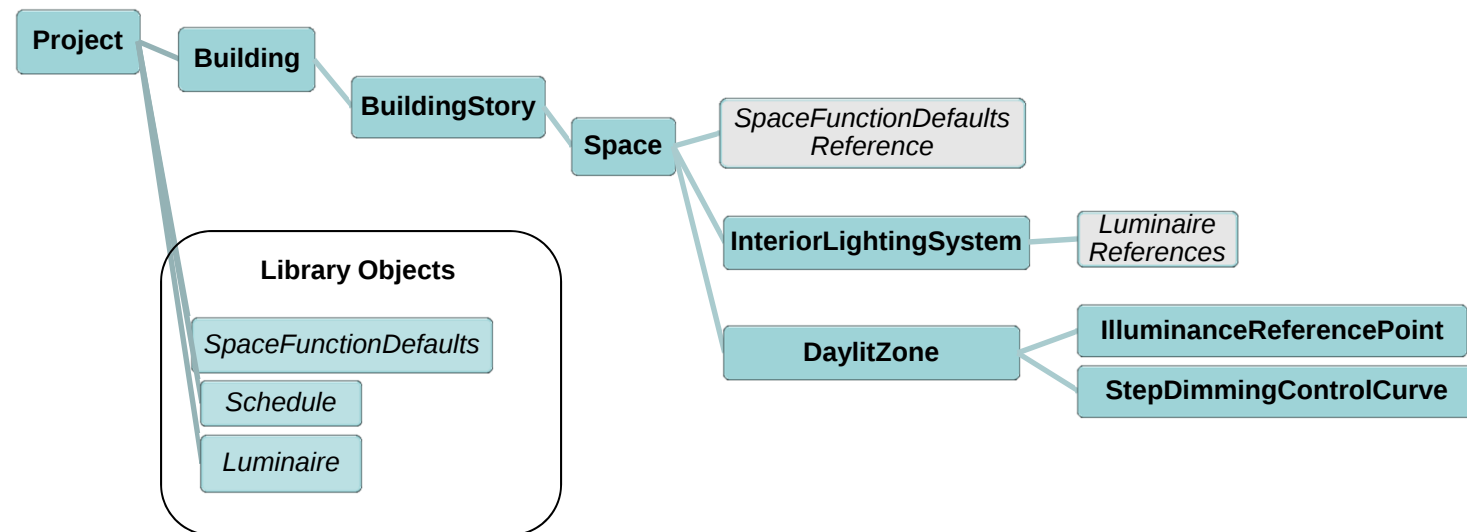
SDD Details

Envelope/Geometry



SDD Details

Lighting/Daylighting/Internal Loads



SDD Workbook

NR ACM SDD Outline				Properties or Array[]
Project				HVACAutoSizing; Name; PermitMonth; PermitYear; SiteFuelType; BldgTerrain; CliZn; CliZnCity; CliZnCounty; Elevation; Lat; Long; TimeZn; AvgDBTemp; MoAvgTempMaxDiff; DD[varies]
	Building			AboveGrdStoryCnt; FuncClassMthd; CoinDsgnClgLd; CoinDsgnHtgLd; ConsPhase; CtrlSysType; NonCoinDsgnClgLd; NonCoinDsgnHtgLd; NonResFlrArea; TotCondFlrArea; TotCondVol; TotFlrArea; TotStoryCnt; CompleteBldgOccClass; ClgUnmetLdHrs; HtgUnmetLdHrs; Name; ResFlrArea; Status; CompleteBldgFunc; CBCOccGrp; RelocPubSchoolBldg
	BuildingStory			Name; Status
		Space		CommRfrgFracLost; CommRfrgRemCndsrFrac; DsgnInfRt; FlrArea; FlrToCeilingHgt; InfMthd; InfModelCoefA; InfModelCoefB; InfModelCoefC; InfModelCoefD; InfSchRef; IntLtgNonRegHtGnRadFrac; IntLtgNonRegHtGnSpcFrac; IntLtgNonRegSchRef; IntLPDNonReg; IntLPDReg; IntLtgRegHtGnRadFrac; IntLtgRegHtGnSpcFrac; IntLtgRegSchRef; Name; OccClass; PlenumSpcRef; FuncSchGrp; CondgType; DsgnNaturalVentRt; ElevCnt; ElevEscalPwr; ElevPwr; EscalCnt; EscalPwr; IntLtgSpecMthd; NaturalVentilationMethod; NaturalVentSchRef; SpcFunc; SpcFuncDefaultsRef; CommRfrgEqpCOP; CommRfrgEqpEPD; CommRfrgEqpSchRef; ElevEscalSchRef; HotWtrHtgRt; HotWtrHtgSchRef; OccDens; OccLatHtRt; OccSchRef; OccSensHtRt; ProcElecLatHtRt; ProcElecPwrDens; ProcElecSchRef; ProcElecSensHtRt; ProcGasPwrDens; ProcGasRadFac; ProcGasSchRef; RecptPwrDens; RecptSchRef; VentRt; Vol
			Ceiling	Area; ConsType; Name; ExtSolAbs; ExtThrmAbs; ExtVisAbs; IntSolAbs; IntThrmAbs; IntVisAbs; AdjacentSpcRef; ConsAssmRef; Name; Status
			DaylitZone	CtrlLtgPwr; DayltCtrlType; DayltSimMthd; FlrArea; IllumSetPt; AdjustmentFactorPrimary; AdjustmentFactorSecondary; MinDimLightFrac; MinDimPwrFrac; Type; Name
			IlluminanceReferencePoint	
			StepDimmingControlCurve	StepDimCtrlPt[varies]
			ExteriorFloor	Area; ExtRoughness; ExtSolAbs; ExtThrmAbs; ExtVisAbs; IntSolAbs; IntThrmAbs; IntVisAbs; Status; ConsAssmRef; Name; Az; Tilt
			ExteriorWall	Area; ExtRoughness; ExtSolAbs; ExtThrmAbs; ExtVisAbs; DisplayPerim; Name; IntSolAbs; IntThrmAbs; IntVisAbs; Status; ConsAssmRef; Name; Az; Tilt
			InteriorFloor	AdjacentSpcRef; ConsAssmRef; IntSolAbs; IntThrmAbs; IntVisAbs; Status; Name
			InteriorLightingSystem	AllowBoardWd; AreaCatAllowType; HtGnRadFrac; HtGnSpcFrac; NonRegExclusion; PAF; PAFcredType; PwrReg; SchRef; Pwr; LumMntgHgt; Name; TailoredMthdAllowType; VeryValDisplayCaseArea; WallDisplayLen; WorkPlaneHgt; Lum[5]; Cnt[5]
			InteriorWall	ExtSolAbs; ExtThrmAbs; ExtVisAbs; IntSolAbs; IntThrmAbs; IntVisAbs; AdjacentSpcRef; ConsAssmRef; Name; Status
			Door	Area; Oper; DrConsRef; Name
			Roof	ExtRoughness; ExtSolAbs; ExtThrmAbs; ExtVisAbs; IntSolAbs; IntThrmAbs; IntVisAbs; ConsAssmRef; Name; Status; Az; Tilt
			Skylight	Area; FenConsRef; Name; Status
			UndergroundFloor	IntSolAbs; IntThrmAbs; IntVisAbs; PerimExposed; ConsAssmRef; Name; Status
			UndergroundWall	Area; IntSolAbs; IntThrmAbs; IntVisAbs; Hgt; ConsAssmRef; Name; Status

