Bloomberg BNA

# International Environment Reporter™

VOL. 38, NO. 25 DECEMBER 16, 2015

*Resource Efficiency*

## Rapidly Transforming Energy Sector: Risks and Opportunities in the U.S., China and Europe




By Marc Campopiano, Paul Davies, Antonio Morales and Joe Bevash

### I. Introduction

Even as the United Nations Framework Convention on Climate Change is under way in Paris, the energy sector is undergoing a rapid transformation toward a lower carbon future due to a historic shift in the supply and demand of electricity.

The worldwide energy sector is changing from an ''old'' paradigm characterized by centralized, utility-controlled, large power plants running nearly full time with major transmission lines connecting remote demand areas (where demand was well-correlated to population and economic growth, but difficult to control) to an evolving, more decentralized and dynamic ''new'' paradigm characterized by flat or declining demand, local power sources, an increasing ability to manipulate demand, reliability challenges from intermittent renewables, and myriad new technologies empowering the customer.

A primary driver of this transformation has been the explosive growth of renewables—mostly wind and solar. Even as prices for petroleum and natural gas dip toward historic lows, the renewable energy market share continues to grow at a rapid pace. Near-exponential growth has occurred at state, national and international levels.

For example, in California, installed renewable capacity in 2015 was nearly eight times greater than 2010, which, in turn, was nearly eight times greater than 2005.[1] A similar story is playing out across the U.S. In 2014, 68 percent of all new generating capacity was from renewables, while a decade earlier it was 4 percent.[2]

Internationally, renewables have garnered a bigger and bigger share of the energy market, and while still small overall, the relative growth is massive. For example, since 2000, the level of installed solar capacity worldwide has increased 68-fold.[3] Looking forward, the International Energy Agency projects that renewable energy will be the largest source of installed new power

[1] California Public Utilities Commission, RPS Quarterly Report, 4th Quarter 2014.

[2] Energy Information Administration, Monthly Energy Review, March 2014; Solar Energy Industries Association, U.S. Solar Market Insight Report, 2014 Year in Review.

[3] Pew Charitable Trusts, Innovate, Manufacture, Compete (2012).

 ISSN 0149-8738

capacity during the next five years, with 700 gigawatts in installations worldwide.[4]

This growth has been accelerated by a range of governmental incentives and mandates that directly or indirectly encourage new renewable energy or discourage coal-fired generation, including stimulus funding, feed-in tariffs, tax credits, renewable energy mandates, air pollution standards and carbon reduction requirements. In the United States, 31 states and the District of Columbia have adopted renewable or clean energy policies. At the federal level, the Clean Power Plan issued by the U.S. Environmental Protection Agency (EPA) puts new pressure on the coal-power sector, with renewable power and natural gas power poised to be the principal beneficiaries. Worldwide, 144 countries have some form of renewable energy standard and myriad tax incentives and feed-in tariffs that increase the cost-competitiveness of renewables.

Yet while governmental incentives and programs have been important drivers, the basis for the paradigm shift is more nuanced. Even as governmental subsidies have dropped sharply in the U.S. and Europe in recent years, renewable growth has continued a strong upward trajectory. Economies of scale and technological advancements have spurred dramatic cost declines. Solar module costs, for example, have fallen by more than 75 percent since the beginning of the decade, while the cost of electricity generated by solar has fallen by more than 50 percent.[5] The cost of wind energy installations has come down by 90 percent since 1980, placing it among the cheapest forms of electricity today.[6]

The private sector has stepped up procurement of renewables as costs have become more competitive. For example, in 2014, almost 25 percent of all wind energy contracts were from companies or institutions—a very large percentage of nonutility procurement. And Apple, the world largest company by market capitalization, has committed to powering its entire operations—including its supply chain—from renewables.[7]

Companies looking to take advantage of opportunities from this transformation, or minimize risk, will benefit from understanding the key drivers. This article provides snapshots of driving factors in three major markets across the globe: the U.S., China and Europe.

