ACTION PLANS FOR IDSM INTEGRATION IN WE&T CONNECTIONS PROGRAMS

FINAL

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1. EXECUTIVE SUMMARY

The California Public Utilities Commission Energy Division has directed the California Investor-Owned Utilities (IOUs)[1] to develop strategies and programs that offer customers opportunities to integrate their energy efficiency (EE), distributed generation (DG), and demand response (DR) choices into an overall strategy called Integrated Demand Side Management (IDSM). The California Energy Efficiency Strategic Plan (CEESP) identifies IDSM as an overarching strategy to promote customer-side energy management and achieve Zero Net Energy (ZNE) goals. The CEESP has a significant focus on Workforce, Education and Training (WE&T) programs, which comprises two main components: The WE&T Centergies program, which promotes adult education, and the WE&T Connections program. The WE&T Connections program targets students from kindergarten through college to teach about energy concepts and energy efficiency actions. The recent Process Evaluation for the WE&T Connections Program that Opinion Dynamics completed for the 2010-2012 program cycle found little IDSM integration among WE&T programs. During the same time period, the WE&T programs began to introduce IDSM concepts, and IDSM integration was added as a program deliverable for all Connections programs in the 2013-2014 bridge cycle.

The WE&T Connections programs have historically focused on energy efficiency concepts and have successfully developed a series of programs and delivery approaches that have resulted in measurable knowledge gains. While SCE and the WE&T Connections implementers have established what IDSM integration means at a high level, to achieve full integration there should be a clear understanding of how to approach and present IDSM concepts in the materials for students, teachers, interns, staff, and other participants. These efforts, when undertaken by the program implementers, should ultimately align with SCE's efforts (and WE&T goals in general) and the statewide definition IDSM integration.

This report outlines Action Steps that can lead to more robust and evident IDSM integration within the program activities, which can lead to knowledge gains on IDSM related topics among the targeted populations by the end of the program cycle for four WE&T Connections programs that are currently operational in the Southern California Edison (SCE) service territory[2], namely LivingWise, PEAK Student Energy Actions, Power Save Schools and Power Save Campus.

The program implementers understand the importance of having their programs address IDSM concepts, and appreciate the opportunity to both provide input into the process and to be more closely aligned with the utilities as they update materials. They will engage in these efforts to ensure that their approach will successful both in terms of meeting IDSM knowledge gain expectations in the school community and meeting contractual requirements.

Finally, some of the timelines presented in this report are aggressive because they are aligned with having materials updated by the time the school community receives training in these topics, which is typically the end of summer/beginning of a new school year.

[1] The California IOUs are Southern California Edison (SCE), Pacific Gas & Electric (PG&E), Southern California Gas (SCG), and San Diego Gas & Electric (SDG&E)

[2] Some of these programs also have a statewide focus

Next Steps

The Action Plans for the WE&T Connections programs outline several requirements to update program objectives, materials and training guides, surveys, etc. within a tight timeframe that for the most part requires that materials be updated by the beginning of a school year. Given the historical focus on energy efficiency rather than the full set of IDSM topics, as well as the aggressive timeline, close collaboration between SCE and the WE&T Connections program implementers will be needed to successfully meet the outlined objectives.

As such, we propose SCE in collaboration with program stakeholders take the following steps to establish an overarching implementation strategy:

1. **Ensure that a common definition of IDSM and its related concepts are adopted throughout program materials.**

This document provides the definition for IDSM from the CEESP and proposes the specific IDSM topics that are to be included in the various program elements, including curricular and training materials, where relevant and feasible. The proposed definitions need to be agreed upon by the various stakeholders (including implementers) and used consistently within and across program components so that the IDSM concept can be commonly understood and adopted.

2. **Establish a collaborative group with implementers to ensure that Action Plan steps can be addressed / incorporated within the suggested timelines.**

Successful collaborations are built on partners who have a vested interest in the goal or outcome. A shared vision is important. It brings about passion and generates synergy and commitment towards a common goal. Choosing and engaging collaborative partners, developing a base of common knowledge, and defining a shared vision is essential to developing the framework for action. This collaborative group should, at a minimum, include program stakeholders, namely the SCE WE&T EM&V and Program staff, as well as representatives from each of the WE&T Connections implementers for their respective programs. While the Action Steps focus on SCE specific programs, most of the WE&T Connections programs also reach other IOUs' jurisdictions. To the extent that it is feasible, other IOUs should be part of this collaborative group.

3. **Establish a process to report on IDSM integration activities and expected timeline of accomplishment**

Implementers should report regularly in writing on their progress on the steps and the Measures of Success outlined in the respective Action Plans. This may be a facilitated process so that stakeholders can verify progress as it occurs and identify issues to resolve them in a timely manner.

Once SCE and stakeholders have undertaken these overarching steps and established a collaborative group, it should undertake the following program-specific steps:

4. **Review and implement the program-specific IDSM Integration Action Steps**

The primary role of the stakeholder group will be to facilitate the implementation of the program-specific Action Steps presented this report. The programs however will have the ultimate responsibility to implement the recommendations. Table 1 below summarizes the recommended IDSM integration Action Steps for the various WE&T Connections programs. These Action Steps are outlined in detail in Chapters 3 through 6 of this report.

Table 1: IDSM Integration Action Steps by WE&T Connections Programs

	LivingWise	PEAK	Power Save Campus	Power Save Schools
Include IDSM as a lesson learning **objective** in the program materials	✓	✓	✓	
Increase IDSM concepts in **program materials**	✓	✓		✓
Incorporate **IDSM exercises** as part of full curriculum		✓		
Increase IDSM concepts in program's **Project Menus/ Roadmap**			✓	✓
Include **an award certificate** for the IDSM Project			✓	
Increase IDSM concepts in **teacher training** materials		✓	✓	✓
Add questions on IDSM concepts to **teacher surveys** and share results periodically with IOUs	✓	✓		✓
Include questions on IDSM concepts to **student post-tests** to measure student knowledge gain	✓	✓	✓	✓
Consider **contractual options** to ensure that IDSM concepts are adopted by teachers given program's inherent flexibility		✓		

5. **Facilitate meetings between SCE and WE&T Program Implementers to provide guidance, set objectives, and monitor progress against measures of success**

The first meeting, not unlike a kick-off, should focus on confirming action plan steps and timelines for each of the WE&T Connections programs. Both this initial meeting and regular subsequent meetings (suggested monthly) can be used as a forum to provide guidance to WE&T Connections programs on IDSM integration expectations, ensure alignment of IDSM integration activities with SCE's objectives, and allow implementers to provide updates on progress towards established measures of success.

We propose that this meeting occur among all three program implementers so that consistency of messaging and approaches can be achieved across all IDSM programs, especially in terms of defining key terms and survey approaches/instruments used to measure progress towards goals. If needed, program -specific meetings can be held separately as well.

While this collaborative group will aid in sharing IDSM concepts, the implementers need to develop expertise in IDSM topics, either through internal knowledge, external resources such as consultants, or through guidance from SCE. This will ensure that curriculum materials are not only appropriately updated for IDSM knowledge gain goals, but that they meet the California Education Content Standards.

2. INTRODUCTION

This report outlines Action Steps that can lead to more robust and evident IDSM integration within the program materials, which can lead to knowledge gains on IDSM related topics among the targeted populations by the end of the program cycle for four WE&T Connections programs that are currently operational in the Southern California Edison (SCE) service territory[3], namely:

1. LivingWise
2. PEAK Student Energy Actions
3. Power Save Schools
4. Power Save Campus

Table 2 provides a high-level description for each of the WE&T Connections programs for which Action Plans have been developed:

Table 2: WE&T Connections Programs High-Level Descriptions

Program Name	Target Grade Levels	Brief Description
LivingWise	6th	Provides one curriculum with several chapters on energy efficiency topics, designed to cover a five- or 10-day implementation. The program targets sixth-grade students. In addition to the classroom workbook, the program provides all participating students with take-home energy savings kits. These kits include energy efficient items that students and parents can install.
PEAK Student Energy Actions	3rd-7th	Provides a flexible classroom curriculum to teachers on energy and electricity topics. Teachers who sign up for the program receive a yearlong curriculum of 11 lessons, of which they must teach at least four. Teachers may use these materials as supplemental lessons or integrate the lessons into their yearly science curriculum.
Power Save Schools	K-12th	Provides curriculum with hands-on activities that teach students about energy efficiency. Provides energy audit tools for classroom lessons and to assist in identifying energy-saving opportunities throughout the school. Teachers receive training at an all-day workshop and through ongoing support, and are provided with a roadmap with lesson plans and activities to complete over the school year.
Power Save Campus	University (UC and CSU systems)	Promotes careers in the field, generates actual energy savings, increases awareness of the importance of energy efficiency, and encourages academic infusion of sustainability concepts. Trained Power Save Campus interns work closely with faculty, staff, administrators and other students to engage them in their projects which range from outreach education to technical retrofits.

2.1 IDSM DEFINITION

IDSM is an emerging key issue in energy policy in California, and generally, current definitions are tailored to stakeholders within the energy industry that understand the concepts associated with "IDSM," such as "demand response," and "distributed generation" terminology. The WE&T

[3] Some of these programs have a statewide focus as well.

