RAP® Energy solutions for a changing world

Carbon Markets 101:

Keys to Effective Design and Management

Presented by
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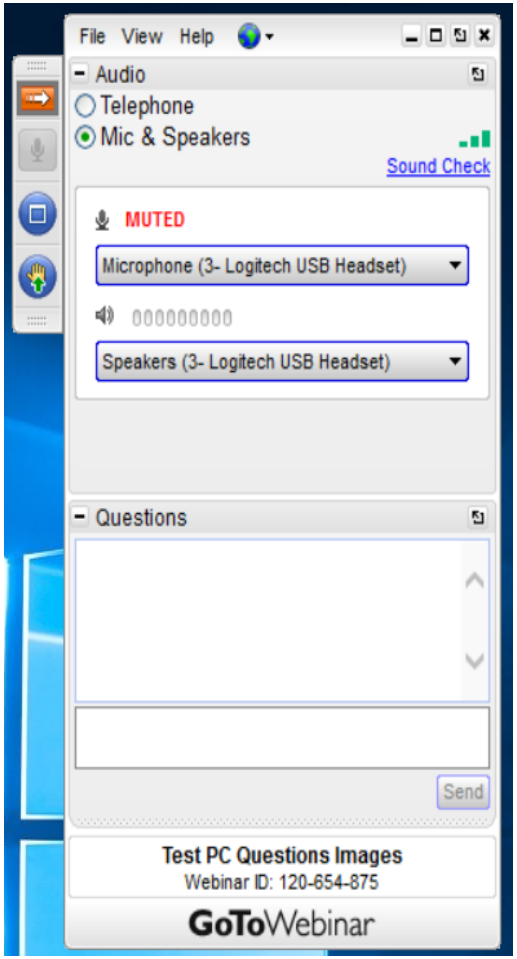
The Regulatory Assistance Project (RAP)®

Submitting Questions

Please send questions through the Questions pane.



Our Experts

David Littell

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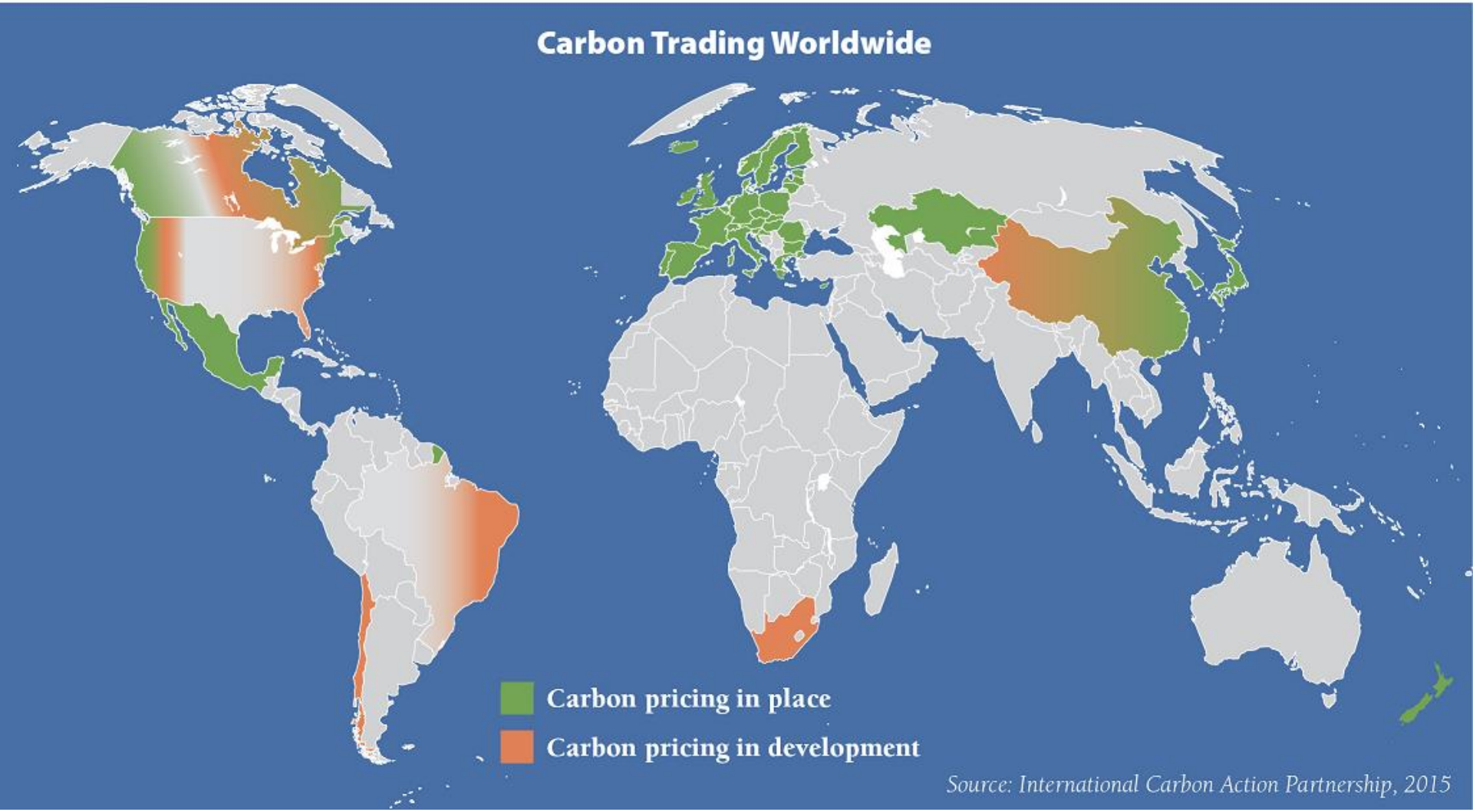