## II. The U.S.

**Congressional Gridlock, More Muscular EPA Rules.** The U.S. lacks an overarching policy or regulatory scheme for controlling greenhouse gases. Under President Barack Obama, it initially appeared that a federal cap-and-trade mandate for greenhouse gases and a federal clean energy standard would be passed. However, neither law was enacted while Democrats controlled both congressional houses, largely due to the intense focus on the president's health care legislation. Since that time, congressional gridlock has left scant room for aggressive environmental legislation of any kind, let alone controversial laws involving climate change. At this time, it appears very unlikely that Congress will pass major new climate change or renewable energy mandates in the near term.

Nevertheless, the intervening years have seen a range of major new regulations affecting the energy sector. In large part due to the lack of congressional action and the president's desire to drive climate policy, the EPA and other federal agencies have adopted a number of aggressive regulations aimed at cutting greenhouse gas emissions and pollutants from a variety of fossil fuel sources, including power plants, tailpipe emissions, the oil and gas industry and industrial sources.

The EPA has been particularly active. In 2007, the U.S. Supreme Court ruled in *Massachusetts v. EPA* that carbon dioxide is an air pollutant within the EPA's existing power to regulate under the Clean Air Act.[8] Adding this authority to its already substantial authority to regulate criteria pollutants, the EPA has proposed a number of major rules that will significantly impact coal-fired power, including the Cross-State Air Pollution Rule, which the D.C. Circuit remanded in part to the EPA on July 28; the Coal Combustion Residuals Rule; Prevention of Significant Deterioration permitting requirements; the Cooling Water Intake Structures Rule; and the Mercury and Air Toxics Standards, which the Supreme Court overturned June 29, and the EPA is reconsidering.

The agency's most far-reaching and expansive rule is its recently finalized Clean Power Plan (CPP). The plan aims to reduce U.S. greenhouse gas emissions by about 32 percent below 2005 levels by 2030.[9]

To accomplish this, the Clean Power Plan sets emission-reduction targets for each state by applying emission performance rates for two categories of fossil fuel-fired power plants to each state's mix of electricity generation sources. Each state is given a target for its emission levels, as well as a series of interim targets, beginning with the initial compliance deadline in 2022 and running through three steps to phase in full compliance by 2030. The plan allows states to establish their own plans to reach the required emissions targets, although it does provide a model for achieving the requirements. The EPA set state targets by calculating reductions from:

[4] International Energy Agency, Renewable Energy, Medium-Term Market Report, Market Analysis and Forecasts to 2020 (2015).

[5] ''Innovate, Manufacture, Compete: A Clean Energy Action Plan,'' Pew Charitable Trusts 13 (January 2013).

[6] *Id.*; U.S. Energy Information Administration, ''Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2015'' (June 2015).

[7] Wall Street Journal, May 10, 2015, Apple Expands Renewable Energy Goal.

[8] *Massachusetts v. EPA*, 549 U.S. 497 (2007).

[9] *See* ''Clean Power Plan for Existing Power Plants,'' U.S. EPA (August 20, 2015), *available at* http://www2.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants.

- on-site changes to regulated power plants;
- switching generation from higher carbon intensity sources to lower carbon intensity sources (e.g., from coal-fired power to natural gas power); and
- increasing reliance on renewable generation.

States have flexibility to design their implementation plans in a variety of ways and are not bound by the assumptions used by the EPA to calculate the state goals. For examples, states can incorporate savings from energy efficiency or other technologies that were not used by the EPA or could increase the relative reductions among the factors considered by the EPA. States may not, however, change their overall performance targets.

The Clean Power Plan also includes the Clean Energy Incentive Program (CEIP), which is designed to incentivize early investment in certain types of renewable energy and energy efficiency projects. Projects that generate carbon-free energy or reduce low-income community end-use energy demand during the years 2020 and 2021 would be eligible under CEIP and would generate allowances or emission reduction credits for participating states. Each megawatt-hour of generation from eligible wind and solar projects would generate one emission reduction credit for the state, counting toward the state's Clean Power Plan target.