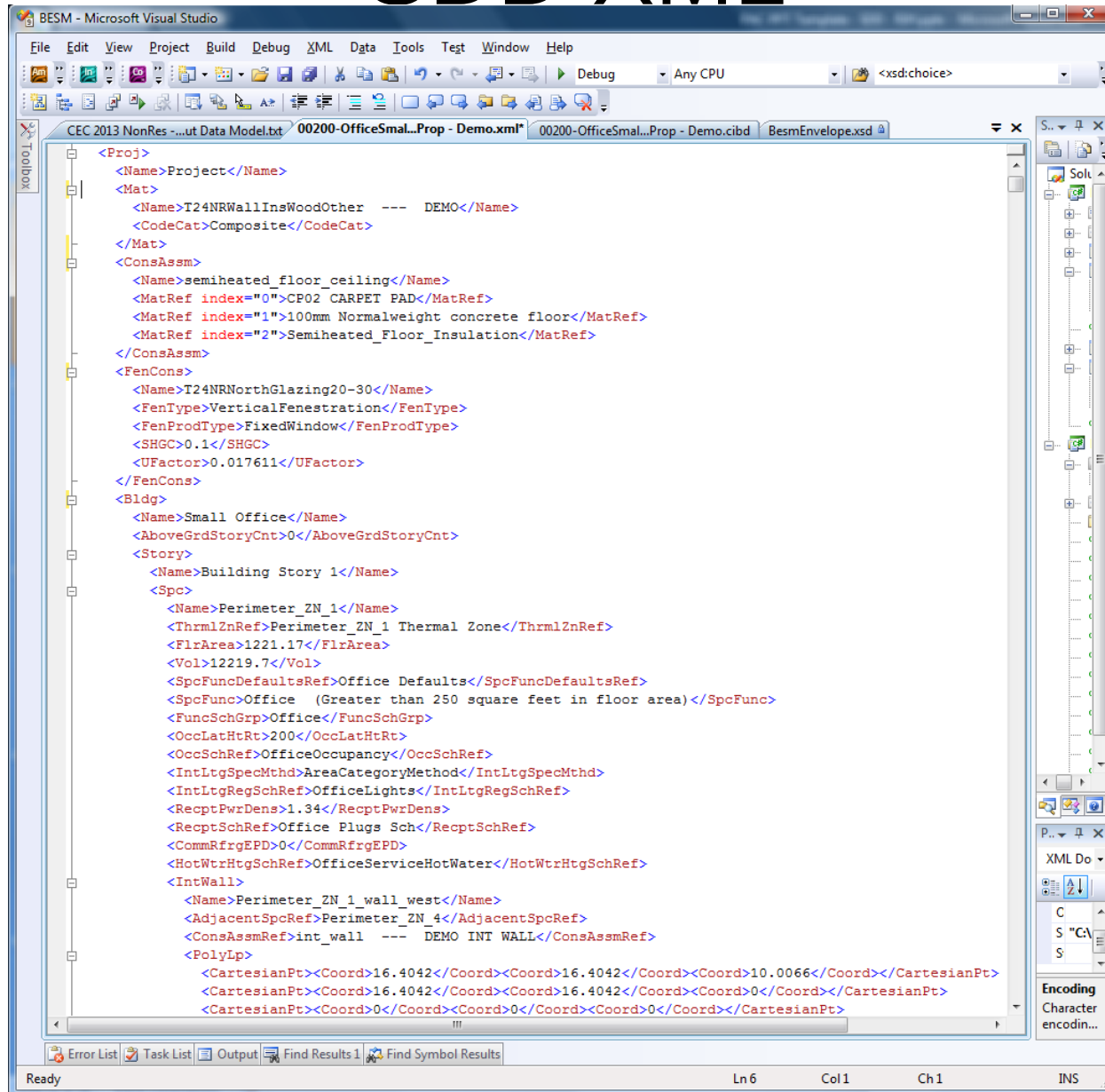


SDD Workbook

Library Objects	
ConstructAssembly	<i>CFactor; CompatibleSurfType; SpecMthd; CRRCAgedEmittance; CRRCAgedRefI; CRRCAgedSRI; CRRCInitialEmittance; CRRCInitialRefI; CRRCInitialSRI; CRRCPProdID; ExtRoughness; ExtSolAbs; ExtThrmIAbs; ExtVisAbs; FFactor; FieldAppliedCoating; IntSolAbs; IntThrmIAbs; IntVisAbs; Name; SlabInsOrientation; SlabInsThrmIR; SlabType; UFactor; MatRef[10]</i>
DoorConstruction	<i>CertificationMthd; Type; Name; UFactor</i>
FenestrationConstruction	<i>AssmContext; CertificationMthd; VT; Diffusing; FenFrm; FenPanels; FenProdType; FenType; GlzTint; GreenhouseGardenWin; Name; OperableWinConfiguration; SkyltCurb; SkyltGlz; SHGC; SHGCCOG; UFactor; UFactorCOG; VTCOG; WinDivider</i>
Luminaire	<i>Cat; HtGnRadFrac; HtGnSpcFrac; Pwr; Name</i>
Material	<i>CavityIns; CMUFill; CMUWt; CompositeMatNotes; FrmConfig; FrmFacCav; FrmFacHeaders; FrmFacMembers; HeaderIns; ICCESRptNum; InsOutsdWtrprfMemb; CodeCat; Dens; SpecHt; ThrmICndct; Thkns; Name; FrmMat; RValue</i>
Schedule	<i>Name; Type; ScheduleWeekReference; EndDay; EndMonth[53]</i>
SpaceFunctionDefaults	<i>CommRfrgEqpCOP; CommRfrgEPD; CommRfrgEqpSchRef; ElevEscalSchRef; HotWtrHtgRt; HotWtrHtgSchRef; IntLtgNonRegHtGnRadFrac; IntLtgNonRegHtGnSpcFrac; IntLtgNonRegSchRef; IntLPDNonReg; IntLPDReg; IntLtgRegHtGnRadFrac; IntLtgRegHtGnSpcFrac; IntLtgRegSchRef; IsStandard; Name; OccDens; OccLatHtRt; OccSchRef; OccSensHtRt; ProcElecLatHtRt; ProcElecPwrDens; ProcElecSchRef; ProcElecSensHtRt; ProcGasPwrDens; ProcGasRadFac; ProcGasSchRef; RecptPwrDens; RecptSchRef; FuncSchGrp; SpcFunc; VentRt</i>



SDD XML



The screenshot displays the Microsoft Visual Studio IDE with the following components:

- Menu Bar:** File, Edit, View, Project, Build, Debug, XML, Data, Tools, Test, Window, Help.
- Toolbar:** Standard editing and development tools.
- Toolbox:** Located on the left, showing XML element categories.
- Code Editor:** Contains the following XML code:

```
<Proj>
  <Name>Project</Name>
  <Mat>
    <Name>T24NRWallInsWoodOther --- DEMO</Name>
    <CodeCat>Composite</CodeCat>
