Discussion Tool Guide

(Excerpt from the Draft Commercial ZNE Action Plan | December 2017

California Public Utilities Commission

Changing the Conversation

"It's not possible to prove analytically that a new idea is a good one in advance. If an idea is new there is no data about how it will interact with the world."

– Roger Martin, Institute Director, Martin Prosperity Institute

There are a number of different ways to achieve ZNE. Each path, as this Plan has described, has various benefits to the grid, to meeting our energy goals, and to customers. The focus of this section is not to prescribe a particular path, but to expand the conversation and provide a new set of ideas that push beyond building-scale and extends the ability to achieve ZNE levels of performance in a wide variety of situations. The following provides a methodology and framework for the reader to explore alternatives to rooftop only solar with decision-makers, staff, and project teams. The goal is to spark innovative ideas and projects that maximize the benefits of ZNE.

Using the Discussion Tool

The discussion tool is an initial step for property owners, local governments, and organizations interested in pursuing ZNE. It helps to reframe what are the options for achieving ZNE and how they connect to customer objectives. Property owners and organizations with larger, multi-building projects associated with a campus, portfolio or neighborhood/district will get the most useful information from the tool.

The online tool provided on the Plan's website (capath2zne.org) allows a user to rank their objectives in pursuing a ZNE project and the tool will provide three options to explore further. Below are details that inform the tool and resources to inform your discussion and ranking of your objectives.

1. Defining a Grid-friendly Project

2. Paths to ZNE

3. Customer Objectives and Discussion Questions

This is the first phase of the Tool and the goal is to work with stakeholders over the coming year to enhance and refine it over the coming year. (We welcome feedback and insights on how to improve it.) In addition, we recognize that understanding the details related to costs are critical to ultimate decision making. The CPUC is working with partners to develop additional resources including tools for determining costs, and locational value for ZNE projects. This extended tool will be available in 2018 or early 2019.

Photo: International Brotherhood of Electric Workers of San Leandro ZNE Center

Defining a Grid-Friendly Project

The following, adapted from the CEC Advance Energy Community criteria, defines what a ZNE grid-friendly project should achieve and assists in explaining why some approaches to ZNE are more desirable than others.

- Minimize the need for new energy infrastructure costs such as transmission and distribution upgrades or fossil fuel power plants.
- Provide energy savings by achieving high levels of energy efficiency and maintaining zero net energy status (accounting for behavior and increasing loads from vehicle and appliance electrification).
- Support grid reliability and resiliency by incorporating technologies such as energy storage and smart inverters.
- Provide easier grid integration and alignment with the California Public Utilities Commission's (CPUC) Integrated Resource Plan (IRP), and the California Independent System Operator's local capacity requirements process.
- Provide affordable access to renewable energy generation, energy efficiency upgrades, water efficiency, and technologies that reduce electricity consumption for all electric ratepayers.
- Make use of smart-grid technologies in the project and when applicable throughout the community.
- Align with other state energy and environmental policy goals at the community level such as the Sustainable Communities and Environmental Protection Act (Senate Bill 375, Steinberg, Chapter 728, Statutes of 2008).

Paths to ZNE

The following "Paths to ZNE" are general examples of potential approaches to ZNE projects. Aligning your objectives to these paths will help to focus how to best reach ZNE goals. Often stakeholders ask for examples and specific details on these concepts. While there is a growing body of examples (see the next section on ZNE Project Examples) of these approaches, there are limited completed case studies.

J. Craig Venter Center, UCSD

1. Building Scale (On-site Solar Only)

ZNE is achieved on-site for a single building, as defined by producing as much energy as it uses over a year.

Grid friendliness: Low - inability to serve load on-site outside of solar generation hours. May reduce summer distribution peaks. Does not reduce transmission and distribution.

2. Building Scale (Solar + Storage On-site)

ZNE is achieved on-site with storage capabilities, includes the ability to reduce solar generation/size of arrays and cover substantial percentage of non-solar generation times with storage.

Grid friendliness: Medium - depends on the storage capacity and ability to flatten load shapes. Storage recharge in off peak times may be with non-renewable power - not desirable.

Photo: Google Headquarters

3. Community Scale Solar (Local)

Local community scale solar serving multiple buildings. May be directly connected to building loads or nearby.