Connections programs target K-12 and college students. While the purpose of the program is education, the terms presented to this target audience must be tailored to include non-technical terms that can be easily understood and repeated. SCE and the WE&T Connections implementers have established what IDSM integration means at a high level in its program contracts for 2013-2014, but to achieve full integration there should be a clear understanding of how to approach and present IDSM concepts in the materials for students, teachers, interns, staff, and other participants. Below is the definition presented in the California Energy Efficiency Strategic Plan:

Comment 1: IDSM Definition

"Energy efficiency, energy conservation, demand response, advanced metering, and distributed generation technologies are offered as elements of an integrated solution that supports energy and carbon reduction goals immediately, and eventually water and other resource conservation goals in the future."[4]

IDSM is at its core supported by the concepts of reducing energy demand (in general, and in specific time periods), reducing energy usage, and using renewable resources. Within the context of IDSM, the Project Team proposes to define these three areas as follows:

1. *Reducing energy use:* "Use" refers to the amount of electric energy that equipment draws over time (as opposed to instantly). When people have high energy usage, they end up consuming more energy resources. People can reduce energy use by turning off or unplugging equipment that they do not need to run, or by installing energy efficient equipment.

2. *Reducing energy demand:* "Demand" refers to the amount of electric power that equipment instantly draws in order to run. Utility customers share a common pool of power from the electrical grid. When a lot of equipment (in a home, or in a community) draws on electric power at the same time, this is called "peak demand." Peak demand increases the risk of blackouts by over-straining the grid, and most often occurs during the afternoons in summer. People can reduce energy demand by turning off equipment, particularly during these peak demand periods.

3. *Using renewable resources:* Resources are what is consumed in order to produce electric energy. Many of the resources currently used are non-renewable, meaning they cannot be replaced in one lifetime (nuclear fuels and fossil fuels such as coal, oil, and natural gas). Renewable resources are resources that can be replaced in one lifetime, such as solar, wind, hydropower, and biomass. Individuals can harness renewable resources in small-scale generators such as solar panels or windmills; utilities can harness these resources through large-scale versions.

At its core, IDSM not only focuses on these three elements, but also on their integration. For example, one way to present IDSM concepts is in terms of actions that "build" on each other:

- Energy efficiency actions are focused actions such as making efficiency upgrades or changing behaviors (draw curtains in summer afternoons). The goal of these is to bring usage to the lowest possible level.

[4] California Energy Efficiency Strategic Plan, Updated 2011, pp. 67

- Demand response actions are simple, short-term actions—practical cutbacks—like turning off appliances only at certain times. They are frequently behavior based, although there are several programs that use technology and price signals through special rates to encourage these actions.

- Distributed/renewable actions are additional actions through installation of renewable technologies that reduce the remaining demand and usage from the electric grid.

2.2 IDSM TOPICS

This section outlines the topics that should be covered in the WE&T Connections programs design and materials. Note that effective IDSM curriculum is not simply the existence of a particular topic (although that is desirable as well), but how well the topics are "integrated and relate to each other." The concept of IDSM should be incorporated into all program components, where it is relevant and feasible, including but not limited to:

1. Program stated goals and objectives
2. Program framework
3. Curriculum / program materials
4. Teacher training materials
5. Success of Integration

Topics for inclusion in WE&T materials include, at a minimum, the following:

- Energy efficiency and energy management in general

- Demand response

    - Importance of keeping customers' lights on (grid reliability, avoiding rotating outages, difficulty of energy storage)

    - Shifting load to off-peak periods

        - Concepts of peak/off-peak periods and seasons

        - Concepts of higher costs (linked to Time of Use [TOU] rates) of consuming energy during peak periods

        - What school community (students/families/schools) can do to shift load (unplug vampire loads, disconnect video games consoles, turn off lights, lower HVAC settings, etc.)

    - Concepts of energy demand, rather than consumption (kWh vs. KW)

    - Time of Use /rate concepts (how it costs more to consume/generate electricity during certain times of day)

    - Calls to action to lowering demand

- Distributed Generation (primarily solar in SCE's service territory)

    - Renewable energy concepts

    - Importance / benefits of DG energy

- Examples of how DG is generated

While not strictly an IDSM topic, and not included in the scope of this project, recommendations that address curriculum updates for inclusion of IDSM topics should also consider inclusion of smart grid concepts. Several of the program materials were developed prior to the widespread installation of smart meters in the California IOUs' service territories and may benefit from including a information related to smart grid, what it is, how students and their families may benefit from engaging with available tools to manage energy consumption. Some of the exercises in the WE&T programs can also leverage examples of smart meter data to provide illustrations of energy consumption/ demand/load shifting and other related IDSM topics.

2.3 PROJECT GUIDING PRINCIPLES

This section lists the overall guiding principles for the Action Plans.

1. Focus on knowledge gain and long-term culture change:

    a. Knowledge gain (rather than simply prevalence of topics) of IDSM concepts should drive integration efforts.

    b. Long-term goal to affect behavior and change the culture, creating "co-conspirators" on IDSM among population in SCE's service territory, and eventually statewide.

2. Getting to scale—cost effectively and strategically disseminate IDSM in the WE&T program across SCE territory, and eventually statewide (budget permitting).

    a. IDSM should be incorporated in every WE&T Connections program. Not all IDSM components need to be mentioned in every chapter or unit; instead, they should be strategically deployed where it makes sense, and where knowledge can be best attained and retained.

    b. Logistical issues, such as specific localities, cost-effectiveness, and capturing and substantiating findings from the IDSM pilots, are lower priority, again with a focus on quality, not a "light sprinkling of DR" concepts throughout programs.

3. How do you know when you get there? Program-specific measures of success focus on measuring knowledge gain through prevalence of IDSM concepts in program design, delivery and materials as well as the integration of these concepts. These initial measures of success are then augmented to reflect additional important elements that if accomplished at a target level, it will serve as an adequate reflection of whether IDSM achievement occurred in any given program. These measures of success capture changes in teacher and student knowledge, robustness of program materials, teacher ability and ease to provide IDSM information and IDSM integration. The measures of success will not purposely focus on counts (e.g., students reached, etc.).

4. Program implementers are expected to be partners in this goal.

    a. Implementers should ensure that they have staff with the relevant expertise to develop IDSM content into their curriculum and guidelines.

    b. Utilities can provide framework and guidance on IDSM projects; actual implementation and materials/approach updates are tasks to be conducted by the program implementers.

5. Need to balance IDSM with other major goals of SCE's WE&T program (energy savings, energy education, and workforce development), as well as statewide WE&T goals. This IDSM project operates in the context of the larger goals for the program and for SCE: e.g., the programs must move to new schools every year, and must meet low-income, underserved communities' requirements.

6. All Action Plan recommendations should be aligned with grade appropriate California Education Standards and be driven by appropriateness of the subject matter.

2.4 REPORT STRUCTURE

In the following sections we provide program specific Action Plans. These are drawn from the review of IDSM related findings from the 2010-2012 process evaluation, discussions with SCE Program staff, discussions with WE&T Connections program implementers, and from a benchmarking study of IDSM content in education and training programs across the country (see Appendix A).

The remainder of the report is structured as follows:

- Chapter 3: LivingWise Action Plan
- Chapter 4: Power Save Campus Action Plan
- Chapter 5: PEAK Action Plan
- Chapter 6: Power Save Schools Action Plan
- Appendix A: Benchmarking of IDSM concepts in WE&T programs
- Appendix B: Implementer Interview Guide
- Appendix C: Bibliography of IDSM concepts in education in training programs across the country

3. ACTION PLAN: LIVINGWISE

3.1 HIGH-LEVEL PROGRAM DESCRIPTION

The LivingWise program, implemented by Resource Action Programs, targets the sixth grade to teach students about energy resources and efficiency. The program materials consist of four workbooks including a Student Workbook, Student Guide, Teacher Book, and supplemental classroom activities. Teachers aim to teach all the units over a one- to two-week period (either in five- or ten-day lesson plans). The program also provides students with a take-home energy kits, which includes energy savings measures and tools that support the lesson plan.

3.2 CURRENT LEVEL OF IDSM ACTIVITY

The 2010-2012 WE&T Connections Process Evaluation report outlined metrics for the LivingWise program, some of which addressed IDSM topics. The LivingWise program performed well in two of the three IDSM categories: energy efficiency and renewables (DG). The demand response metrics received an overall score of 57% (out of a possible 100%), given the more limited prevalence of demand response topics and related calls for action.

LivingWise has addressed several of the recommendations from the 2010-2012 WE&T Connections Process Evaluation, namely:

- Included learning objectives statement in the educational materials (added in 2012-2013).
- In the fall of 2011, developed a pilot program for LivingWise called "Find the Watt Monsters" to explain IDSM concepts to participating students. Concepts included "vampire" loads and peak demand.[5]
    - This pilot also included an activity where students used a Belkin Energy Use Monitor (watt meter) to measure the demand from equipment in their classrooms and at home.
    - Watt meters are currently part of the energy kit that is sent to all schools. This has become a standard practice throughout the service territory, to the ratio of one watt meter to every six students, and exercises from the energy kit include demand response topics.
- Conducted teacher advisory board focus groups with proposed changes to the workbook content in 2012. These focus groups included eleven teachers specifically from SCE territory who gave in-depth feedback on the materials.
- Incorporated two post-surveys with students: one to measure knowledge change and installation of energy kit measures at home. The program also includes post-surveys with teachers to assess satisfaction and areas of program improvement.