  </Mat>
  <ConsAssm>
    <Name>semiheated_floor_ceiling</Name>
    <MatRef index="0">CP02 CARPET PAD</MatRef>
    <MatRef index="1">100mm Normalweight concrete floor</MatRef>
    <MatRef index="2">Semiheated_Floor_Insulation</MatRef>
  </ConsAssm>
  <FenCons>
    <Name>T24NRNorthGlazing20-30</Name>
    <FenType>VerticalFenestration</FenType>
    <FenProdType>FixedWindow</FenProdType>
    <SHGC>0.1</SHGC>
    <UFactor>0.017611</UFactor>
  </FenCons>
  <Bldg>
    <Name>Small Office</Name>
    <AboveGrdStoryCnt>0</AboveGrdStoryCnt>
    <Story>
      <Name>Building Story 1</Name>
      <Spc>
        <Name>Perimeter_ZN_1</Name>
        <ThrmZnRef>Perimeter_ZN_1 Thermal Zone</ThrmZnRef>
        <FlrArea>1221.17</FlrArea>
        <Vol>12219.7</Vol>
        <SpcFuncDefaultsRef>Office Defaults</SpcFuncDefaultsRef>
        <SpcFunc>Office (Greater than 250 square feet in floor area)</SpcFunc>
        <FuncSchGrp>Office</FuncSchGrp>
        <OccLatHtRt>200</OccLatHtRt>
        <OccSchRef>OfficeOccupancy</OccSchRef>
        <IntLtgSpecMthd>AreaCategoryMethod</IntLtgSpecMthd>
        <IntLtgRegSchRef>OfficeLights</IntLtgRegSchRef>
        <RecptPwrDens>1.34</RecptPwrDens>
        <RecptSchRef>Office Plugs Sch</RecptSchRef>
        <CommRfrgEPD>0</CommRfrgEPD>
        <HotWtrHtgSchRef>OfficeServiceHotWater</HotWtrHtgSchRef>
      </Spc>
      <IntWall>
        <Name>Perimeter_ZN_1_wall_west</Name>
        <AdjacentSpcRef>Perimeter_ZN_4</AdjacentSpcRef>
        <ConsAssmRef>int_wall --- DEMO INT WALL</ConsAssmRef>
        <PolyLp>
          <CartesianPt><Coord>16.4042</Coord><Coord>16.4042</Coord><Coord>10.0066</Coord></CartesianPt>
          <CartesianPt><Coord>16.4042</Coord><Coord>16.4042</Coord><Coord>0</Coord></CartesianPt>
          <CartesianPt><Coord>0</Coord><Coord>0</Coord><Coord>0</Coord></CartesianPt>
        </PolyLp>
      </IntWall>
    </Story>
  </Bldg>
</Proj>
```
- Right Side:** Solution Explorer showing a project structure, and a Properties window with XML-related settings.
- Status Bar:** Shows 'Ready', 'Ln 6', 'Col 1', 'Ch 1', and 'INS'.