Grid friendliness: Low - depending on location relative to generation/distribution peak requirements. How is solar distributed, does it serve a locational and time value?

Photo Mountain. View Los Altos High School District – Solar + Storage

4. Community Solar Plus Storage (Local)

As above with the addition of community scale storage and enhanced controls for demand response and load management.

Grid friendliness: High - can help manage loads and power requirements within a local area.

Particular useful when it supports locational benefits.

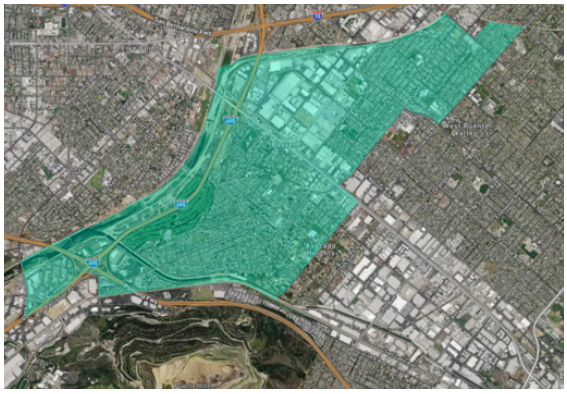


Photo Avocado Heights, Los Angeles EPIC, AEC District Planning

5. District ZNE/Grid Connected Microgrid (On-site)

Multi-faceted distributed energy system on-site, connected to the grid normally, but a level of self-reliance during events. May include CHP/district system.

Grid friendliness: High - can help manage loads and power requirements within a local area and improve reliability to connected loads.

Photo. Solar Farm in Southern California

6. Utility Scale Renewables (Off-site, not local)

ZNE is achieved by utility owned/contracted power or by a third party PPA and wheeled through the grid.

Grid friendliness: Medium - Requires transmission and distribution system, potential upstream environmental impacts, and reduces resiliency. Locational value and increased reliability may not be considerations.

Customer Objectives and Discussion Questions

The following are the "Customer Objective" categories that are designed to help determine what is important to your ZNE project. Additional questions have been added under each to spur additional conversation and to hone in on the relative importance of that objective. These can help to frame any ZNE project, but also are intended to align with the online tool and be rated on a scale of 0 – 10, with 0 being not important, 5 being neutral and 10 being extremely important.

Develop Your Project Description

Before you begin this process, you should first develop a fairly well-developed project description that addresses the following at a minimum:

- Is the project a single building under 50,000 sq. ft., a single building over 50,000 sq. ft., a combination of multiple similar buildings, or a larger/complex district, campus or community project?
- Do you have land and/or sufficient rooftop area for the needed renewable energy array at the project site?
- Who is your utility provider? Are there incentives or other programs that you are eligible for?
- Are you located with an active or soon to be established CCA?

Sustainability

Reduces environmental footprint by providing on-site (or nearby) energy supply; reduction or elimination of fossil fuels/natural gas; supports sustainable transportation choices, Local Climate Action Plan, and green building practices.

- Does your organization have a Local Climate Action Plan or Sustainability Plan that this project will address?
- What will the impact of this project be on your sustainability goals?
- Will your project be a model of sustainability for your City or region?

Resiliency

Increase ability to withstand and recover from adverse events, in particular to function during larger grid outages; mitigate effects of disruptive events on local communities.

- Does your organization have goals for climate adaptation?
- Is resiliency during power disruptions a priority for your project or organization?
- Does this project need to maintain electricity in emergency situations, such as first responders, on-going patient care, or other critical operational elements related to data/research/communications?
- For how long, and at what level, is emergency electricity needed? A few hours, two or three days, indefinitely? Some backup power is needed, full back up power is needed?
- Do you plan to install, or do you have, a fossil fueled generator as part of resiliency?
- Will your project reduce risks in emergency situations?

Carbon Zero/Neutral Development

Creates no new greenhouse gas emissions or GHG are 100% offset. Assumes if a project relies on grid power, that there are some associated GHG emissions.

- Is your goal to have 100% renewable or clean energy?
- Is this project trying to achieve electrification (i.e. no fossil fuels used on site, and 100% renewable electricity)?
- Are you looking to integrate electric vehicle (EVs) charging into the project?

Infrastructure Modernization

Project will improve other infrastructure not associated with the building - water, sewer, fiber network, etc.; ability to leverage new or existing district-scale systems, may provide needed new services to an area.