[5] Note that this pilot was not included as part of the evaluation, so these materials did not count toward the yardstick rating of 57%.

Based on the results from the pilot, the teacher advisory board, and the evaluation findings, in 2013 LivingWise has added new units and activities to its workbooks for the SCE territory that cover demand and "vampire" load topics. Based on the review of these materials, the recommendations for the Action Plan focus primarily on ensuring depth of knowledge and broadening of IDSM topics, as in some instances, there are "cursory" references to demand response in program materials, which may be insufficient for robust depth-of-knowledge ratings. The Action Plan therefore includes enhancing the prevalence and depth of knowledge of demand response topics and in integrating the IDSM concepts throughout its materials.

Further, Resource Action Programs appears to have the required expertise in demand response topics in its staff to successfully update the program materials, where warranted, on IDSM concepts.

3.3 PROGRAM ACTION PLAN

The Action Plan for the LivingWise program comprises four main recommendations:

1. Include IDSM in lesson learning objectives in program materials
2. Increase IDSM concepts in LivingWise program materials
3. Add questions on IDSM concepts to teacher surveys and share results periodically with IOUs
4. Include questions on IDSM concepts to student post-tests to measure student knowledge gain

For each recommendation, we outline the current state of IDSM integration and list additional actions and resources needed to accomplish this step. Each sub section also outlines a proposed Action Step schedule. The overarching goal is to complete these recommendations within the current program cycle, where feasible (December 2014).

3.3.1 INCLUDE IDSM IN LESSON LEARNING OBJECTIVES IN PROGRAM MATERIALS

Based on a recommendation from the WE&T Connections Process Evaluation for 2010-2012, Resource Action Programs has already added overall Learning Objectives to its LivingWise teacher guides for 2013-2014. Current Lesson Objectives include some IDSM concepts, such as renewables, energy efficiency, and energy demand, but are not explicitly linked to with each other to create depth of knowledge about IDSM.

To ensure that IDSM concepts are integrated in learning objectives:

- Review the listed Student Learning Objectives at the beginning of each unit in the teacher guides, and add IDSM-specific learning objectives, where appropriate.
- Update the relevant LivingWise Program documents to include an agreed-upon definition of IDSM and an outline of what should be included in program design, delivery and materials.

Timing

- Beginning of the 2013-2014 school year

3.3.2 INCREASE IDSM CONCEPTS IN LIVINGWISE PROGRAM MATERIALS

LivingWise publishes four related workbooks, which include the following IDSM-related activities:

- **Student Guide:** In-class exercises measure draw for typical devices. Student groups measure draw from each device, calculate yearlong use and cost. Students can "check out" the watt meters and measure demand at home for extra credit, but these activities do not include TOU and load shifting concepts

- **Student Workbook:** Includes descriptions and tracking of energy efficiency measures, but not demand and/or renewables topics.

- **Teacher Book:** Workbook materials discuss demand (some) and explain shifting usage off peak, but they do not track behavior change. Demand reduction activities include identifying opportunities at home, such as turning off video game consoles. Includes discussion of energy sources (renewable and non-renewable). It should be updated to include information related to TOU rate and load shifting concepts.

- **Extra Activities:** Activities include tracking kWh savings from CFLs versus incandescent light bulbs over a 26-hour period, and questions about resources, but not demand-related activities.

In general, the LivingWise programs did not consistently contain IDSM topics, especially related to demand response concepts, and/or the topics were presented in a cursory manner. In order to ensure that IDSM Concepts are integrated in program materials, where possible:

1. Review existing program materials to identify areas for improvement in metrics in the process evaluation that were less than 100% in the 2010-2012 evaluation. Please note that these focus on program design/materials where IDSM integration is relevant and feasible:

    a. Includes elements (concepts, lessons, activities) that address renewable energy (67%)
    b. Includes elements (concepts, lessons, activities) specific to demand response and demand reduction (33%)

2. Further update program materials to include the following, where relevant:

    a. Definitions to distinguish between "demand" and "usage" to materials
    b. Grade-appropriate concepts related to demand response, including:
        i. TOU rates / higher costs of generating load at different times
        ii. Shifting consumption to different time periods
        iii. Students' ability to participate in outage prevention / increase grid reliability
    c. Integration of IDSM concepts throughout, as feasible

Timing

- Pilot program addresses short-term needs although materials can be enhanced to reflect load shifting concepts: beginning of the 2013-2014 school year

- Any additional changes or more in-depth materials updates to reflect IDSM concepts: beginning of the 2014-2015 school year

3.3.3 Add Questions on IDSM Concepts to Teacher Surveys and Share Results Periodically with IOUs

Resource Action Programs conducts teacher surveys as part of the current program as a feedback mechanism to improve program design. The results of these surveys are available to the IOUs upon request.

To ensure that IDSM concepts are reflected in teacher surveys, review the survey and ensure that IDSM questions are included. These questions should, at a minimum, address the following topics:

- Are materials and measures for student IDSM labs adequate and easy to understand and use?
- What is the likelihood of persistence of teaching IDSM concepts?
- What is the level of student engagement with IDSM tools and concepts?
- What is the reported level of students' knowledge gain on IDSM concepts (specifically describe concepts)?
- Are students taking IDSM concepts home?

Timing

- Update surveys: beginning of the 2013-2014 school year
- Conduct surveys: throughout the school year
- As noted earlier, survey results are available to SCE upon request; SCE can establish a regular schedule for receipt of survey results.

3.3.4 Include Questions on IDSM Concepts to Student Post-tests to Measure Student Knowledge Gain

Resource Action Programs conducts student pre- and post-tests as part of the current program design. To ensure that IDSM concepts are reflected in student post-test surveys, review current post-test document and update for IDSM concepts where relevant and feasible. These questions should be linked to the IDSM concepts, exercises, and information included in the program materials.

Timing

- Develop survey: beginning of 2013-2014 school year
- Conduct surveys: throughout the school year

3.4 Proposed Measures of IDSM Success

The measures of success below aim at measuring IDSM concept prevalence and integration throughout the program design and materials. They are designed to reflect IDSM achievement in any

given program. They measure changes in student and teacher knowledge, robustness of program materials, and high-level training on IDSM integration.

Table 3: Living Wise Program Measures of IDSM Success[6]

Measure of Success	Description	Goal
IDSM Concepts	• Concepts in program materials at a minimum include: o Concepts of energy demand and consumption o Importance/benefits of reducing demand and consumption o Load shifting benefits (cost savings, grid reliability) o Load shifting strategies o Concepts of renewable energy (sources, benefits) o Calls to action	100% (on program materials where relevant/ feasible)
IDSM Integration	• State IDSM learning objectives in materials • Energy Efficiency, Demand Response and Distributed Generation concepts are integrated, with clear linkages that build on one-another, where feasible and relevant	Yes
Teacher Surveys	Teacher surveys: o IDSM materials and measures (if included in the kit) are adequate and easy to use o Likelihood of persistence of teaching IDSM concepts o Level of student engagement and knowledge gain on IDSM concepts o Taking IDSM concepts home	Scores of 8 or higher (on a 10-point scale)
Student Surveys	• Post-tests should show a statistically significant increase in overall scores on IDSM concepts, or meet a certain score increase threshold o Address shift in usage pattern in the students' households o Address interest / understanding of distribution generation, demand response and energy efficiency concepts	Yes
Education Standards	• Aligns and supports grade-appropriate California Education Content Standards	Yes

[6] The contract between the IOUs and Resource Action Programs governs performance metrics. These outlined metrics are established to indicate prevalence and integration of IDSM concepts in the curriculum, teacher training, and program delivery plan

4. ACTION PLAN: POWER SAVE CAMPUS

4.1 HIGH-LEVEL PROGRAM DESCRIPTION

The Alliance to Save Energy (ASE) implements the Power Save Campus program (formerly known as the Green Campus program).This program targets college and university campuses with 16 participating locations. Each participating campus has a campus lead, who is a full-time Alliance to Save Energy staff member, and a team of three to six interns on each campus who develop projects throughout the year that include one or more of the following four key areas: workforce development, academic infusion, outreach, and energy savings. All intern projects must address at least one of these areas, and each campus must address all four areas with their projects over the course of the year.

Projects are intern-developed and Power Save Campus program materials provide a "menu" of options that students can select for potential projects. These Project Menus contain success stories from other campuses and/or examples of potential project approaches. Interns also work closely with campus stakeholders and ASE staff members on an ongoing basis to seek their advice on prime projects and initiatives that are suitable to their specific campus.

4.2 CURRENT LEVEL OF IDSM ACTIVITY

ASE is currently reviewing program materials and guidelines to incorporate findings from the process evaluation and to include IDSM concepts. Historically, the program had a strong focus on energy efficiency concepts. ASE staff reported that it is considering and/or undertaking the following initiatives:

1. ASE is currently integrating IDSM concepts as an underlying guiding principle/objective within the program's four key areas (rather than as a separate objective). Currently, the academic infusion component of the program objectives is being updated to reflect IDSM integration by stating that it should "ensure that the program trains interns and promotes Energy Efficiency, Demand Response and Distributed Generation across campus."[7]

2. ASE is considering adding IDSM type projects to its menu of options

3. An IDSM module is included in the upcoming Summit Training (led by SCE staff)

Given its historical focus on energy efficiency, ASE may benefit from additional guidance and clarification from the utilities on the concept of IDSM and its integration. A common definition and a list of IDSM topics are included in Chapter 2 of this report and can serve as a starting point. SCE staff has also offered to develop and participate in training sessions such as the Summit training meeting. SCE may need to be available for further guidance and clarification as needed.