SDD – HVAC

- Motivations for new data model
 - gbXML lacking detail
 - EnergyPlus-related models complex, but wanted to maintain flexibility and parallels to reference program.
- HVAC systems described using a structure of individual objects rather than a single “HVAC System” object with many properties.
- Equipment interconnections described using a combination of reference properties and established parent/child relationships.



SDD HVAC - Workbook

AirSystem		CtrlSysType; ClgAvailSchRef; ClgCtrl; HtgAvailSchRef; HtgCtrl; NightCycleFanCtrl; OptStart; PkCoinCld; PkCoinHtgLd; VentCtrl; AvailSchRef; CIRstOutdrHi; CIRstOutdrLow; CIRstSupHi; CIRstSupLow; CustomCldAvailSch; CustomFanSch; CustomHtgAvailSch; GarageVentiCtrlMthd; HtRstOutdrHi; HtRstOutdrLow; HtRstSupHi; HtRstSupLow; Type; Name; UnmetCldLdHrs; UnmetHtgLdHrs; WesternCldChallengeCert
	AirSegment	DuctCndctLoss; DuctLkgeFac; DuctSurfArea; DuctSurfAreaCoef; DuctSurfAreaOutdr; DuctThrmIR; MakeupAirSysRef;
	FluidSystem	AvailSchRef; CIRstOutdrHi; CIRstOutdrLow; CIRstSupHi; CIRstSupLow; Desc; ClgCtrl; EqpCtrlRef; HtgCtrl; Type; HtRstOutdrHi; HtRstOutdrLow; HtRstSupHi; HtRstSupLow; Name; UnmetCldLdHrs; UnmetHtgLdHrs
	Boiler	AFUE; CombEff; DraftType; EIR; Fuel; FuelFullLd; HtLoss; Type; CapRtd; Cnt; EntTempDsgn; FluidFlowInRef; FluidFlowOutRef; HIR_fPLRCrvRef; Status; LvgTempDsgn; Name; ThrmIEff; UnldRatMin
	Pump	Cnt; MinSpdRat; MtrBHP; MtrEff; MtrHP; Name; Pwr_fPLRCrvRef; FlowCap; FlowMin; ModelingMthd; OperCtrl; PwrPerFlow; SpdCtrl
	Chiller	CapRtd; Cap_fTempCrvRef; CndsrInRef; CndsrOutRef; CndsrPwrRtd; COPRtd; EIR_fPLRCrvRef; EIR_fTempCrvRef; EIR; EngSpdMin; EntTempRtd; EvapInRef; EvapOutRef; FIR_fPLRCrvRef; FIR_fTempCrvRef; Fuel; FuelRtd; LvgTempRtd; Type; CndsrType; Cnt; EntTempDsgn; Status; LvgTempDsgn; Name; UnldRatMin
	Pump	Cnt; MinSpdRat; MtrBHP; MtrEff; MtrHP; Name; Pwr_fPLRCrvRef; FlowCap; FlowMin; ModelingMthd; OperCtrl; PwrPerFlow; SpdCtrl
	FluidSegment	CndctLoss; PipeDia; PipeInsThkns; PriSegRef; Src; Type; Name
	Pump	Cnt; MinSpdRat; MtrBHP; MtrEff; MtrHP; Name; Pwr_fPLRCrvRef; FlowCap; FlowMin; ModelingMthd; OperCtrl; PwrPerFlow; SpdCtrl
	HeatExchanger	FluidSegDemInRef; FluidSegDemOutRef; FluidSegSupInRef; FluidSegSupOutRef; Type; Name
Energy	HeatRejection	CapRtd; Cap_fTempCrvRef; EntTempDsgn; FluidSegInRef; FluidSegOutRef; CellCnt; DsgnWBTemp; FanType; LowSpdAirFlowRat; LowSpdPwrRat; ModCtrl; Pwr_fPLR; Setpoint; SetptCtrl; TotFanHP; Type; LvgTempDsgn; MinSpdRat; Name; Pwr_fPLRCrvRef; Status
Evapo	Pump	Cnt; MinSpdRat; MtrBHP; MtrEff; MtrHP; Name; Pwr_fPLRCrvRef; FlowCap; FlowMin; ModelingMthd; OperCtrl; PwrPerFlow; SpdCtrl
Outsic	ProcessLoad	Name; EngyLd; Flow; Type
Prehe:	StorageTank	FluidFlowInRef; FluidFlowOutRef; Name; Cap; R
Termi:	WaterHeater	Cnt; FluidSegInRef; FluidSegOutRef; HIR_fPLRCrvRef; Status; Name; ThrmIEff; EF; FluidSegMakeupRef; StdbbyLoss; StorCap; Type
	Pump	Cnt; MinSpdRat; MtrBHP; MtrEff; MtrHP; Name; Pwr_fPLRCrvRef; FlowCap; FlowMin; ModelingMthd; OperCtrl; PwrPerFlow; SpdCtrl
		WtrEconoHXEff; WtrEconoType; WCCSensCreditedCap; WCCTotCreditedCap; WCCTotCreditedEER; CndsrType; FluidSegInRef; FluidSegOutRef; Name; SizingRat; CoilCoolingCapacitySensibleRatedStageFraction; CoilCoolingCapacityTotalRatedStageFraction; CoilCoolingSupplyAirStageTemperature[2]
	CoilHeating	CapRtd; CndsrFlowType; DsgnHtgTemp; FuelSrc; FurnFuelFullLd; FurnIgnType; FurnPilotFuelInp; FurnThrmIEff; HtPumpCap_fTempCrvRef; HtPumpCprsrLockoutTemp; HtPumpCOP; HtPumpCOPAdj; HtPumpCrankcaseCtrlTemp; HtPumpDefCtrl; HtPumpDefCtrlTemp; HtPumpDefHtSrc; HtPumpEIR_fPLRCrvRef; HtPumpEIR_fTempCrvRef; HtPumpEIR; HtPumpHIR_fPLRCrvRef; HtPumpHSPF; HtPumpSuppTemp; NumHtgStages; Type; CndsrType; FluidSegInRef; FluidSegOutRef; Name; SizingRat; CoilHeatingCapacityTotalRatedStageFraction; CoilHeatingSupplyAirStageTemperature[]
	Fan	AxialType; CentType; CtrlMthd; DrvEff; FlowCap; FlowMin; ModelingMthd; MtrPoleCnt; MtrPos; MtrRPM; MtrType; OverallIEff; Pos; Pwrldx; PwrMinRat; PwrPerFlow; SpdMinRat; TotStaticPress; MtrBHP; MtrEff; MtrHP; Name; Pwr_fPLRCrvRef
ThermalZone		Desc; FirArea; Name; PlenumThrmIznRef; CldDsgnLd; CldSupAirToRmAirTempDiff; CldSysRef; CldTstatSchRef; CldUnmetLdHrs; DsgnVentRate; ExhSysRef; HtgDsgnLd; HtgSupAirToRmAirTempDiff; HtgSysRef; HtgTstatSchRef; HtgUnmetLdHrs; MinVentRate; PassiveCldMthd; PassiveCldRt; PassiveCldSchRef; SuppCldSysRef; SuppHtgSysRef; ThrtlgRng; Type; VentCtrlMthd; VentSysRef