The Clean Power Plan's scope and impact are unprecedented, and it will almost certainly be reviewed by the D.C. Circuit and the Supreme Court. Assuming it survives legal challenge in whole or in part, the Clean Power Plan will have major ramifications for U.S. energy markets:

- **Decrease Coal-Fired Power, Shift to Natural Gas and Renewables**: By design, the Clean Power Plan will require states to reduce the carbon intensity of statewide emissions from regulated power sources, thereby shifting generation from higher-intensity sources (coal-fired power) to lower- or zero-intensity sources (natural gas or renewables) or reducing demand (energy efficiency measures).
- **Increased Renewable Investment**: Investment in new renewable energy generation capacity will be one of the primary mechanisms for realizing the mandated emissions reductions. Utility-scale renewable energy generation, particularly wind and solar, will benefit from increased demand in both the near term and long term as assets to facilitate compliance. In the near term, wind and solar could see additional demand spurred by the CEIP, while, in the long term, utility-scale renewable generation will assist states in complying with the Clean Power Plan.
- **Credit Trading Will Create New Markets**: The Clean Power Plan was designed to allow the monetization of greenhouse gas reductions in the form of credits or allowances that could be bought or sold on new intra- or interstate markets. The use of markets will improve the efficiency of emission reductions, allowing producers of excess reductions to sell to generators who would otherwise not be able to meet compliance obligations.
- **New Opportunities for Technologies and Innovations**: The Clean Power Plan represents a significant market opportunity for clean technology companies looking to monetize greenhouse gas reductions by selling credits on newly formed markets. Distributed resources and energy efficiency technologies are expected to play a major role in meeting the plan's targets.
- Biomass, waste-to-energy systems, combined heat and power, and demand-side energy efficiency, however, are all technologies included within the EPA's model rule but not the agency's proposed federal implementation plan (i.e., the plan that would be imposed on states that do not adopt their own plan). Other clean technologies such as energy storage were not included in the model rule. Therefore, for companies prioritizing these technologies, advocacy at the state level is critical to ensure that state implementation plans include the technology as a compliance option.
- **International Agreements**: The Clean Power Plan was central to the U.S.'s pledge to reduce carbon emissions for the United Nations climate agreement talks in Paris. The U.S. submitted its intent to reduce greenhouse gas emissions ''by 26 percent to 28 percent below its 2005 level in 2025 and to make best efforts to reduce its emissions by 28 percent.''[10] If the U.S. and other major emitters such as China support significant reductions, then the possibility for an international agreement increases, potentially creating a global framework for reducing greenhouse gases, a large proportion of which would come from reducing the carbon intensity of the energy sector.

**California Continues to Lead**. At the state level, California continues to lead with the adoption of increasingly ambitious climate change and renewable energy policies. California is on a glide path to meet two of its seminal environmental requirements: (1) a renewables portfolio standard (RPS) requiring the state to obtain 33 percent of its electricity from renewables by 2020, and (2) the 2006 Global Warming Solutions Act requiring a reduction of greenhouse gas emissions to 1990 levels by 2020. Given this success, California policy makers have begun looking beyond 2020.

California Senate legislation (S.B. 350) introduced in early 2015 initially called for a 50 percent reduction in petroleum use in cars and trucks, a 50 percent increase in energy efficiency in buildings, and for 50 percent of the state's utility power to be derived from renewable energy, all by 2030, termed the 50-50-50 formula. Following a contentious political fight by the oil and gas industry, however, lawmakers dropped the requirement for a 50 percent reduction in petroleum use for cars and trucks. As modified, the bill passed on a 52–27 vote in the Senate.

Despite the removal of the petroleum reduction provision, which garnered headlines, S.B. 350 represents a sweeping expansion of renewable energy and energy

[10] United Nations Framework Convention on Climate Change (UNFCCC), United States Cover Note to Intended Nationally Determined Contribution (INDC), available at http://www4.unfccc.int/submissions/INDC/Published%20Documents/United%20States%20of%20America/1/U.S.%20Cover%20Note%20INDC%20and%20Accompanying%20Information.pdf.

efficiency mandates. The bill increases the RPS to 50 percent by 2030 and requires a doubling of energy-efficiency savings from existing buildings by 2030, which remain ground-breaking measures in themselves.

S.B. 350 also requires utilities to develop strategies to advance the electrification of the transportation fleet. Indeed, widespread transportation electrification is now ''the policy of the state'' and a legislatively recognized means to achieve both ambient air quality standards and the state's climate goals.

The bill also lays the groundwork for increasing coordination with neighboring states. S.B. 350 expands the mandate of the California Independent System Operator (CAISO) to permit it to enter into compacts with states within the Western Electricity Coordinating Council and to, thereby, become a regional system operator. While this ultimately will require additional legislation and the willingness of other states to participate in the new organization, it could lead to much greater coordination throughout the Pacific-Western region, in keeping with the goals of the federal Clean Power Plan.