[7] Power Save Campus PG&E Statement of Work Transition 2013-2014, pg. 4. Note that Opinion Dynamics received the PG&E Statement of Work from the Alliance to Save Energy as the SOW with SCE had not been finalized (February 2013). The Alliance to Save Energy informed Opinion Dynamics that the PG&E SOW was identical to SCE's in all major key performance indicators, objectives, and deliverables, so it is used as a proxy in developing this action plan.

ASE should consider engaging staff with subject expertise in demand response and distributed generation. As the program implementer, it bears the responsibility for developing program materials and meeting WE&T program standards for guidance in curriculum updates and, as such, should be able to draw from the relevant expertise to meet these goals.

4.3 PROGRAM ACTION PLAN

The Action Plan for the Power Save Campus Program comprises of five main recommendations.

1. Include IDSM as part of overall program objectives
2. Incorporate IDSM concepts in the program's Project Menu
3. Incorporate IDSM concepts in all program training sessions
4. Include an award certificate for the IDSM Project
5. Include questions on IDSM concepts in student post-tests to measure intern knowledge gain

For each recommendation, we outline the current state of IDSM integration and list additional actions and resources needed to accomplish this step. Each sub section also outlines a proposed Action Step schedule. The overarching goal is to complete these Action Steps within the current program cycle, where feasible (December 2014).

4.3.1 INCLUDE IDSM AS PART OF OVERALL PROGRAM OBJECTIVES

As noted above, ASE is currently integrating IDSM concepts as an underlying guiding principle/objective within the program's four key areas (rather than as a separate objective). Within these areas, ASE is currently reviewing the program goals' objectives to incorporate IDSM concepts throughout the definition and description of these goals—in other words, the four goals will remain unchanged, but explicit IDSM objectives will be incorporated supporting each of the goals.

A preliminary review of materials indicates that this may be underway for some of the program goals, namely, there are statements in the Academic Infusion goal related to IDSM as follows:

- "Convene faculty members from each campus to focus specifically on integrating IDSM into academic courses and to share thinking across campuses."
- "Design and implement student-led campaigns that produce measurable awareness and attitude changes towards energy efficiency and the environment, and obtain energy savings through promotion of available energy efficiency and demand response programs for homes."[8]

To ensure that IDSM is included as part of the overall program objectives:

[8] Power Save Campus statement of work, pg. 6.

- Review /update the program objectives so that they reflect IDSM concepts throughout the four stated program goals (workforce development, academic infusion, outreach, and energy savings) in all program materials
- Update the relevant Power Save Program documents to include an agreed-upon definition of IDSM and an outline of what should be included in program materials, approach, and Project Menus. ASE works with an external graphic designer on the fact sheets and Project Menus and can therefore update them up to twice per year. Training materials are produced internally can be updated on an ongoing basis.

Timing

- Beginning of the 2013-2014 school year

4.3.2 INCORPORATE IDSM CONCEPTS IN THE PROGRAM'S PROJECT MENU

Interns often select projects based on a program-provided Project Menu that lists and describes potential projects, which they receive during orientation and training. To ensure IDSM integration in the Project Menu options:

- Develop specific IDSM project to be included in the Project Menu. We recommend that initially this IDSM project be drafted from review of other studies/benchmarking or other similar sources. Once IDSM related "success stories" are accomplished in the participant campuses, the Project Menu should be updated with these project specific descriptions.
- Further, review other current projects listed in the Project Menu and update to integrate IDSM concepts into existing projects, where relevant and feasible.
- Update all supporting materials to include the IDSM Project option for students-interns.

Timing

- IDSM project in Project Menu: beginning of 2013-2014 school year
- IDSM concepts updates in existing projects, where relevant: end of 2013-2014 school year
- Ensure that IDSM concepts are included in training related to Project Menus (see 4.3.3 below):
    - For IDSM specific project: beginning of 2013-2014 school year
    - For review of all Project Menus and inclusion of IDSM where relevant: beginning of the 2014-2015 school year

4.3.3 INCORPORATE IDSM CONCEPTS IN ALL PROGRAM TRAINING SESSIONS

Power Save Campus holds at least two statewide training sessions, the Energy Efficiency Summit in the winter, and an end-of-year session in the summer. These gatherings include multiple training

classes on multiple topics. The Energy Efficiency Summit in February 2013 included a training session specifically introducing IDSM topics (led by SCE staff).

In addition to these statewide trainings, ASE hosts occasional regional training sessions in which interns from nearby colleges train together on certain topics. ASE also has added webinar capabilities in the 2012-2013 school year to conduct training sessions remotely.

ASE also commented that SCE resource support on campus would be welcome, in the form of having utility staff visit the campus and hold sessions on IDSM or by leveraging relationships with utility representatives.

Action steps to ensure that IDSM concepts are reflected in the statewide and regional training sessions include:

- Develop an IDSM-specific training module, and require all new interns to participate in this module during the summer training session (or upon entry into the program). This module would include the agreed-upon definition of IDSM, how IDSM integration is measured, and what campus audiences should learn from their projects (i.e., "training the trainer"). With webinar capabilities, this training can also be recorded and reused as new interns enter the program (SCE staff has prepared this training and will present at the upcoming Campus Summit training meeting)

- Review existing training materials and update for IDSM concepts, where feasible and relevant

- Reinforce IDSM concepts throughout the year with webinars

- Leverage IOUs Energy Center led classes on IDSM topics (where available) for both ASE staff and student intern knowledge enhancements on IDSM topics

- Include student-led sessions where experienced interns can share success stories from projects that successfully integrated IDSM concepts.

ASE may benefit from guidance, either from the utilities and/or external expertise in IDSM topics. In addition, ASE staff suggested the following utility resources:

- Pamphlets and other educational materials describing IDSM concepts that interns can distribute at tabling events

- Utility representatives could speak on campus either at student events, or conduct training on IDSM issues

Timing

- IDSM module already developed for summit training (led by SCE)

- Update of current training materials to reflect IDSM concepts related to IDSM updates to Project Menu: beginning of 2013-2014 school year

- Update of current training materials to reflect IDSM concepts where relevant and feasible: end of 2013-2014 school year

- Webinars on IDSM concepts:

- Leverage session taught by SCE in Campus training: beginning of 2013-2014 school year
- Hold refresher sessions periodically: commencing by end of 2013-2014 school year

4.3.4 Include an Award Certificate for the IDSM Project

Power Save Campus recognizes achievement of campuses related to performance in selected projects at an end-of-the-year meeting, where award winners receive a certificate based on project performance (e.g., most energy saved, etc.). ASE should include an award for the campus with the most successful IDSM project at the end-of-the-year meeting.

Timing

- Update literature establishing award targets: beginning of 2013-2014 school year
- Present end-of-the-year award certificate: End of school year (or timing that matches certificate program presentation)

4.3.5 Include Questions on IDSM Concepts in Student Post-tests to Measure Intern Knowledge Gain

The Power Save Campus Statement of Work (SOW) for 2013-2014 includes Key Performance Indicators (KPIs) that measure knowledge gain and experiences among Power Save Campus interns and stakeholders, as well as among students who participate in Power Save Campus energy efficiency courses. Students should be measured on level of knowledge gained by their undertaking of an IDSM-based project.

To ensure IDSM concepts are incorporated into a student post-test survey, ASE should:

- Develop survey questions to measure IDSM knowledge baselines and increases, based on the measures of success and definitions of IDSM described above
- Develop survey questions to measure positive attitudes or intent to take action related to IDSM concepts learned

Timing

- Develop Surveys: beginning of the 2013-2014 school year
- Conduct Surveys: throughout the school year

4.4 Proposed Measures of IDSM Success

The measures of success below aim at measuring IDSM concept prevalence and integration throughout the program design and materials. They are designed to reflect IDSM achievement in any

given program. They measure changes in student and teacher knowledge, robustness of program materials, and high-level training on IDSM integration.