Carbon Trading Worldwide
Carbon pricing in place
Carbon pricing in development
Source: International Carbon Action Partnership, 2015

Basics of Carbon Market Design

- Stakeholder input is crucial at every step
- Stakeholders become pillars of an efficient market
- State regulators do not directly regulate secondary markets
- Minimize fraud and manipulation opportunities

Creation of a Carbon Market

Design and Implementation Steps

1. Determine scope of the system
Power sector, transportation sector, industry, regional, other?

2. Choose type of system: (mass-based or rate based?) Establish an emissions budget or emissions rate

3. Allocation (auction or free?)
- Freely allocate (historically-based or output-based) or
- Sell at set price or through auction (allocate revenues, e.g., to energy efficiency, renewable energy, customer rebates, reduced program fees) or
- Hybrid approach

3.5 If a rate-based system, set rate credit mechanisms (scope of eligible activities and rate of credits)

4. Flexibility mechanisms and address volatility
Banking, borrowing, allowance price collar/cap; allowance reserve, offsets

5. Oversight and compliance assurance

6. Implement program
Clear start dates for market participants for market, oversight, and compliance (may be different dates)

7. Program review
Scheduled process for evaluation and improvement/corrections

Three important concepts are crucial to establishing an effective carbon market. They should be considered in many of the steps.