- Will this project include other infrastructure improvements such as water, sewer, transportation or landscape systems?
- Will the project be able to leverage these improvements and increase overall benefits?
- Are there major infrastructure upgrades required in the project area?
- Are there additional funding sources that can be leveraged from other infrastructure efforts?

Local Energy Supply

Reduce or eliminate energy imports into a community and increase control by local government/partners (particularly CCAs and RENs).

- Is it a goal or a requirement of your organization to have local control of your energy supply (verses utility)?
- Can you partner with a CCA?

Certification

Contributes to eligibility to achieve high performance certifications such as U.S. Green Building Council's LEED Platinum, International Living Future Institute (ILFI) Living Buildings, and EcoDistrict.

- Does your organization want your project to be certified?
- What certification are you interested in?
- What does this project need to achieve in terms of energy provision to make sure you get the certification?

Monetization of Energy

Enable energy system to be leveraged for revenue generation; offset of costs.

- Should this project help to establish an energy system and infrastructure that can be a revenue source?
- Do you have the organizational structure to operate and manage such a system?
- Is economic development a driver for the project?
- Are you eligible or organized so that you can monetize your energy (PPA/CCA other)?

Economic Development

Potential to improve branding, attraction to the project. Project contributes to the local economy through job creation, the development of sustainable infrastructure, and may support developer objectives.

- Will this project improve the image or brand of your organization?
- Will this project spur job creation or help the surrounding neighborhood?

Asset Control/Management

Increase control of the management and operations of physical assets related to energy systems and investments.

- Is it important to your organization that you control and own the energy infrastructure as part of this project?
- Do you have the financial resources to purchase, install and manage the solar array, are you looking for external financing/managements, or are you interested in an alternative financing structure such as a lease or a project share?

Ease of Access/Entitlement

Ability to receive incentives to streamline development or reduce barriers to implementation or get entitlements.

- Will entitlement incentives or streamlining be important for your project to succeed?

Architecture Flexibility

Reduces the need for roof space/architectural changes for solar arrays on building siting and building design, and provides more design flexibility/innovation.

- Are you interested in architectural design that has the flexibility for various roof designs, or can it be designed to accommodate solar PV?
- Do you have sufficient land for community scale solar and storage?
- Are there shading or tree issues that would limit the space you have for solar panels?

Optimize Electricity Rates

Enhanced ability to manage and distribute energy loads across different buildings and/or uses, flatten energy demand peaks and reduces costs to customer.

- Is it a goal to carefully manage electric loads to reduce demand charges?
- Are you planning specific demand reduction measures such as off-peak ice for cooling?
- If the project covers several buildings, is there a capability to manage electricity demand among several users?

Capital Costs

The incremental capital cost increase for a solution.

- How will you calculate your project costs?
- Will you consider the benefits of lower operating costs when balancing your capital costs (aka total cost of ownership)?
- Will you incorporate costs/benefits such carbon into your project?

Financing Options

Ability to leverage other Government and/or private industry partnerships for funding, financing and/or other resources.

- Will the size of your project help financing options?
- Are there local programs or incentives that could help finance your project?
- Can you leverage other infrastructure investments into your project to create an economy of scale?
- Is the project within a special tax district?
- Can you utilize the Enhanced Infrastructure Financing District tool (EIFD)?

Level of Effort

Incremental increase in time, resources and effort to implement.

- What are your organization's goals for the length of the project and the level of effort?
- Do you have the capacity and resources to embark on more complex projects that may have greater benefits but could be more intense to manage?

Operation Costs

Incremental costs and resources for operations.

- Are you planning to be the owner and tenant of the project? Or are you a developer that may not need to consider operations?
- Is lowering your operating costs a goal?

Environmental Justice

Provides a benefit to disadvantaged communities, increases affordability and access to renewable energy, and helps to lower bills.

- Will or do you want this project to help disadvantaged communities?
- How can you optimize those benefits if it is a goal?
- Will the addition of community solar and storage help?
- Will working with disadvantaged communities help ensure support of the project?

ZNE Projects Examples

The development of ZNE projects, especially at the district-scale is relatively new and there are not a lot of examples or best practices to build upon. However, there is a growing body of projects and pilots that are exploring and establishing new approaches to achieve ZNE. The following are a sample of some of those efforts.