Table 4: Power Save Campus Program Measures of IDSM Success [9]

Measure of Success	Description	Goal
IDSM Options in Program Design	▪ IDSM-related projects are included in the Project Menu of options provided to students ▪ IDSM concepts are embedded in other projects within the Project Menu, as appropriate and relevant	Yes
IDSM Concepts	• IDSM concepts in program materials at a minimum include: o Concepts of energy demand and consumption o Importance/benefits of reducing demand and consumption o Load shifting benefits (cost savings, grid reliability) o Load shifting strategies o Concepts of renewable energy (sources, benefits) o Calls to action	100% (on program materials where relevant/ feasible)
IDSM Integration	• State IDSM learning objectives in materials • Energy Efficiency, Demand Response and Distributed Generation concepts are integrated, with clear linkages that build on one-another, where feasible and relevant	Yes
Training Materials	• IDSM module is included in official training sessions, including Summit training • IDSM topics are included/embedded in training sessions/materials where relevant (where not a separate module) • IDSM concepts (module and/or embedded) are delivered through other channels such a webinars	Yes
Project Lead Surveys	• Include questions on: o Project Menu includes IDSM option o Likelihood of selecting IDSM project o Ease of use/understanding of project materials/information/guidelines on IDSM o Satisfaction rating on IDSM project	Scores of 8 or higher (on a 10-point scale)
Student Surveys	• Post-tests with Internet show an increase in overall score on IDSM concepts o Address shift in usage partners on campus / intern households o Address knowledge gain in Energy Efficiency, Demand Response and Distributed Generation concepts	Yes

[9] The contract between the IOUs and Alliance to Save Energy governs performance metrics. These outlined metrics are established to indicate prevalence and integration of IDSM concepts in the program design and materials

5. ACTION PLAN: PEAK STUDENT ENERGY ACTIONS

5.1 HIGH-LEVEL PROGRAM DESCRIPTION

The PEAK Student Energy Actions program (PEAK), implemented by The Energy Coalition, provides teachers with a flexible curriculum on energy resources and efficiency. These units are designed to be infused into the regular curriculum, and can be used as either a supplemental lesson or a full-year curriculum as the teacher chooses. This program targets the third to seventh grades in SCE territory, and is most often used in fourth and fifth grades given that the program materials aid in the preparation for standardized testing in these grades.

PEAK lists four overall program objectives for students known as the "four PEAK Actions," which guide the overall curricular content:

1. Shifting energy use off peak demand time
2. Shrinking energy use through cutting waste
3. Exploring renewable energy
4. Plugging in to new technology

The Energy Coalition is currently in the process of updating its program materials. The existing materials from 2010 included some IDSM concepts:

- Unit 1 (Natural Resources): Defines energy and resources, with a focus on **renewable** and non-renewable resources. Students play a game where they manage energy resources to ensure that a city does not lose power, and also learn the "four PEAK Actions."

- Unit 2 (Electrical Generation): Students learn about **generation**, with a unit focusing specifically on the development and capabilities of Smart Grid technology. Students also learn how to calculate **energy usage and costs over time**.

- Unit 3 (Greenhouse Gases): Students learn carbon emissions and carbon footprint concepts, and link these concepts to **energy usage** and **demand**.

- Unit 5 (Insulation): Students learn specifically about the role of insulation in **reducing energy use**. They also learn to identify opportunities for improving insulation at home and how it might reduce their home energy bills.

- Unit 6 (How Electricity Moves): Students learn about **energy efficient** lighting and calculate how much they might lower their energy usage and bills by using energy efficient bulbs in their homes.

- Unit 7 (Circuits): Students learn how to **identify demand** and **calculate usage** of home appliances. They then determine ways to **conserve energy** and **shift loads** for these appliances.

- Unit 8 (Exploring Peak Demand Time): Students learn about the interaction of **energy supply** (from circuits) and **demand**, and results when energy demand exceeds supply. They also learn about **load shifting** and devise a list of **potential load shifting actions**.

- Unit 9 (Electricity and Magnetism): Students identify potential "**energy vampire**" devices in the classroom and at home, such as game consoles and chargers. They then calculate potential cost and **energy savings** from turning off these "energy vampire" devices.

- Unit 10 (Using Electricity to Do Work): Students create comprehensive **home energy savings plans** to present to parents/guardians based on the four PEAK energy actions. The unit includes example actions to include in the savings plans under all four areas.

- Unit 11 (A Healthy Energy Future): Students learn about the need for increased **renewable resources** and play a game where they account for energy consumption using simulated non-renewable and renewable resources. They also study a map of California to identify ideal places for different types of renewable power installations.

5.2 CURRENT LEVEL OF IDSM ACTIVITY

PEAK includes the key areas of IDSM in its existing program objectives listed above:

1. Shifting energy use off peak demand time (demand response)
2. Shrinking energy use through cutting waste (energy efficiency/conservation)
3. Exploring renewable energy (distributed generation)
4. Plugging in to new technology (energy efficiency)

In the 2010-2012 process evaluation, the PEAK received marks above 90% in two of the three IDSM-related metrics: energy efficiency (95%) and distributed generation (100%). Its lowest rated area was in demand response, which received an 83% overall according to the evaluation metrics, mostly due to the relative cursory prevalence of demand response topics in the program materials.

PEAK provides breadth of IDSM topics but not necessarily depth of information and knowledge within its units; PEAK along with SCE, tested a pilot module aimed at providing both integration and depth of knowledge in IDSM specific topics, focused on DR activities. The pilot included a watt meter to be used with lab activities.

The main objective for PEAK is to identify ways to integrate these existing IDSM concepts, which are mostly standalone in each unit, across its program materials. Given the flexibility of the curriculum, one particular challenge for this program is to identify ways to build student IDSM knowledge even when teachers only teach a few of the units.[10] As shown above, the vast majority of PEAK units teach at least one IDSM concept, but they tend to be cursory in nature, and these concepts may or may not link to other concepts in other units that teachers choose to teach.

5.3 PROGRAM ACTION PLAN

The Action Plan for the PEAK program comprises seven main recommendations.

1. Include IDSM as part of overall lesson learning objectives in program materials

2. Increase IDSM concepts in PEAK program materials

[10] Teachers are required to teach a minimum of four PEAK units, and may teach anywhere between four and all eleven.

3. Incorporate IDSM exercises as part of the full curriculum for appropriate units
4. Consider options to ensure that IDSM concepts are adopted by teachers given program's inherent flexibility
5. Add questions on IDSM concepts to teacher surveys and share results periodically with IOUs
6. Include questions on IDSM concepts to student post-tests to measure student knowledge gain
7. Include IDSM concepts in teacher training materials

For each recommendation, we outline the current state of IDSM integration and list additional actions and resources needed to accomplish this step. Each sub section also outlines a proposed Action Step schedule. The overarching goal is to complete these Action Steps within the current program cycle, where feasible (December 2014).

5.3.1 Include IDSM as Part of Overall Lesson Learning Objectives in Program Materials

The teacher units for PEAK already include overall Learning Objectives. These Learning Objectives include some IDSM concepts, such as renewables, energy efficiency, and energy demand, but are not explicitly linked to IDSM.

Action steps include:

- Review the listed Student Learning Objectives at the beginning of each unit in the teacher guides, and add IDSM-specific learning objectives, where appropriate.
- Update the relevant PEAK Program documents to include an agreed-upon definition of IDSM and an outline of what should be included in program design, delivery and materials.

Timing

- As units are updated; target for overall completion is beginning of the 2014-2015 school year

5.3.2 Increase IDSM Concepts in PEAK Program Materials

The PEAK program offers up to 11 units to teachers in SCE service territory, which cover the IDSM topics listed in Section 5.1. While the PEAK materials include the key concepts of IDSM, they are "sprinkled" throughout the materials and are not fully integrated or developed in-depth.

Thus, program materials in general should be reviewed and updated to address the following topics, where relevant and feasible:

- Demand response:
    - Importance of keeping the customers' lights on (grid reliability, avoiding rotating outages, difficulty of energy storage)

    - Shifting load to off-peak periods
        - Concepts of peak/off-peak periods and seasons
        - Concepts of higher costs (linked to TOU rates) of consuming energy during peak periods
        - What school community (students/families/schools) can do to shift load (unplug vampire loads, disconnect video games consoles, turn off lights, lower HVAC settings, etc.)
    - Concepts of energy demand, rather than consumption (kW vs. kWh)
    - Time of Use /rate concepts (how it costs more to consume/generate electricity during certain times of day)

- Distributed Generation: (primarily solar in SCE's service territory) including concepts/topics/ elements that address renewable energy, particularly solar (if focused in the SCE service territory)

The update of program materials should follow two parallel approaches:

1. **Short-term:** IDSM 101 supplemental module (leveraging pilot module developed with SCE) should be developed that reflects the IDSM and its integration concepts). This would include new (or moved) labs and activities that specifically target IDSM integration. This module can serve as the basis for IDSM overall concepts and ideally, can be used as a foundation for teaching all other modules. This would be a short-term option that can be deployed in the upcoming program year. A supplemental unit can serve as an interim document to help orient The Energy Coalition on what concepts will be most important to add throughout the existing program materials including:
    a. IDSM knowledge and content
    b. Teacher and student engagement
    c. Testing teacher receptivity to have a required module in the program materials
2. **Long-term:** all units should be reviewed and IDSM concepts incorporated where feasible and relevant (thus, it would not necessary apply to all units). Special consideration could be paid to Units 1, 6, 7, and 9, as the 2010-2012 Connections Process Evaluation identified these units as ones that teachers are most likely to teach (73% taught Unit 1, 72% taught Unit 6, 78% taught Unit 7, and 73% taught Unit 9). The majority of teachers also said that they taught Unit 2 (50%) or Unit 8 (56%).

The Energy Coalition would also need to include SCE in the review process for the revamped materials to ensure that IDSM concepts are sufficiently integrated.