Share info
Public/stakeholder process/release of all information for feedback

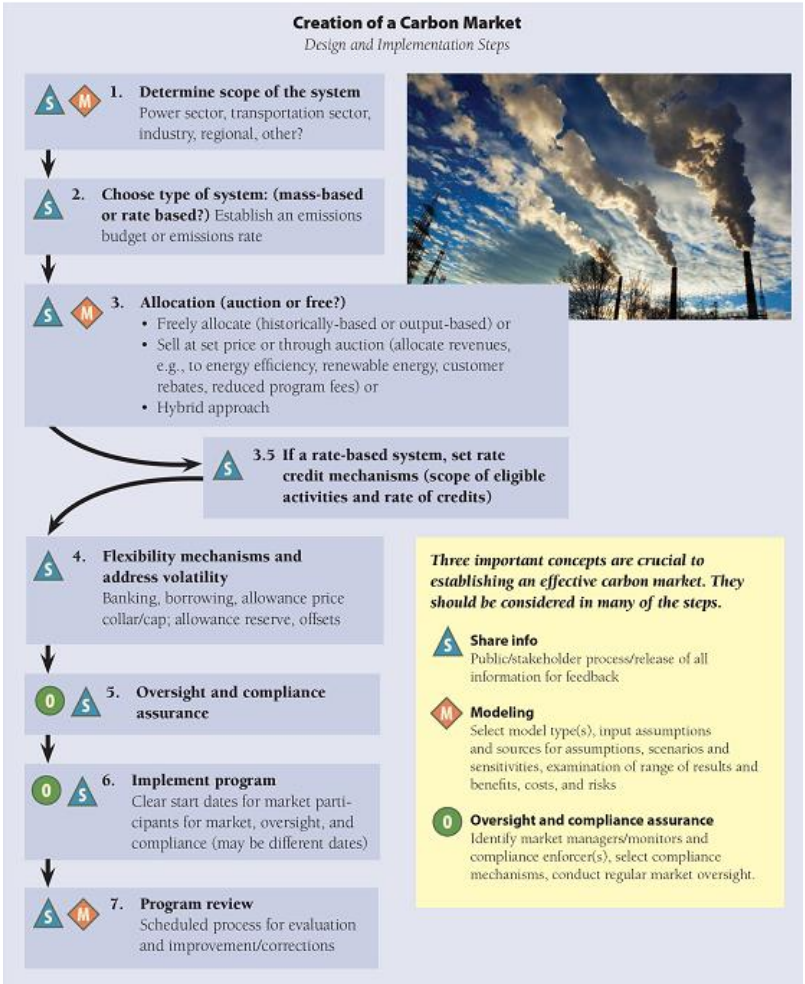
Modeling
Select model type(s), input assumptions and sources for assumptions, scenarios and sensitivities, examination of range of results and benefits, costs, and risks

Oversight and compliance assurance
Identify market managers/monitors and compliance enforcer(s), select