SDD-OS Mapping Comparison

 NR SDD	OpenStudio 
AirSystem	OS:AirLoopHVAC OS:Sizing:System OS:SetpointManager
AirSegment	<i>Connections</i> <i>Nodes</i> <i>Splitters/Mixers</i>
CoilCooling	OS:Coil:Cooling:Water OS:Coil:Cooling:DX:TwoSpeed ...
CoilHeating	OS:Coil:Heating:Water OS:Coil:Heating:Electric ...
Fan	OS:Fan:ConstantVolume OS:Fan:VariableVolume ...
OutsideAirControl	OS:AirLoopHVAC:OutdoorAirSystem OS:Controller:OutdoorAir
TerminalUnit	OS:AirTerminal:SingleDuct:VAV:Reheat OS:AirTerminal:SingleDuct:VAV:Uncontrolled ...
CoilHeating	OS:Coil:Heating:Water OS:Coil:Heating:Electric ...
ThermalZone	OS:ThermalZone OS:Sizing:Zone OS:DesignSpecification:OutdoorAir
Other referenced objects:	Other referenced objects:
Schedule	OS:Schedule...
Curves (CrvDblQuad, etc)	OS:Curve:Biquadratic, etc



SDD HVAC Object Definitions

- Complete specification of OS/E+ object defined by combination of SDD object and a few select properties.