In April 2015, California Gov. Jerry Brown (D) issued an executive order requiring state agencies to reduce greenhouse gas emissions to 40 percent below 1990 levels by 2030.[11] Senate Bill 32 was proposed to codify this order as state law and extend the mandate to 80 percent below 1990 levels by 2050, but the bill stalled in the state Legislature. S.B. 32 will likely be reconsidered in the 2016 legislative session.

As California is a major economy and has historically been a leader on environmental policies, its actions will drive markets and incentivize some other states to act. Nevertheless, political differences among states means there will continue to be a patchwork of statewide climate change and renewable energy regulations within the U.S.

**Countervailing Trend: Declining Incentives**. The U.S. has seen a sharp drop in tax and stimulus funding in recent years. The $840 billion in stimulus funding from the American Recovery and Reinvestment Act has largely been expended. Key tax credits for the wind and solar industry—the Production Tax Credit and the Investment Tax Credit—have not been fully extended, given political gridlock in Congress, and future extension remain uncertain. While some programs have been expanded, such as the Department of Energy's loan guarantee programs for certain low-carbon technologies, the overall trend has been declining governmental incentives, adding uncertainty about the future strength of certain renewable markets.

**What to Expect Next?**. The Clean Power Plan, California S.B. 350 and other state and federal programs will drive a continued shift toward a lower-carbon energy sector in the West and throughout the U.S. Enhanced regional coordination to facilitate renewable energy markets and even intra- and interstate trading of carbon reduction credits in newly formed markets is expected. Declining costs will continue to make wind and solar increasingly cost-competitive with traditional sources in a number of markets, although the availability of cheap natural gas-fired generation could provide an alternative for displacing coal-fired power. Renewable growth will not only occur at the utility scale but also will be increasingly located near the customer, as rooftop solar, energy storage and informational technologies drive trends toward decentralization and consumer empowerment.

If the Clean Power Plan is overturned in court or watered down by a new administration, the force of these trends could diminish somewhat, but they will not likely disappear. A broad mix of federal and state polices, along with falling prices, will continue to push the transformation of the U.S. energy sector toward a lower-carbon paradigm.

## III. China

China's economic growth has historically been dependent on fossil fuels, and, in particular, coal. For example, since 2000, China has accounted for 47 percent of total global coal demand,[12] and coal is still used to produce around two-thirds of China's electricity.[13] A more detailed review of China's energy sources, however, suggests that coal's dominance could be waning.

In 2013, for the first time, more new clean energy sources than fossil fuel sources were added to the electrical grid in China. Government data shows that coal consumption fell by 2.9 percent in 2014; wind capacity increased by 26 percent, nuclear capacity by 36 percent and solar capacity by 67 percent in the same period.[14] In the first four months of 2015, coal consumption fell an additional 7.7 percent.[15]

The main drivers for this shift are: (i) the increasing cost-competitiveness of clean energy technologies; and (ii) the domestic and international pressures China faces in its role as the world's largest energy user.

**Increasing Cost-Competitiveness of Clean Energy Technologies**. China invested $90 billion in low-carbon energy in 2014—more than all of Europe combined and nearly twice as much as the U.S.[16] China is the world's biggest solar panel producer, accounting for more than 40 percent of global supplies.[17] It has more wind-generating capacity than any other country. By developing mass-production solar and wind expertise, China is contributing to a strengthening of the economic arguments for these low-carbon technologies across the globe.

As it has successfully done with solar and wind, China plans to export its burgeoning nuclear energy expertise in the coming decades. There are currently 26 nuclear power reactors in operation and 25 more under construction. By the end of this year, China will boast

[11] ''Governor Brown Establishes Most Ambitious Greenhouse Gas Reduction Target in North America,'' Office of Gov. Edmund G. Brown Jr. (April 29, 2015), *available at* https://www.gov.ca.gov/news.php?id=18938.