compliance mechanisms, conduct regular market oversight.

Importance of Transparency in Market Design

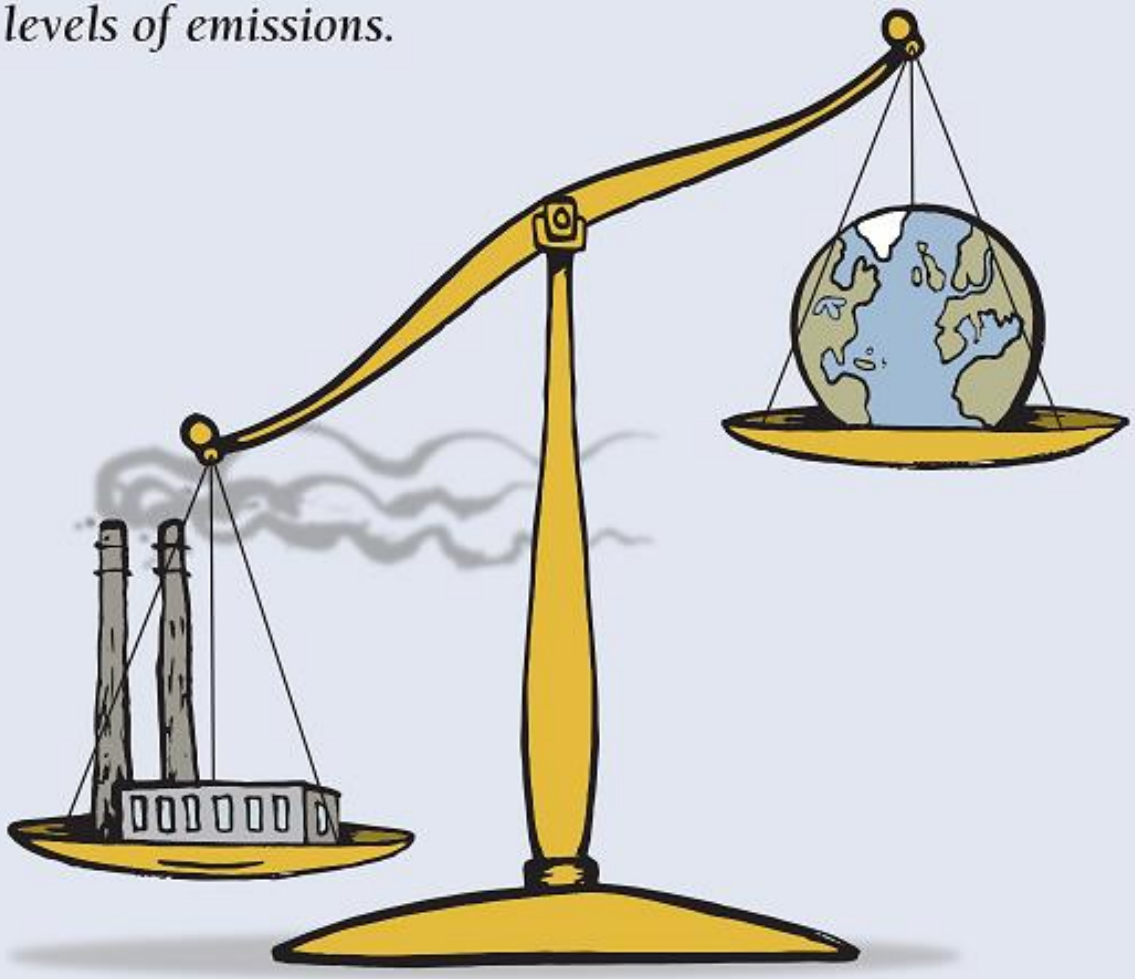
- The first step is open dialogue with stakeholders
- Ensures basis for investment decisions is clear to all market participants
- Modelling should be consensus-driven
- Different model scenarios and sensitivities illuminate varied costs and risk