Commercial and Residential Developments

There are numerous examples of leading builders, architects and developers incorporating low- and zero energy features, with hundreds of commercial building examples and thousands of residential buildings that have achieved zero energy performance in California. The "Net Zero Energy Building Report" (Navigant Consulting, 2016) estimate that the North American **market for Zero Energy Buildings will grow at an annual rate of 38%, increasing in size to $127 billion in 2035.** The report lists perceived and real costs and lack of awareness and education as the primary challenges to growing the market.

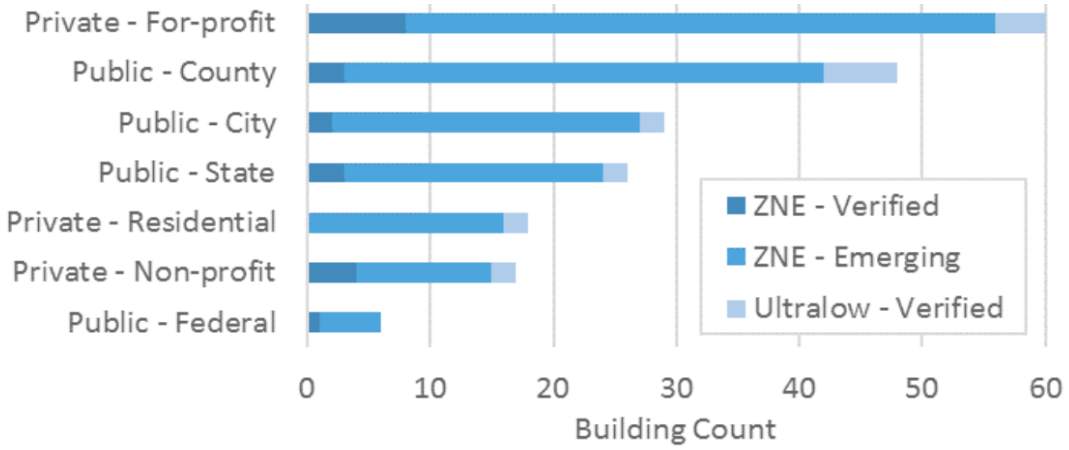
California has led the nation in ZNE commercial construction since formal tracking began in 2011. The New Buildings Institute's most recent list of California ZNE buildings includes 204 ZNE projects either completed or under construction. ZNE commercial buildings and campuses have now reached approximately 14 million square feet in California, including the University of California Merced campus project. Private buildings account for approximately 40% of the buildings with a wide variety of office buildings, multifamily dwellings and corporate/retail buildings. Public buildings represent over 50% and including K-12 schools, universities, and local state and national government projects.

University and College ZNE Initiatives

Universities and colleges are also working on towards reducing their carbon footprints and using ZNE initiatives as one of the tools. An important example is the University of California has committed to become carbon neutral by 2025 through their "Carbon Neutrality Initiative". Specific projects included are utilizing ZNE as an element to achieve their goals and include the following:

- UC San Diego now generates about 85% of its electricity using an ultra-clean and efficient cogeneration plant, the world's largest commercial fuel cell and solar panels.
- UC Davis has built a net-zero community on its 130-acre West Village campus that provides housing for approximately 3,000 people in 662 apartments and 343 single-family homes.

California Commercial ZNE Buildings by Building Ownership (n= 204)



Source: New Buildings Institute, 2017

- UC Irvine has 3.7 MW of solar throughout the campus.
- UC Merced, the newest addition to the UC system, has implemented their comprehensive Triple Zero Commitment which aims for zero net energy use, the creation of zero net landfill waste and climate neutrality on campus by 2020 while nearly doubling the campus's physical capacity by that same year.

The California State University (CSU) system has also been working towards energy efficiency and ZNE by incorporating a mix of sustainability measures throughout the universities. Currently, 23% of the CSU's electric power is from renewable sources. For example, CSU Long Beach installed 4.5 MW of solar. This is the largest PV installation in the CSU system and it powers one-third of their campus during peak demand. They are also planning to reach carbon neutrality by 2030.

K-12 Schools and Community Colleges

Beginning in 2013, Proposition 39 has allocated over $1.3 billion dollars to fund clean energy jobs and support reduction of energy use and costs for schools. (K-12 and Community Colleges) The funding has resulted in over a thousand projects and $8 billion in energy savings for the schools.