Timing

- Interim IDSM 101 supplemental lesson: beginning of the 2013-2014 school year
- Revamped curriculum with IDSM: beginning of the 2014-2015 school year

5.3.3 INCORPORATE IDSM EXERCISES AS PART OF THE FULL CURRICULUM FOR APPROPRIATE UNITS

PEAK typically provides one kit of materials for every five students (a total of seven to eight per classroom). In the SCE pilot in 2011, watt meters were added to the kits as part of the "Energy Vampires" activity in Unit 9.

The Energy Coalition should add the watt meters as a permanent component of the lab kits. These watt meters could also be used in other labs where students analyze energy usage. This meter can be further leveraged to incorporate grade-appropriate IDSM-specific lessons that focus on demand and demand shifting and demand response.

Because the watt meters were included as part of a small-scale pilot conducted in 2011, The Energy Coalition would need additional funding to purchase enough watt meters to make them a permanent part of the lab kits.

Timing

- Beginning of the 2013-2014 school year

5.3.4 CONSIDER OPTIONS TO ENSURE THAT IDSM CONCEPTS ARE ADOPTED BY TEACHERS GIVEN PROGRAM'S INHERENT FLEXIBILITY

Given that teachers have the flexibility of selecting which units to teach, even with a complete update of all program units, there will be some units where the topic of IDSM may not be applicable (for example, Unit 5 on insulation). In addition, given that the focus of IDSM integration is on developing depth of knowledge, the IDSM depth of knowledge may not be sufficient depending on which units teachers select. While the thoroughness of IDSM concepts in all units can only be established after these units have been developed, PEAK should consider options to ensure that IDSM is in fact promoted through its programs.

During interviews, the program implementers stated that requiring teachers to select a specific unit (e.g., the IDSM 101 referred to above) may encounter resistance. Teachers may prefer to select units that are aligned with their curriculum approach, and they would rather maintain ownership of what is taught in their classroom.

For purposes of this Action Plan, The Energy Coalition and/or SCE should test the potential requirement of a module to cover basic IDSM concepts with teachers to obtain feedback on potential resistance it would meet. Depending on the feedback received, either the required module can be updated to meet teachers' needs, or the requirement to teach a particular module lifted, but in this case, more in-depth IDSM knowledge should be incorporated into all units.

Therefore, The Energy Coalition should leverage short-term modules discussed in 5.3.2 above and require that teachers select these modules as part of the options to teach in the curriculum. This will require first that the short-term module be developed and vetted, and the teacher training must be updated to include the needed concepts (see 5.3.7).

After the IDSM 101 module is implemented, the program should include follow up with a teacher survey to determine reactions to the module requirement. If negative sentiments are expressed

about that, determine whether they are from the module requirement, or from the quality/alignment/approach within the module that could be updated to better reflect their needs and make them more likely to choose the module, even in the absence of this requirement.

Timing

Given expected resistance on this issue, this should be rolled out as a test in select schools with a sample size sufficient to draw statistically valid assumptions from survey results (minimum n=30).

- Short-term module developed: beginning of 2013-2014 school year
- Teacher training updated: beginning of 2013-2014 school year
- Teachers trained: beginning of 2013-2014 school year
- Teacher survey: Within weeks of PEAK units being taught (schedule to be provided by PEAK)
- Survey results/analysis: throughout the school year (for the first year, in time to inform changes, if needed, to this approach)

5.3.5 ADD QUESTIONS ON IDSM CONCEPTS TO TEACHER SURVEYS AND SHARE RESULTS PERIODICALLY WITH IOUS

The Energy Coalition conducts teacher surveys in the current program as a part of a feedback mechanism to improve program design. The results of these surveys are available to the IOUs upon request.

The Energy Coalition should review the survey and ensure that IDSM questions are included. These questions should, at a minimum, cover the following topics:

- Are materials and measures for student IDSM labs adequate and easy to understand and use?
- What is the likelihood of persistence of teaching IDSM concepts?
- What is the level of student engagement with IDSM tools and concepts?
- What is the reported level of students' knowledge gain on IDSM concepts (specifically describe concepts)?
- Are students taking IDSM concepts home?
- Do teachers understand the IDSM concepts from the training?

Timing

- Update surveys: beginning of the 2013-2014 school year
- Conduct surveys: throughout the school year
- As noted earlier, this data is available to SCE upon request; SCE can establish a regular schedule for receipt of survey results

5.3.6 Include Questions on IDSM Concepts to Post-tests to Measure Student Knowledge Gain

The Energy Coalition conducts student pre- and post-tests as part of the current program design.

To ensure that IDSM concepts are reflected in student post-test surveys, review the current post-test document and update for IDSM concepts where relevant and feasible. These questions should be linked to the IDSM concepts, exercises, and information included in the program materials.

Timing

- Develop survey: beginning of 2013-2014 school year
- Conduct surveys: throughout the school year

5.3.7 Include IDSM Concepts in Teacher Training Materials

At the beginning of the school year, teachers participating in PEAK attend an all-day training session, where they are oriented to the program materials, including hands-on practice for the labs they will teach. PEAK should add training materials that specifically explain IDSM concepts so that teachers can explain them to students. Development of training materials should include the agreed-upon definition of IDSM (see section 2.1 as a starting point). Beginning-of-year teacher training sessions include discussion or explanation specifically of IDSM concepts, so that teachers understand the program measures of IDSM success that they should meet as part of their participation.

Timing

- Training on interim IDSM 101 supplemental lesson: beginning of the 2013-2014 school year
- Training on revamped curriculum with IDSM: beginning of the 2014-2015 school year

5.4 Proposed Measures of IDSM Success

The measures of success below aim at measuring IDSM concept prevalence and integration throughout the program design and materials. They are designed to reflect IDSM achievement in any given program. They measure changes in student and teacher knowledge, robustness of program materials, and high-level training on IDSM integration.

Table 5: PEAK Program Measures of IDSM Success [11]

Measure of Success	Description	Goal
IDSM Concepts	• Concepts in program materials at a minimum include: o Concepts of energy demand and consumption o Importance/benefits of reducing demand and consumption o Load shifting benefits (cost savings, grid reliability) o Load shifting strategies o Concepts of renewable energy (sources, benefits) o Calls to action	100% (on projects where relevant/ feasible)
IDSM Integration	• State IDSM learning objectives in materials • Energy Efficiency, Demand Response and Distributed Generation concepts are integrated, with clear linkages that build on one-another, where feasible and relevant	Yes
General Objectives	• IDSM exercises are incorporated as part of the of student lab work for appropriate units • IDSM topics are included / embedded in training sessions	Yes
	• IDSM concepts are prevalent in units o IDSM is consistently one of the units taught (if new module developed) o IDSM is prevalent in most units taught (if updates of existing materials are performed)	100%
Teacher	Teacher surveys: o Materials and measures for student labs are adequate and easy to use o Likelihood of persistence of teaching IDSM concepts o Level of student engagement and knowledge gain on IDSM concepts o Taking IDSM concepts home o Teachers understand IDSM concepts from training	Scores of 8 or higher (on a 10-point scale), or equivalent
Student Surveys	• Post-tests should show a statistically significant increase in overall scores on IDSM concepts, or meet a certain score increase threshold o Addresses shift in energy consumption in students households o Address knowledge gain in EE, DR and DG concepts	Yes
Education	• Aligns and supports California Education Content Standards for appropriate grade levels	Yes

[11] The contract between the IOUs and The Energy Coalition governs performance metrics. These outlined metrics are established to indicate prevalence and integration of IDSM concepts in the curriculum, teacher training and program delivery plan

6. ACTION PLAN: POWER SAVE SCHOOLS

6.1 HIGH-LEVEL PROGRAM DESCRIPTION

The Power Save Schools (formerly Green Schools) program, implemented by the Alliance to Save Energy, targets all grade levels from kindergarten through 12th grade. ASE enlists entire school districts, and establishes core teams of teachers and custodians at each school site. Core team members attend an all-day workshop where they receive training and a program curriculum, complete with a road map with lesson plans and hands-on activities. These core teams then recruit students to join the team, who help lead the program and expand its focus throughout the whole school community.

Implementation of the program is flexible, as teachers choose the order in which they complete twelve benchmarks activities, each accompanied by related lesson plans. Power Save Schools also uses energy saving projects as an educational tool, providing students with hands-on learning opportunities on energy savings.

The participation process for Power Save Schools is highly flexible, as teachers can choose from a set of materials to teach, but there are no required subject areas or lesson plans, and teachers can modify these materials if desired. Power Save Schools also uses an energy savings project as an educational tool, providing students with hands-on learning opportunities on energy savings.

6.2 CURRENT LEVEL OF IDSM ACTIVITY

In the process evaluation yardstick, the Power Save Schools score low on demand response metrics.

ASE is currently revising and updating the Power Save Schools program framework and materials. Given its historical focus on energy efficiency, ASE may benefit from additional guidance and clarification from the utilities on the concept of IDSM and its integration. A common definition and a list of IDSM topics are included in Section 0 of this report and can serve as a starting point. SCE may need to be available for further guidance and clarification as needed.

ASE should consider engaging staff with subject expertise in demand response and distributed generation. As the program implementer, it bears the responsibility for developing program materials and meeting WE&T program and California Education standards for guidance in curriculum updates and, as such, should be able to draw from the relevant expertise to meet these goals.

6.3 PROGRAM ACTION PLAN

The Action Plan for the Power Save Schools program comprises five main recommendations.