Transparency in Implementation and Regulation



- Market rules and practices must provide a level playing field
- Participants equal access to information (prices, volumes, future regulation)

Polluting for free creates an economic externality that tilts markets to excessive (and inefficient) levels of emissions.



Modeling in Market Design

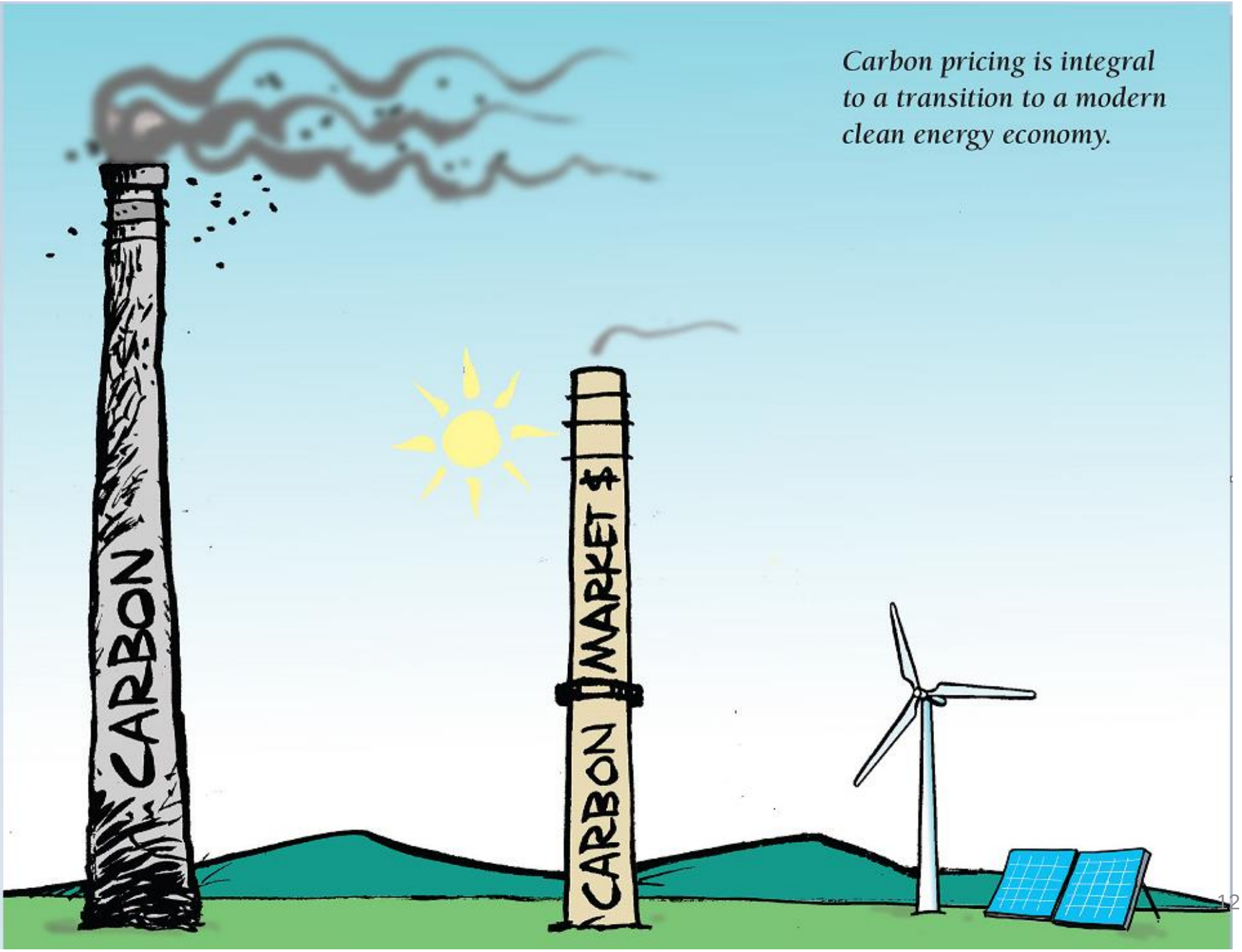
- Modeling is an attempt to predict the future
- Assumptions on future generator mix, fuel costs, EE, RE, transmission builds, cost of new builds should be clear
- Range of assumptions run in different scenarios and sensitivities
- Different scenarios and sensitivities illustrate cost range and risk – and illustrate ways to manage risk and cost-reduction strategies