Over $165 million in funding has been provided for community college projects statewide including energy efficiency and solar arrays.[1] The Pasadena Community College District and the Peralta Community College District are two examples of community colleges interested in developing Zero Net Energy campuses and districts. The potential impact of reaching zero net energy in all of the state higher educational institutions is substantial from an energy savings perspective but also in the opportunity to lower operating costs and reallocating those funds for education programs. Further, these intuitions can become learning labs to establish the careers and talent needed in California to build and support a clean energy economy.

The IOUs managed a ZNE K-12 School Pilot Program and ZNE Existing Buildings Retrofit Program using funding from Proposition 39. Over 4,000 school sites have benefited from the funding to add solar panels, improve energy efficiency and develop ZNE projects. Two school districts: Oakland Unified School District and San Diego School

Photo Courtesy NBI. Bishop O'Dowd High School, Oakland, California

1 California Community Colleges Chancellor's Office, 11/27/17, http://extranet.cccco.edu/Divisions/FinanceFacilities/Proposition39.aspx.

District have recently been recognized as early leaders with their commitment to ZNE.

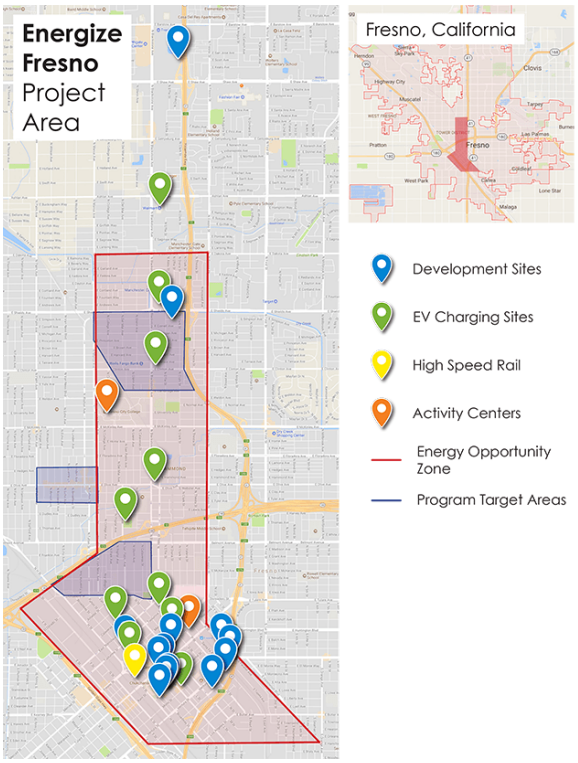
District-Scale Advanced Energy Communities and ZNE Districts

Adopting community-scale or district efforts for renewable energy and storage is becoming an attractive and a more economically viable approach than building by building. ZNE buildings have demonstrated how to link deep efficiency with renewables and advanced building operation to achieve remarkable energy performance. District-scale ZNE efforts have the ability to address and encompass existing buildings in a district by sharing renewable power, storage, enhanced controls and other elements, enabling a more sustainable approach to development. Establishing fully functioning and integrated ZNE districts is a relatively new concept with most projects still in the conceptual and planning phases. Nationally, there are three notable district initiatives: EcoDistricts, Department of Energy District Accelerator Program, and Architecture 2030 Districts. In California, districts approaches are using the national initiatives as well as being funded by the CEC's EPIC program.

EPIC Advance Energy Communities

In 2016, the Energy Commission awarded approximately $16 million dollars to 13 grantees for "Accelerating the Deployment of Advanced Energy Communities." This Phase I solicitation focuses on researching barriers and opportunities, designing a strategic framework and an energy master plan, and developing models and tools for target pilot communities. Teams comprised of building developers, local governments, technology developers, researchers, utilities, and other project partners will spend 18 months developing innovative and replicable plans for Advanced Energy Communities. Projects will be eligible for Phase II funding to implement specific projects in the pilot communities, most of which aim to develop micro-grids or advance zero net energy implementation.