CoilHeating
Type = Furnace
FuelSrc = NaturalGas

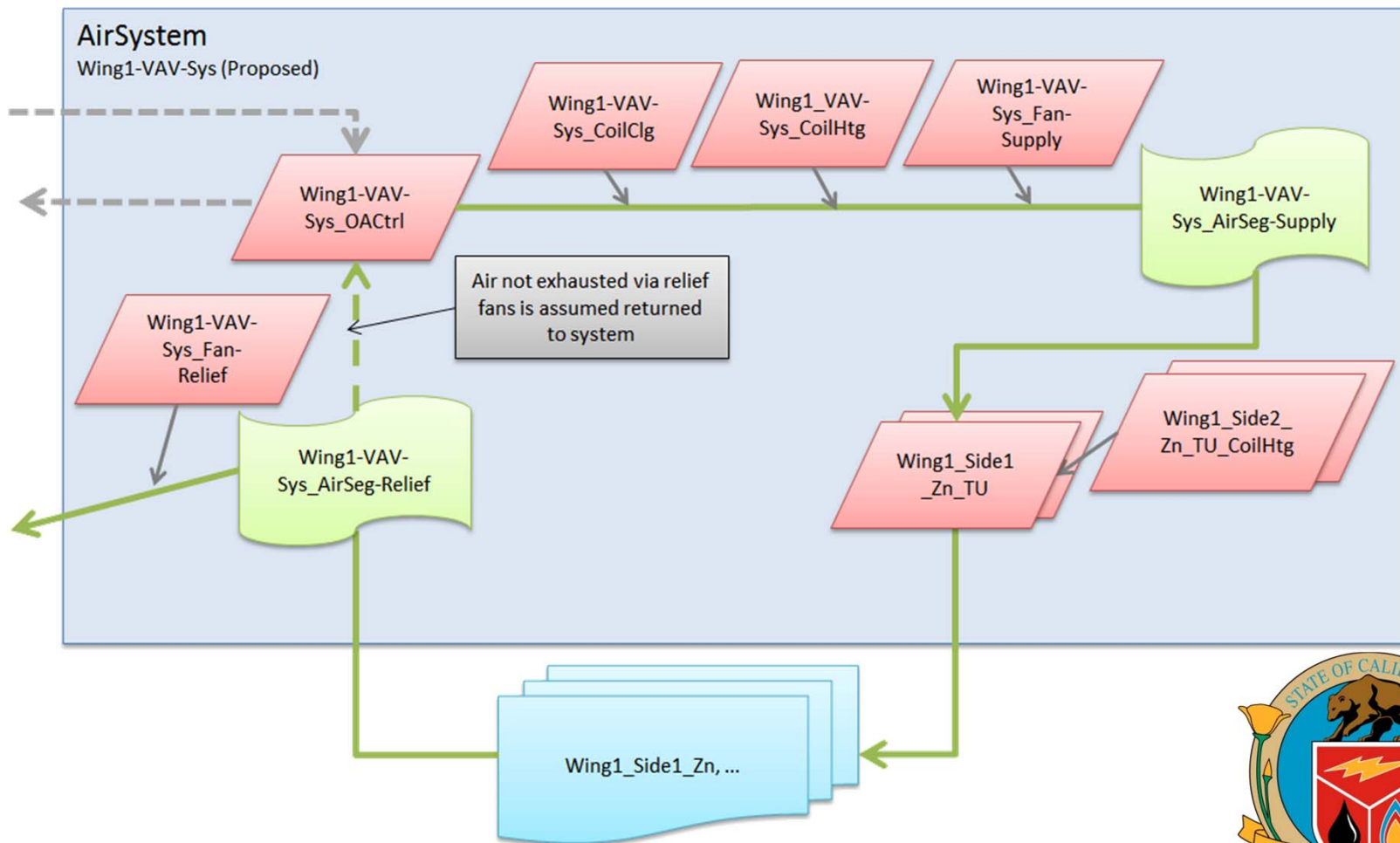
Coil:Heating:Gas

CoilCooling
Type = DirectExpansion
FuelSrc = Electric

Coil:Cooling:DX:TwoSpeed



SDD HVAC Example



```

<Project>
<Building>
  <AirSys>
    <Name>Wing1-VAV-Sys</Name>
    <OptStart>0</OptStart>
    <AirHndlrAvailSchRef>School HVAC Sch</AirHndlrAvailSchRef>
    <NightCycleFanCtrl>StaysOff</NightCycleFanCtrl>
    <ClgCtrl>OutsideAirReset</ClgCtrl>
    <ClRstSupHi>65</ClRstSupHi>
    ...
  <AirSeg>
    <Name>Wing1-VAV-Sys_AirSeg-Supply</Name>
    <Type>Supply</Type>
    <Path>Ducted</Path>
    <CoilClg>
      <Name>Wing1-VAV-Sys_CoilClg</Name>
      <Type>DirectExpansion</Type>
      <FuelSrc>Electric</FuelSrc>
      <DsgnClgTemp>55</DsgnClgTemp>
      <CapTotGrossRtd>387926</CapTotGrossRtd>
      <CapTotNetRtd>364475</CapTotNetRtd>
      <Cap_fTempCrvRef>DXCoilClgQRatio_fTwb_fToadb</Cap_fTempCrvRef>
      <DXEER>12</DXEER>
      <DXEIR>0.233</DXEIR>
      <CndsrType>Air</CndsrType>
      ...
    </CoilClg>
    <CoilHtg>
      <Name>Wing1_VAV-Sys_CoilHtg</Name>
      <Type>Furnace</Type>
      <FuelSrc>NaturalGas</FuelSrc>
      <DsgnHtgTemp>105</DsgnHtgTemp>
      <CapTotGrossRtd>96924</CapTotGrossRtd>
      <FurnThrmLEff>0.8</FurnThrmLEff>
      <FurnHIR_fPLRCrvRef>FurnCoilHtgFIRRatio_fQRatio</FurnHIR_fPLRCrvRef>
      ...
    </CoilHtg>
    <Fan>
      <Name>Wing1-VAV-Sys_Fan-Supply</Name>
      <CentType>AirFoil</CentType>
      <CtrlMthd>VariableSpeedDrive</CtrlMthd>
      <MtrBHP>9.214</MtrBHP>
      <MtrHP>10</MtrHP>
      <MtrPos>InAirStream</MtrPos>
      <Pwr_fPLRCrvRef>VSDFanPwrRatio_fCFMRatio</Pwr_fPLRCrvRef>
      ...
    </Fan>
  </AirSys>
  <AirSeg>
    <Name>Wing1-VAV-Sys_AirSeg-Relief</Name>
    <Type>Relief</Type>
    <Path>Direct</Path>
    <Fan>
      <Name>Wing1-VAV-Sys_Fan-Relief</Name>
      ...
    </Fan>
  </AirSeg>