[12] http://www.eia.gov/todayinenergy/detail.cfm?id=9751

[13] http://www.forbes.com/sites/mclifford/2015/09/03/chinas-economic-slowdown-we-may-have-seen-peak-coal/

[14] http://www.carbonbrief.org/blog/2015/02/official-data-confirms-chinese-coal-use-fell-in-2014/

[15] http://energydesk.greenpeace.org/2015/05/14/china-coal-consumption-drops-further-carbon-emissions-set-to-fall-by-equivalent-of-uk-total-in-one-year/

[16] http://www.wri.org/blog/2015/06/what-look-china%E2%80%99s-new-climate-proposal

[17] http://www.climatenewsnetwork.net/clouds-over-chinas-solar-power-industry/

  INER ISSN 0149-8738

the fourth-largest nuclear energy capacity in the world.[18]

**Domestic Pressures**. As China grapples with the environmental costs of rapid economic growth, its attention has now turned to the future and how to achieve sustainable development. Air pollution in China's cities has been reported to be almost 40 times higher than the World Health Organization's daily recommended limit. The cause of the pollution is due only in part to the burning of coal, as vehicle emissions and dust from construction and industry combine to generate smog that blankets many of China's largest cities.

Recognizing the impact of pollution on health, China is moving away from the kind of ad hoc measures seen at the Beijing Olympics and last year's Asia-Pacific Economic Cooperation conference to clear the skies toward a more comprehensive solution.

For instance, in September the legislature adopted an amendment to the Air Pollution Control Law obliging local governments to ban low-quality coal for residential use and specifying that more information about polluters is made publicly available. Last month, China's Ministry of Environmental Protection revealed that major polluting emissions have been ''on a large-scale decline in the first six months of 2015.''[19]

**U.S.-China Climate Agreement**. International agreements also are influencing the shift in Chinese policy. For example, when China signed the U.S.-China Climate Agreement in November 2014, it committed to carbon emissions reaching their peak by 2030 at the latest. By the same deadline, a minimum of 20 percent of energy must be sourced from renewables.

The U.S.-China Climate Agreement also contributed, in part, to the roll-out of a trial carbon permit trading system across seven provinces and cities, ahead of a plan to introduce a countrywide carbon trading scheme in 2016. This national market will dwarf the European emissions trading system, currently the world's largest.

**What to Expect Next**. Despite rapid growth in low-carbon energy sources, coal continues to have a critical part to play in meeting China's energy needs. The question is for how long? Data show that coal consumption continues to decline significantly, and as China further builds its capacity and expertise in low-carbon sources, this trend is expected to accelerate. It follows that coal's dominance will continue in the immediate term, but in the medium to longer term, a very different story may develop. Skeptics point to the heavy subsidization of new technologies by the Chinese government and note that China's commitment to economic growth may somewhat limit the extent to which it can further scale back the use of low-cost fossil fuels. There is strong evidence, however, that China is making significant progress in transitioning to a low-carbon economy.

China is at a crossroads, and its role at the Paris climate change conference was a key indicator of its future direction.

## IV. Europe

The European Union has developed a strategic ''Energy Union'' that is designed to achieve energy independence for the continent.[20] The Energy Union includes the following targets through 2020, which were set by EU leaders in March 2007:

- 20 percent reduction in EU greenhouse gas emissions from 1990 levels;
- Raising the share of EU energy consumption produced from renewable resources to 20 percent; and
- 20 percent improvement in the EU's energy efficiency, all by 2020.

These targets are interrelated, because an increase in renewable energy production will inevitably lead to a reduction in greenhouse gas emissions.

**Reduction in EU Greenhouse Gas Emissions**. The EU emissions trading system, commonly referred to as the ETS, is the cornerstone of the EU's drive to reduce the emissions of human-generated greenhouse gases for combating climate change. The ETS sets a cap on the total amount of certain greenhouse gases that can be emitted by industrial companies. In 2020, emissions from sectors covered by the ETS will be 21 percent lower than in 2005.[21]

**Renewable Energy**. The EU has placed special emphasis on promoting renewable energy sources within the member states. The European Commission passed Directive 2009/28/EC of the European Parliament and of the Council on April 23, 2009, on the promotion of the use of energy from renewable sources in line with the 2020 targets (the Renewable Energy Directive).