1. Integrate IDSM elements into existing roadmap steps
2. Add IDSM concepts in Power Save Schools program materials where appropriate
3. Incorporate IDSM concepts into teacher training sessions
4. Add questions on IDSM to school community (teachers) surveys and share results periodically with IOUs

5. Include questions on IDSM concepts to student post-tests to measure student knowledge gain

For each recommendation, we outline the current state of IDSM integration and list additional actions and resources needed to accomplish this step. Each sub section also outlines a proposed Action Step schedule. The overarching goal is to complete these Action Steps within the current program cycle, where feasible (December 2014).

6.3.1 INTEGRATE IDSM ELEMENTS INTO EXISTING ROADMAP STEPS

Power Save Schools provides teachers with a roadmap at the beginning of the school year as part of their training and orientation. This roadmap guides activity development for the rest of the school year, including activity benchmarks that should be met at certain points in the year.

Action steps include:

- Review roadmap steps to identify opportunities to integrate IDSM concepts in existing steps where appropriate, particularly demand response activities and energy efficiency activities.
- Update the relevant Power Save Schools Program documents to include an agreed-upon definition of IDSM and an outline of what should be included in program design, delivery and materials.

Timing

- Revisions to roadmap and review of objectives: before the training at the start of the 2013-2014 school year

6.3.2 ADD IDSM CONCEPTS IN POWER SAVE SCHOOLS PROGRAM MATERIALS WHERE APPROPRIATE

Some existing program materials developed by Alliance to Serve Energy in conjunction with the U.S. EPA include IDSM concepts, such as the "Watt Does it Cost to Use It?" lesson (see Appendix A for a high-level description). [12] Students who participate in the Student Energy Audit Training (SEAT) also learn to measure demand, using audit tools that include watt and light meters. The SEAT curriculum also offers instruction on renewable and non-renewable sources of energy, the importance of energy efficiency, and green careers. The key task for Power Save Schools is to leverage some of the materials developed for other contexts as well as identify additional opportunities for IDSM integration. In general, program materials should include the following IDSM concepts:

- Energy demand and consumption

[12] The "Watt Does it Cost to Use It?" lesson, which was developed by a teacher for the Power Save Schools program, is currently included in the Energy Education and Workforce Development materials provided by the U.S. Department of Energy but was not included in the Power Save Schools teacher materials for 2010-2012. Other materials taught by the program in 2010-2012 touch on energy cost concepts, such as "Appliances: How Much Electricity Does it Use" and "Which Light Bulb Is Really Cheaper?". We included "Watt Does It Cost to Use It?" as part of the benchmarking lessons due to its content that explains the differences between usage and demand, as discussed in Appendix A.

- The importance/benefits of reducing demand and consumption
- Load shifting benefits (cost savings, grid reliability)
- Load shifting strategies
- Renewable energy

Not all materials should include all of these concepts, but all of these concepts should be included in the program overall. To ensure that these concepts are included, ASE should undertake the following steps:

- Develop a new "IDSM 101" lesson plan that offers all key IDSM concepts together. This would include new (or moved) activities that specifically target IDSM integration. These materials should also be aligned to support the California Education Content Standards, with consideration paid to what grade levels are targeted by each activity.

- Add specific IDSM principles throughout existing units and activities where appropriate. As part of this method, the materials should note any other activities or lesson plans that are "linked" to supporting IDSM concepts. One additional way to add these concepts is to review the listed Student Learning Objectives at the beginning of each unit in the teacher guides (where provided)[13], and add IDSM-specific learning objectives, where appropriate. One consideration is "linking" learning objectives so that students will increase IDSM knowledge over the course of several units. During the 2010-12 cycle, teachers were required to achieve 12 benchmarks on the program's Road Map and to teach a minimum of one energy efficiency lesson provided by the program. Because of the wide variety of activities and topics that teachers include as part of this program, we recommend that ASE develop both in-depth and cross-linking materials to provide maximum opportunities for teachers to include IDSM concepts.

- After these materials are developed, encourage teachers to conduct one in-depth IDSM activity/unit or include multiple, linked IDSM-integrated materials/activities.

- Energy efficiency projects are a major component of the Power Save Schools implementation in schools, and the school teams devise these projects at the beginning and throughout the year. Schools that participate in the program would need to agree to sharing their utility bills or billing data with the program, particularly for any time-of-use related activities. Two types of savings activities could integrate or increase IDSM topics:

    - Include IDSM concepts in the SEAT for grades 7 to 12. Schools that participate in SEAT already receive watt meters as part of the auditing kit, so SEAT activities may include additional activities that use the watt meter for measuring and understanding demand. These students conduct walkthroughs to identify energy saving opportunities in the schools, so these opportunities could include IDSM concepts such as demand response and distributed generation in addition to energy efficiency.

    - ASE could provide examples to teachers and facilities of ways to include IDSM concepts, such as load shifting, demand response, or time of use rates. These projects, particularly when students are included as part of the teams, will help increase IDSM learning.

[13] Any materials that do not already have learning objectives listed should add them, per our process evaluation recommendation.

Timing

- IDSM integration in savings activities: beginning of the 2013-2014 school year
- Update lesson plans for IDSM concepts as they are reviewed; target for overall completion is beginning of the 2014-2015 school year

6.3.3 INCORPORATE IDSM CONCEPTS INTO TEACHER TRAINING SESSIONS

At the beginning of the school year, Power Save Schools holds a district-wide workshop session for teachers and facilities managers who participate in the Power Save Schools team. In order to ensure IDSM integration, these sessions should add training materials that specifically explain IDSM concepts so that teachers can explain them to students. Development of training materials should include the agreed-upon definition of "energy management."

Beginning-of-year (academic year) teacher training sessions include discussion or explanation specifically of IDSM concepts, so that teachers understand the program measures of IDSM success that they should meet as part of their participation. Training sessions should provide teachers and facilities managers with hands-on opportunities to consider IDSM integration into savings projects. SCE representatives might also present key IDSM ideas to teachers as part of the workshop sessions.

Timing

- Beginning of the 2013-2014 school year

6.3.4 ADD QUESTIONS ON IDSM CONCEPTS TO SCHOOL COMMUNITY (TEACHERS) SURVEYS AND SHARE RESULTS PERIODICALLY WITH IOUS

Power Save Schools staff is in contact with participating school teams (typically led by teachers and facilities managers) throughout the school year and monitors progress toward the roadmap benchmarks, with an end-of-year meeting.

To ensure that IDSM concepts are reflected in teacher surveys, review the survey and ensure that IDSM questions are included. These questions should, at a minimum, address the following topics

- Are program materials and guidelines related to IDSM adequate and easy to understand and use?
- What is the likelihood of persistence of teaching IDSM concepts?
- What is the level of student engagement with IDSM tools and concepts?
- What is the reported level of students' knowledge gain on IDSM concepts (specifically describe concepts)?
- Are students taking IDSM concepts home?
- Do teachers understand the IDSM concepts from the training?

Timing

- Design teacher survey: beginning of the 2013-2014 school year
- Conduct survey: throughout school year

6.3.5 Include Questions on IDSM Concepts to Student Post-tests to Measure Student Knowledge Gain

ASE conducts student pre- and post-tests as part of the current program design. To ensure that IDSM concepts are reflected in student post-test surveys, review current post-test document and update for IDSM concepts where relevant and feasible. These questions should be linked to the IDSM concepts, exercises, and information included in the program materials.

Timing

- Develop survey: beginning of 2013-2014 school year
- Conduct surveys: throughout the school year

6.4 Proposed Measures of IDSM Success

The measures of success below aim at measuring IDSM concept prevalence and integration throughout the program design and materials. They are designed to reflect IDSM achievement in any given program. They measure changes in student and teacher knowledge, robustness of program materials, and high-level training on IDSM integration.

Table 6: Power Save Schools Program Measures of IDSM Success [14]

Measure of Success	Description	Goal
IDSM Concepts	• Concepts in program materials at a minimum include: o Concepts of energy demand and consumption o Importance/benefits of reducing demand and consumption o Load shifting benefits (cost savings, grid reliability) o Load shifting strategies o Concepts of renewable energy (sources, benefits) o Calls to action	100% (on program materials where relevant/ feasible)
IDSM Integration	• State IDSM learning objectives in materials • Energy Efficiency, Renewables and Demand Response concepts are integrated, with clear linkages that build on one-another, where feasible and relevant	Yes

[14] The contract between the IOUs and the Alliance to Save Energy governs performance metrics. These outlined metrics are established to indicate prevalence and integration of IDSM concepts in the curriculum, teacher training and program delivery plan.