```

```

<OACtrl>
  <Name>Wing1-VAV-Sys_OACtrl</Name>
  <Type>Economizer</Type>
  <EconoCtrlMthd>FixedDryBulb</EconoCtrlMthd>
  <EconoHiTempLockout>75</EconoHiTempLockout>
  <AirSegSupRef>Wing1-VAV-Sys_AirSeg-Supply</AirSegSupRef>
  <AirSegRetRef>Wing1-VAV-Sys_AirSeg-Relief</AirSegRetRef>
</OACtrl>
<TrmlUnit>
  <Name>Wing1_Side1_Zn_TU</Name>
  <Type>VAVReheat</Type>
  <ZnServedRef>Wing1_Side1_Zn</ZnServedRef>
  <PriAirFlow>4577</PriAirFlow>
  <PriFlowSegRef>Wing1-VAV-Sys_AirSeg-Supply</PriFlowSegRef>
  <CoilHtg>
    <Name>Wing1_Side1_Zn_TU_CoilHtg</Name>
    <Type>ElectricResistance</Type>
    <FuelSrc>Electric</FuelSrc>
    ...
  </CoilHtg>
</TrmlUnit>
</AirSys>
<ThrmLzn>
  <Name>Wing1_Side1_Zn</Name>
  <Type>Conditioned</Type>
  <ClgSysRef>Wing1-VAV-Sys</ClgSysRef>
  <ClgTstatSchRef>Cooling Tstat Sch</ClgTstatSchRef>
  <HtgSysRef>Wing1-VAV-Sys</HtgSysRef>
  <HtgTstatSchRef>Heating Tstat Sch</HtgTstatSchRef>
  <VentSysRef>Wing1-VAV-Sys</VentSysRef>
  <VentCtrlMthd>FixedVentilation</VentCtrlMthd>
  <ThrtlRng>2</ThrtlRng>
</ThrmLzn>
</Building>
<CrvDblQuad>
  <Name>VSDFanPwrRatio_fCFMRatio</Name>
  <Coef1>0.0013</Coef1>
  <Coef2>0.147</Coef2>
  <Coef3>0.9506</Coef3>
  <Coef4>-0.0998</Coef4>
  <MaxVar1>1</MaxVar1>
  <MinVar1>0.2</MinVar1>
</CrvDblQuad>
<CrvQuad>
  <Name>FurnCoilHtgFIRRatio_fQRatio</Name>
  <Coef1>0.01861</Coef1>
  <Coef2>1.09421</Coef2>
  <Coef3>-0.112819</Coef3>
  <MaxVar1>1</MaxVar1>
  <MinVar1>0</MinVar1>
</CrvQuad>
<CrvDblQuad>
  <Name>DXCoilClgQRatio_fTwb_fToadb</Name>
  <Coef1>0.874030</Coef1>
  <Coef2>-0.001142</Coef2>
  <Coef3>0.000171</Coef3>
  <Coef4>-0.002957</Coef4>
  <Coef5>0.000010</Coef5>
  <Coef5>-0.000059</Coef5>
</CrvDblQuad>
</Project>

```



Interfacing via SDD XML

- SDD Objects & Properties Drive Compliance Analysis And Full Hourly Simulation
- Energy Code (ACM) Determines Valid Inputs to Analysis, for example:
 - Input-Only objects: Space Function Defaults, ...
 - Input-Only properties: Space Function, Fenestration Type, ...
 - Construction Material Properties:
 - User Input Restricted to Pre-Defined ACM List (with exception for framing/cavity layer)
 - Detailed Material Properties passed to Simulation (excluding ACM list references)



Interfacing via SDD XML

- Different Subsets of SDD Designated for User Input vs. Simulation
 - Input SDD - CEC...nRes - Input Data Model.txt
 - Sim SDD - CEC...nRes - Sim Data Model.txt
- Iteration Comparisons of these files Highlight Differences



Interfacing via SDD XML

- User Input Subset of SDD (text file generated during compliance ruleset packing):

```
-----
ConsAssm      ConstructAssembly      #Props: 21/ 25  MaxDefinable:  0

CompatibleSurfType  CompatibleSurfaceType  Enumeration  - - - - -  Compulsory input
                    default: -1
                    1: "ExteriorWall"
                    2: "Roof"
                    3: "ExteriorFloor"
                    4: "UndergroundWall"
                    . . . .

-----
Spc            Space                  #Props: 58/ 69  MaxDefinable: 1000
Parent(s): Story
Children: IntLtgSys / Ceiling / ExtFlr / ExtWall / IntFlr / IntWall / Roof / UndgrFlr / UndgrWall / PolyLp
. . . .

CondgType      ConditioningType      Enumeration  - - - - -  Required input
                    default: 1
                    1: "DirectlyConditioned"
                    2: "IndirectlyConditioned"
                    3: "Unconditioned"
                    4: "Plenum"

PlenumSpcRef    PlenumSpaceReference  ObjectRef   - - - - -  Optional input
                Spc (Spc:CondgType = "Plenum")

Thrm1znRef      ThermalZoneReference  ObjectRef   - - - - -  Required input
                Thrm1zn

. . . .

FlrArea         FloorArea             Float       - - - Units: ft2      Required input
FlrToCeilingHgt FloorToCeilingHeight    Float       - - - Units: ft        Required input
. . . .

OccDens         OccupantDensity        Float       - - - Units: people/1,000 ft2 Required input
                Error if not: 0 < Value < 200, Warning if not: 1 < Value < 70
OccSensHtRt     OccupantSensibleHeatRate Float       - - - Units: Btu/h-person Required input
                Error if not: 0 < Value < 2000, Warning if not: 100 < Value < 1000
OccLatHtRt      OccupantLatentHeatRate Float       - - - Units: Btu/h-person Required input
                Error if not: 0 < Value < 2000, Warning if not: 100 < Value < 1000
. . . .
```