The Renewable Energy Directive established that a mandatory 20 percent share of EU energy consumption come from renewable energy sources by 2020. The directive fostered the deployment of renewable energy across the EU member states. Each country has tackled the target from different perspectives, since the production from renewable energy sources varies according to the particular environmental conditions of each member state. The result has been a push toward wind energy and photovoltaic energy.

a) Photovoltaic Energy. Over the past few years, photovoltaic energy was among the two most installed sources of electricity in the EU. In order to promote the development of renewable energy sources, many countries set supporting mechanisms such as tax incentives, feed-in tariffs and feed-in premium schemes. This trend is changing, however, as the retroactive effect of certain measures adopted in several countries concerning renewable energy incentives and tax relief have created uncertainty for potential investors.[22]

b) Wind Energy. Wind energy was the generating technology with the highest rate of new installations in 2014.[23] Germany remains the EU member state with the largest wind installed capacity, followed by the United Kingdom, Spain and France, but more than half

[18] http://www.technologyreview.com/news/539691/china-will-soon-leapfrog-traditional-leaders-in-nuclear-power/

[19] http://english.mep.gov.cn/News_service/media_news/201509/t20150907_309452.htm

[20] European Commission, '*A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy*' Communication [COM(2015) 80 final], 2015.

[21] European Commission, '*EU ETS Fact Sheet,*' October 2013.

[22] European Photovoltaic Association, *Retrospective measures at national level and their impact on the photovoltaic sector*, 2013.

[23] European Wind Energy Association, *Wind in Power 2014 European Statistics*, February 2015.

of the installed capacity was located in just two countries—Germany and the U.K. Such a significant concentration of installed wind capacity in just two member states is due to institutional support, commitment from their authorities and a stable regulatory framework.

**Energy Interconnections.** One of the key drivers of EU energy policy is securing energy supplies. The increase in renewables implies greater energy independence, minimizing potential strategic shortcomings arising from political or commercial disputes (*e.g.*, the Russia-Ukraine conflict and the associated impacts on Europe of dependence on Russian natural gas supplies).

Another large influence has been the Third Energy Package, designed to create full energy interconnections within the EU. There are currently two ''energy islands'' within Europe—the Iberian Peninsula, due to a lack of infrastructure; and the Baltic states, which are isolated from the rest of Europe and dependent on Russia. Connection of these areas to the rest of Europe is a priority, with a new interconnection grid going up between Spain and France and the Baltic Energy Market Interconnection plan designed to plug the Baltic states into global gas and energy markets.

**What to Expect Next?**. The EU plans to continue its energy strategy through the fostering of renewable energy sources and development of energy interconnections. The European Commission has proposed to set a greenhouse gas emission reduction target for domestic EU emissions of 40 percent below 1990 levels by 2030, which would require a 27 percent share of renewable energy, as well as increasing the energy efficiency by approximately 25 percent by 2030.[24]

Consequently, new regulations will likely continue to follow the current trajectory to reach the 2020 targets and, thereafter, the 2030 targets. In the medium term, we can expect an increase in interconnection projects and investments, as well as a progressive cutback on new renewable energy subsidies. The new emissions targets have triggered a ''race against the clock'' as the emission cap decreases and the ETS becomes progressively more relevant for industry.

**Marc Campopiano** is a partner in the Orange County, Calif., office of Latham & Watkins who advises on a wide variety of energy and infrastructure matters related to power generation, cleantech, renewable energy resources, transmission lines, land-use entitlements, air and water quality permitting and compliance, and environmental diligence and transaction review.

**Paul Davies** is a partner in the London office of Latham & Watkins whose practice focuses on advising on the environmental aspects of corporate transactions, in addition to a wide variety of work related to the management of contaminated land, the insurance of environmental risk, climate change, health and safety, asbestos and waste management issues.

**Antonio Morales** is the Deputy Office Managing Partner of the Spanish offices of Latham & Watkins, and his practice focuses on resolving a broad range of disputes through litigation proceedings, particularly related to energy and power projects, engineering, infrastructure and cleantech.

**Joseph Bevash** is the Office Managing Partner of the Tokyo office of Latham & Watkins and a partner in the Hong Kong and Singapore offices who has extensive experience representing lenders, underwriters and owner/developers in connection with a variety of international projects, including many of Asia's landmark power, gas and petrochemical projects.

[24] European Commission, ''*A policy framework for climate and energy in the period from 2020 to 2030*'' *Communication* [COM(2014) 15 final], 2014.

  INER ISSN 0149-8738