Relative Risk Exposure of New Generation Resources

Price and risk determine the relative cost and reliability exposure of future energy resource portfolios.

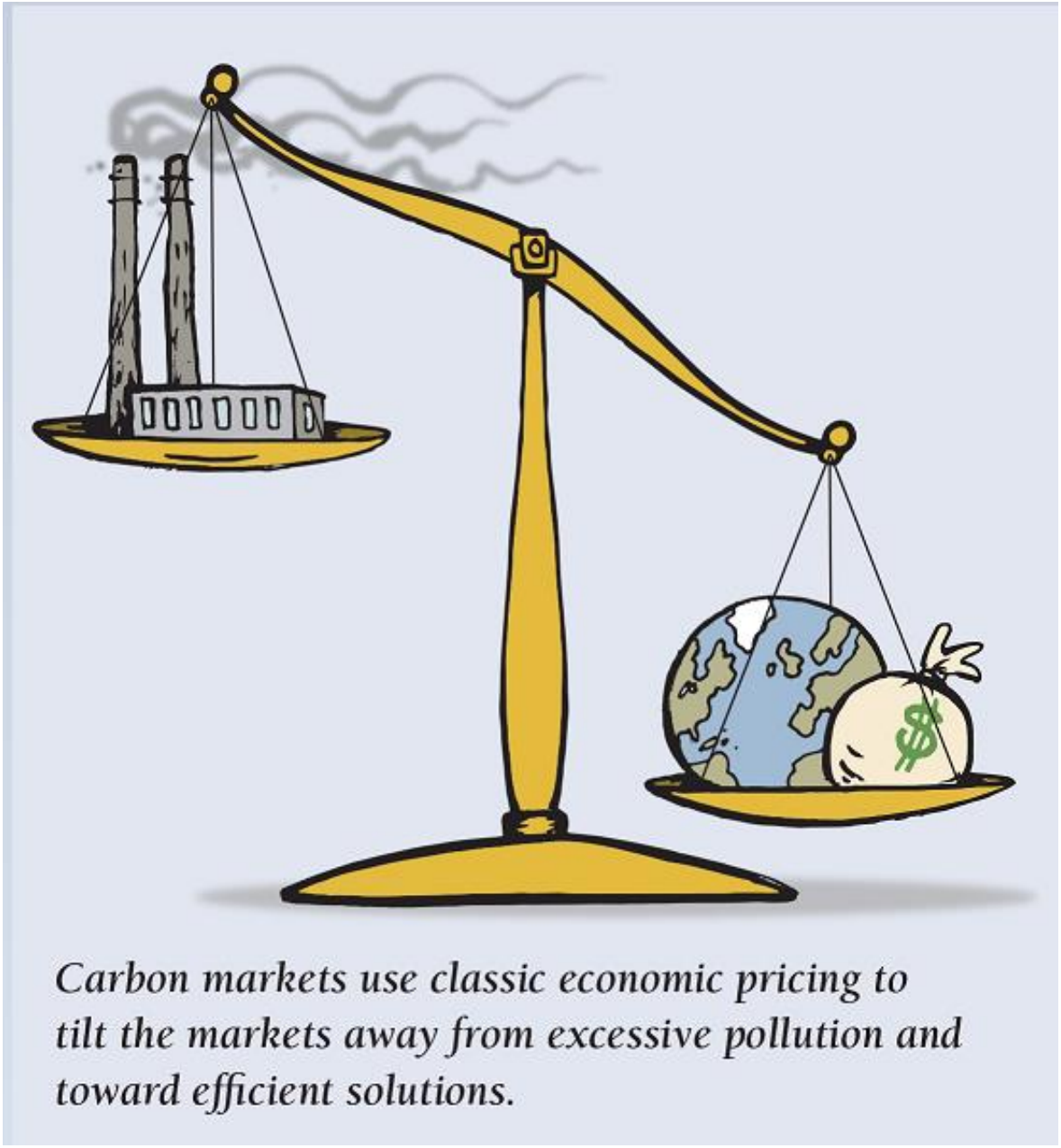
Resource	Initial Cost Risk	Fuel, O&M Cost Risk	New Regulation Risk	Carbon Price Risk	Water Constraint Risk
Biomass	Medium	Medium	Medium	Medium	High
Biomass Co-firing	Low	Low	Medium	Low	High
Coal IGCC	High	Medium	Medium	Medium	High
Coal IGCC-CCS	High	Medium	Medium	Low	High
Efficiency	Low	None	Low	None	None
Geothermal	Medium	None	Medium	None	High
Large Solar PV	Low	None	Low	None	None
Natural Gas CC	Medium	High	Medium	Medium	Medium
Natural Gas CC-CCS	High	Medium	Medium	Low	High
Nuclear	Very High	Medium	High	None	High
Onshore Wind	Low	None	Low	None	None
Pulverized Coal	Medium	Medium	High	Very High	High
Solar - Distributed	Low	None	Low	None	None
Solar Thermal	Medium	None	Low	None	High

Source: Ceres, 2014. CC = combined cycle; CCS = carbon capture and storage; IGCC = integrated gasification combined cycle; O&M = operations and maintenance; PV = photovoltaic


Carbon pricing is integral to a transition to a modern clean energy economy.
CARBON
CARBON MARKET $

Energy Sector of the Past or Future?

- Allocations can influence what clean energy will look like in the state:
  - ❑ Free?
  - ❑ EE, RE, advanced distributed energy resources?
  - ❑ Low-income rate relief?
- Regional approach?
  - ❑ Diversity of generation and demand-side resources
  - ❑ Maximizes cost-reductions to achieve least-cost options
  - ❑ Diversifies risk of getting energy markets wrong



Carbon markets use classic economic pricing to tilt the markets away from excessive pollution and toward efficient solutions.

Initial Allocation and Distribution

- Allowances for free risk a potential windfall benefit to recipients
- To eliminate this windfall, you need a binding requirement to use free allocations to reduce rates or benefit ratepayers in specific ways
- Auctions?
  - RGGI, CA, EU
  - Auctions provide a clear market signal for price discovery
- Proceeds for consumer benefit such as: EE, RE, low-income efficiency, bill-credits. . . .

Mass-Based or Rate-Based?

- Mass-based –
  - ~40% lower cost than rate-based
  - Readily tradeable
  - Create opportunity for auctions
  - Opportunity to influence value transfer to consumers
- Recipients of value in rate-based system are:
  - Resources that generate emission reduction credits (ERCs)
    - Highly efficient existing (pre-2014) gas combined cycles units
    - RE built post-2013
    - EE post-2013

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Rate-based emissions reduction credits and the Clean Energy Incentive Program provide direct credits for renewable energy.