Interfacing via SDD XML

- Simulation Subset of SDD (text file generated during compliance ruleset packing):

```
-----
ExtWall      ExteriorWall      #Props:  8/ 15  MaxDefinable:10000  SingleRecord: F  XMLIgnoreName: F
      Parent(s):  Spc
      Children:  Win /  Door /  PolyLp

ConsAsmRef    ConstructAssemblyReference      Type: ObjectRef      #Vals:  1  Units:      WriteSimFlag: 1  WriteXMLArrayIndices: F
ConsAsm      (ConsAsm:CompatibleSurfType = 1)
ExtRoughness  ExteriorRoughness      Type: Enumeration    #Vals:  1  Units:      WriteSimFlag: 1  WriteXMLArrayIndices: F
      default:  0
      0:  "-" specify "-"
      1:  "VeryRough"
      2:  "Rough"
      3:  "MediumRough"
      4:  "MediumSmooth"
      5:  "Smooth"
      6:  "VerySmooth"

ExtSolAbs     ExteriorSolarAbsorptance      Type: Float          #Vals:  1  Units:      WriteSimFlag: 1  WriteXMLArrayIndices: F
ExtThrmAbs    ExteriorThermalAbsorptance      Type: Float          #Vals:  1  Units:      WriteSimFlag: 1  WriteXMLArrayIndices: F
ExtVisAbs     ExteriorVisibleAbsorptance      Type: Float          #Vals:  1  Units:      WriteSimFlag: 1  WriteXMLArrayIndices: F
IntSolAbs     InteriorSolarAbsorptance      Type: Float          #Vals:  1  Units:      WriteSimFlag: 1  WriteXMLArrayIndices: F
IntThrmAbs    InteriorThermalAbsorptance      Type: Float          #Vals:  1  Units:      WriteSimFlag: 1  WriteXMLArrayIndices: F
IntVisAbs     InteriorVisibleAbsorptance      Type: Float          #Vals:  1  Units:      WriteSimFlag: 1  WriteXMLArrayIndices: F
      . . . . .
```



SDD XML – Validation/Error Checking

- Validation/Error Checking @ File Open/Read Time for:
 - Numeric Ranges (error & warning)
 - Enumerations (selections)
 - Object Assignments (& type compatibility)
- More Detailed Validation Checking via Rules in Initial Analysis Step



SDD XML – Validation

- Numeric Ranges, Enumerations & Object Assignment Compatibility Echoed in Input Data Model Ruleset File

```

-----
ConsAsm          ConstructAssembly          #Props: 21/ 25  MaxDefinable:   0

CompatibleSurfType  CompatibleSurfaceType  Enumeration  - - - - - Compulsory input
                    default: -1
                    1: "ExteriorWall"
                    2: "Roof"
                    3: "ExteriorFloor"
                    4: "UndergroundWall"
                    . . . .

-----
Spc              Space                    #Props: 58/ 69  MaxDefinable: 1000
Parent(s): Story
Children: IntLtgSys / Ceiling / ExtFlr / ExtWall / IntFlr / IntWall / Roof / UndgrFlr / UndgrWall / PolyLp
                    . . . .

CondgType        ConditioningType        Enumeration  - - - - - Required input
                    default: 1
                    1: "DirectlyConditioned"
                    2: "IndirectlyConditioned"
                    3: "Unconditioned"
                    4: "Plenum"

PlenumSpcRef      PlenumSpaceReference    ObjectRef    - - - - - Optional input
                    Spc (Spc:CondgType = "Plenum")

Thrm1znRef        ThermalZoneReference    ObjectRef    - - - - - Required input
                    Thrm1zn

                    . . . .
FlrArea           FloorArea               Float        - - - Units: ft2      Required input
FlrToCeilingHgt   FloorToCeilingHeight    Float        - - - Units: ft       Required input
                    . . . .
OccDens           OccupantDensity          Float        - - - Units: people/1,000 ft2 Required input
                    Error if not: 0 < Value < 200, Warning if not: 1 < Value < 70
OccSensHtRt       OccupantSensibleHeatRate Float        - - - Units: Btu/h-person Required input
                    Error if not: 0 < Value < 2000, Warning if not: 100 < Value < 1000
OccLatHtRt        OccupantLatentHeatRate   Float        - - - Units: Btu/h-person Required input
                    Error if not: 0 < Value < 2000, Warning if not: 100 < Value < 1000
                    . . . .

```



SDD XML – Validation/Error Checking

- Error Messages Written to Project Log File & Available To Calling Applications

```
2013-Feb-27 01:00:28 - Error: Range check failure on Space 'Perimeter_ZN_1'. Value being checked = 2200.  
Error if not less then to 2000 (Spc:OccSensHtRt)  
  
2013-Feb-27 01:04:13 - ERROR - reading file: ConsAssm 'NACM_Metal Framed Wall' property CompatibleSurfType = ExteriorWa  
  
2013-Feb-27 01:08:10 - Error: Data classified by the compliance ruleset as Compulsory not defined for  
ConstructAssembly 'NACM_Metal Framed Wall': ConsAssm:CompatibleSurfType.
```



Future Efforts

- Next “Vendor PAC” discussion
 - Connecting to CBECC
- Next Full PAC discussion
- XSD Schema Development
- Additional Features



Q & A



Wrap Up

- Team will distribute
 - SDD Workbook
 - Link to Example SDD XML Files
 - Other Resources Presented Today
 - dcontoyannis@archenergy.com