Measure of Success	Description	Goal
Training	▪ Teacher workshops include session or discussion of IDSM concepts • IDSM concepts are prevalent in activities o Teachers conduct one in-depth IDSM lesson/activity or include multiple IDSM-integrated materials/activities	100%
Teacher and Students surveys	Teacher surveys: o Materials and measures for student labs are adequate and easy to use o Likelihood of persistence of teaching IDSM concepts o Level of student engagement and knowledge gain on IDSM concepts o Taking IDSM concepts home o Teachers understand IDSM concepts from training	Scores of 8 or higher (on a 10-point scale)
Students Survey	• Post-tests should show a statistically significant increase in overall scores on IDSM concepts, or meet a certain score increase threshold o Addresses shift in energy consumption in students households o Address knowledge gain in EE, DR and DG concepts	Yes
Education	• Aligns and supports California Education Content Standards for appropriate grade levels	Yes

APPENDIX A: U.S. BENCHMARKING OF IDSM CONTENT IN EDUCATION AND TRAINING PROGRAMS

As part of our Action Plan hypothesis development, Opinion Dynamics conducted a benchmark analysis of domestic educational programs that include IDSM-related materials. While no other known education and training programs have explicit IDSM education goals, several programs across the country contain IDSM concepts. The table summarizes the descriptions of existing programs and can be used as a reference for IDSM content.

Table 7: Summary of IDSM Education Benchmarking Programs

Hypothesis	Benchmarking Program Description	Learning Outcomes (from Lesson Plan)	Name	Author	Program	Grade Level
Pre-post subject tests including concepts of: definitions of energy and electricity, energy sources and resources, definitions of PV	Add quiz using true-false questions with class discussion of IDSM "misconceptions" at the beginning of materials to help teachers identify what students need to learn and "unlearn."	▪ Students discuss answers then turn in quiz. After related activities (separate lesson plan), they take the quiz again. ▪ A few questions apply to IDSM directly, such as how PV converts light to electricity and how energy works	Energy Miscon-ceptions Quiz	Solar Educa-tion for NY	NYSERDA WE&T	7th-8th
Energy Management /IDSM Topics integrated in lesson plans (topics include TOU, smart meters, Demand Response, Home Energy Assessments, kWh vs. kW, etc.)	National action plan for EE and DR integration. Suggests customer education on energy management themes is the primary way to educate them, as energy efficiency and demand response are complex topics	Suggested topic of energy management education as easiest topic to understand	Energy Efficiency and Demand Response Action Plan	U.S. EPA	N/A	N/A
Workbook with information on Energy 101	Provides information about different energy resources, electricity production and electromagnetism, energy consumption, and energy efficiency. Includes associated quizzes. Includes tables with calculations of approximate cost savings of energy efficient lighting and washing machines.	Not defined in the documents, but lists correlations with national and state curricular standards.	Intermediate Energy Infobook	NEED	The NEED Project	6th-8th

Hypothesis	Benchmarking Program Description	Learning Outcomes (from Lesson Plan)	Name	Author	Program	Grade Level
Exercises where students list ways that energy is "wasted" at home, including computing relative usage and cost of CFL and incandescent bulbs for energy usage and heat output	Students list ways that energy is "wasted" at home. Includes computing relative usage and cost of CFL and incandescent bulbs for energy usage and heat output. It connects usage with cost, includes take-home actions	1. Connection between energy use and global climate change 2. Different appliances and technologies with similar output vary in the amount of energy they consume 3. Identify and list technologies and other practical ways to be more energy efficient in a home 4. Build or display an apparatus or energy-efficient device that demonstrates its practical application for energy efficiency 5. Compare the relative value of an energy-efficient product or practice versus an equivalent product or practice that uses energy less efficiently, and use specific data, facts, and ideas to support their findings 6. Convey information and ideas from primary and secondary sources accurately and coherently 7. Report information and convey ideas logically and correctly	Energy Efficiency Ambassadors	U.S. EPA	ENERGY STAR	6th-8th
Online interactive activities and games where students look at micro-level demand of household appliances and macro-level demand of cities balanced against available energy resources	Provides in-depth explanation of connection between electricity usage and time of use. Differentiates between different pricing and different times of day. Includes games demonstrating demand of different household devices, as well as grid accounting for different types, amounts, and costs of energy supply and demand. (However, online games are very specific and may be difficult for students to understand.)	Students learn the following concepts: 1. Energy is delivered from the distribution network to the various loads throughout the home. 2. Different electrical loads vary greatly in their power demands. 3. The relationship between power and energy, terms that are often confused. 4. Energy is metered and priced over time in units of kilowatt-hours. 5. Energy (and money) can be conserved by using more energy-efficient loads.	Electricity and Time-of-Use Pricing	University of Illinois	TCIPG: Trust-worthy Cyber Infras-tructure for the Power Grid	6th-12th
Average rate information from utility included in energy cost calculation activities	Take-home activities that teach students and families about energy resources, costs of use of different appliances, and identifying potential cost savings of energy efficiency measures (especially CFLs).	Build connections of approximate costs and use based on what is rate and what students use in the home	Energy Action at Home	NYSERDA	NYSERDA	K-12th

Hypothesis	Benchmarking Program Description	Learning Outcomes (from Lesson Plan)	Name	Author	Program	Grade Level
Exercises where students calculate energy and power needs from school and household appliances using watt meter	Part of a program where solar panels are installed in schools and students receive related curricular materials (although that is not required). Students calculate energy and power needs from household appliances (based on list of deemed amounts provided in lesson), and then calculate how much power they need to allocate from the 6.5 kWh produced by a 2 kW solar PV system in NY state. Based on their allocations, students identify ways to save in their homes. Students learn distinction between power and amounts of electric energy generated or used. Also learn demand and energy impacts of home appliances, as well as supply-side considerations (applied to PV, they also calculate how much is used, stored, and drawn from local utility)	Adds PV information. Students look up and analyze power ratings for the appliances they use, and make decisions on the allocation of the photovoltaic energy, as it is generated, to appliance use on an hourly basis. Students then are able to cite examples of compromises that could be made to conserve energy while experiencing minimal effects on lifestyle; students could play a game where they take on the role of energy supplier with X amount of energy available and must allocate various amounts of demand and energy needs.)	Allocating Energy from a PV System	Solar Educa-tion for NY	NYSERDA WE&T	9th-12th
Exercises where students read their home meter to measure their current use	Explains how different behaviors at home may waste energy. Teaches students to read electric meters to determine how many kW their home is using. Students inventory home actions to determine ways to conserve energy. Teaches students how to read an electric meter (not a smart meter). Teaches students how to read electric and gas meters, and use watt monitor to identify usage of appliances in classroom and at home.	1. Students will identify ways to save energy in their daily lives and explain how saving energy can reduce air pollution.	Waste Watchers; Saving Energy at Home and School	American Forest Foun-dation; NEED	Project Learning Tree; The NEED Project	4th-8th/ K-6th

Hypothesis	Benchmarking Program Description	Learning Outcomes (from Lesson Plan)	Name	Author	Program	Grade Level
Information on TOU rate and shifting consumption to different periods	Hands-on lessons where students learn concepts of power and energy, and then calculate energy needs for different home appliances, as well as how to calculate power in kW and energy in kWh. They then learn rate concepts and calculations based on energy needs, as well as comparative costs of energy efficient appliances (namely CFLs). Concludes with a homework assignment where students calculate usage and cost of appliances in their homes. Integrates energy and demand concepts with hands-on and take-home materials. Integrates use of a watt meter to calculate demand of specific appliances and rate calculations to determine average cost per day and per year based on usage, but does not include information about peak demand times.	1. How electrical energy is measured in units of kilowatt-hrs 2. Determine the power needs (wattage) of representative electrical items in homes and businesses 3. Calculate kWh of an appliance when given its power consumption in watts and the amount time that it is on 4. Law of energy conservation 5. Recall the dollar cost per kWh for electrical energy in their area. 6. Convert electrical energy in kWh to dollars 7. Project costs to use representative items for one year 8. Generalize which electrical items are big users, and which are small, and evaluate the merit of leaving items on against the cost to leaving them on 9. Feel the personal need to conserve electrical energy 10. Make an energy inventory of their houses, and make recommendations for conservation	Watt Does It Cost to Use It?	U.S. EPA (with Alliance to Save Energy)	Green Schools	9th-12th

APPENDIX B: PROGRAM IMPLEMENTER INTERVIEW GUIDE

As part of this project, the Study Team met with program implementers to discuss IDSM concepts, test the hypothesis to achieve IDSM integration, and review potential measures of success. An in-depth discussion guide outlining the hypothesis and measures of success was distributed ahead of the meetings, which helped guide the discussions. While the interviews were fluid, the questions below reflect the topics discussed during these meetings.

1. What does IDSM mean to you?
2. Are you aware of the mandate for IDSM integration in the WE&T Connections Program?
3. What are you or your program doing to achieve IDSM integration, if anything?
4. How would you approach IDSM integration in your program?
5. What resources would you need to incorporate IDSM integration?
6. We would like to test options about achieving IDSM integration within the PEAK program. For each of these options, we would like to get your perspective on the following:
    a. Is it possible?
    b. What would it take to make it happen in terms of resources?
    c. What would be a reasonable timeline to have it achieved?
    d. Who would need to be involved?
    e. How would it be disseminated?
7. In reviewing proposed measures of success (provided to each company interviewed), please comment on:
    a. Would scoring high in the measure of success reflect a high level of IDSM integration?
    b. Are the proposed measures of success reasonable? Achievable?
        i. Using current resources
        ii. New resources would be needed
    c. Are there other suggested measures of success that would effectively measure level of IDSM integration?
8. [AFTER GOING THROUGH HYPOTHESIS] Given what we discussed, do you have additional ideas or suggestions for IDSM integration? If so, what are the implications for resources and time?

APPENDIX C: BIBLIOGRAPHY

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