EPIC Advance Energy Community: Energize Fresno District



- Santa Monica Advanced Energy City Yards District, City of Santa Monica
- Integrated Community Resource Marketplace: Energize Fresno, Local Government Commission
- Berkeley Energy Assurance Transformation (BEAT) Project, City of Berkeley
- Peninsula Advanced Energy Community (PAEC), Natural Capitalism Solutions
- Huntington Beach Advanced Energy Community Blueprint, University of California Irvine
- Accelerating AEC Deployment Around Existing Buildings in Disadvantaged Communities, University of California Los Angeles
- Zero Net Energy Farms, Biodico, Inc.
- EnSEED (Encanto Social-Economic and Environmental Education Development), Groundwork San Diego, Chollas Creek

- The Oakland EcoBlock – A ZNE, Low Water Use Retrofit Project, University of California, Berkeley
- ZipPower San Leandro, Olidata Smart Cities
- Advanced Renewable Energy Community for Disadvantaged California Community, Charge Bliss, City of Carson
- Richmond Advance Energy Community Project, The Zero Net Energy Alliance
- Lancaster Advanced Energy Community Project, The Zero Net Energy Alliance

EcoDistricts

EcoDistrict certification process focuses on the development of a roadmap to establish an advance sustainable and equitable community. The EcoDistrict protocol requires projects to emphasize three key tenets: equity, resilience, and climate protection. While zero net energy is not a requirement, it is an essential tool to achieve many of the protocol's goals, dependent on the city or project. There are 11 communities in 10 cities across North America that have committed to this certification[2].

The City of San Francisco is currently developing five EcoDistricts[3] within the city that include acquiring upgrading infrastructure, creating greener public housing and private buildings, and transit infrastructure. The City of Los Angeles is developing a similar effort, the Crenshaw Corridor. Project goals include the development of two mixed-use facilities with solar; and a new affordable senior housing project.

2030 Districts

2030 Districts are public/private partnerships in urban areas organized by the nonprofit organization, Architecture 2030. Through benchmarking, strategic development and implementing best practices, the organization is working in 15 cites including San Francisco and Los Angeles, to adopt aggressive energy performance targets. Through the "2030 Challenge for Planning" they work to renovate existing buildings to a 70% reduction in energy use relative to typical buildings. The goal is that all new building and major renovations are to be carbon neutral by 2030.

Microgrids

A microgrid is a small energy system capable of balancing captive supply and demand resources to maintain stable service within a defined boundary. They combine local energy assets, resources and technologies into a system that is designed to satisfy the host's requirements like basic electrification and balancing variable DER's into an integrated ZNE system.[4]

The following examples of microgrids serve different purposes, but illustrate how effective organization of renewables with DER optimize energy usage and generation to achieve resilience, reliability and sustainability:[5]

- **Santa Rita Jail:** The Santa Rita Jail is an excellent demonstration of a microgrid and includes approximately 1.5 MW of PV, a 1.0 MW molten carbonate fuel cell, back-up diesel generators and a 2 MW Lithium-Ion battery and functions either grid connected or islanded[6].
- **City of Berkeley Parking Garage**: The City of Berkeley is completing construction of a 720-space parking garage microgrid[7]. The microgrid is designed to power the structure and can be used as clean backup energy to neighboring key buildings, such as City Hall and the Public Safety Building.

2 Ecodistricts.org, 11/7/2017, (https://ecodistricts.org/district-registry/)
3 sf-planning.org, 11/7/2017, sf-planning.org/sustainable-development.
4 microgridinstitute.org, 11/7/2017, www.microgridinstitute.org/about-microgrids.html.
5 microgridinstitute.org, 11/7/2017, http://www.microgridinstitute.org/uploads/1/8/9/9/18995065/microgrid_institute_-_naseo_presentation_v2.4.pdf.
6 building-microgrid.lbl.gov, 11/7/2017, https://building-microgrid.lbl.gov/santa-rita-jail.
7 cityofberkeley.info, 11/7/2017, https://www.cityofberkeley.info/City_Manager/Press_Releases/2016/2016-07-12_Microgrid_for_a_Resilient_Berkeley.aspx.

- **College of Marin/Tesla Demonstration:** In an effort to kick-start demand for its Powerpack energy storage solution, Tesla Energy is initiating pilot projects that demonstrate the value of energy storage to potential customers in the commercial space. One of the first of these pilots, a 4-MW storage project at California's College of Marin.[8]

8 marinij.com, 11/7/2017, http://www.marinij.com/article/NO/20160515/NEWS/160519871.