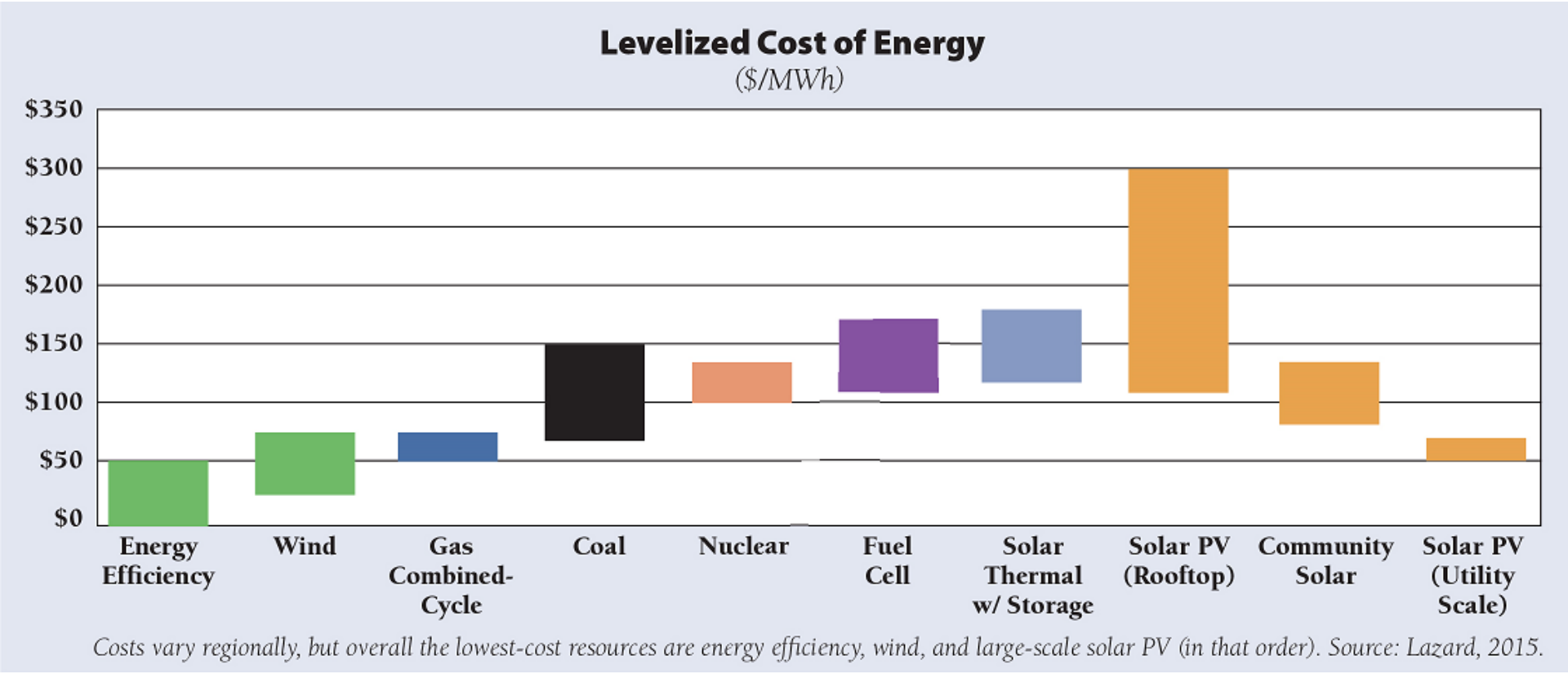
Secondary Markets – Trading after Initial Distribution

- Not regulated by state officials
- No market liquidity means purchasers cannot find sellers & buyers cannot find sellers
- Lack of liquidity opens opportunities for market manipulation

Achieving Least-Cost Compliance

- Carbon markets around electricity regions generally:
  - ❑ Reduce costs
  - ❑ Increase liquidity
  - ❑ Reduce price volatility
  - ❑ Reduce risk
- Give to retail electricity companies and require to sell and use proceeds for ratepayer benefit (PUC)
- Integrated Resource Planning (IRP)

Cost of Primary Energy Resources 2015 Lazard Analysis

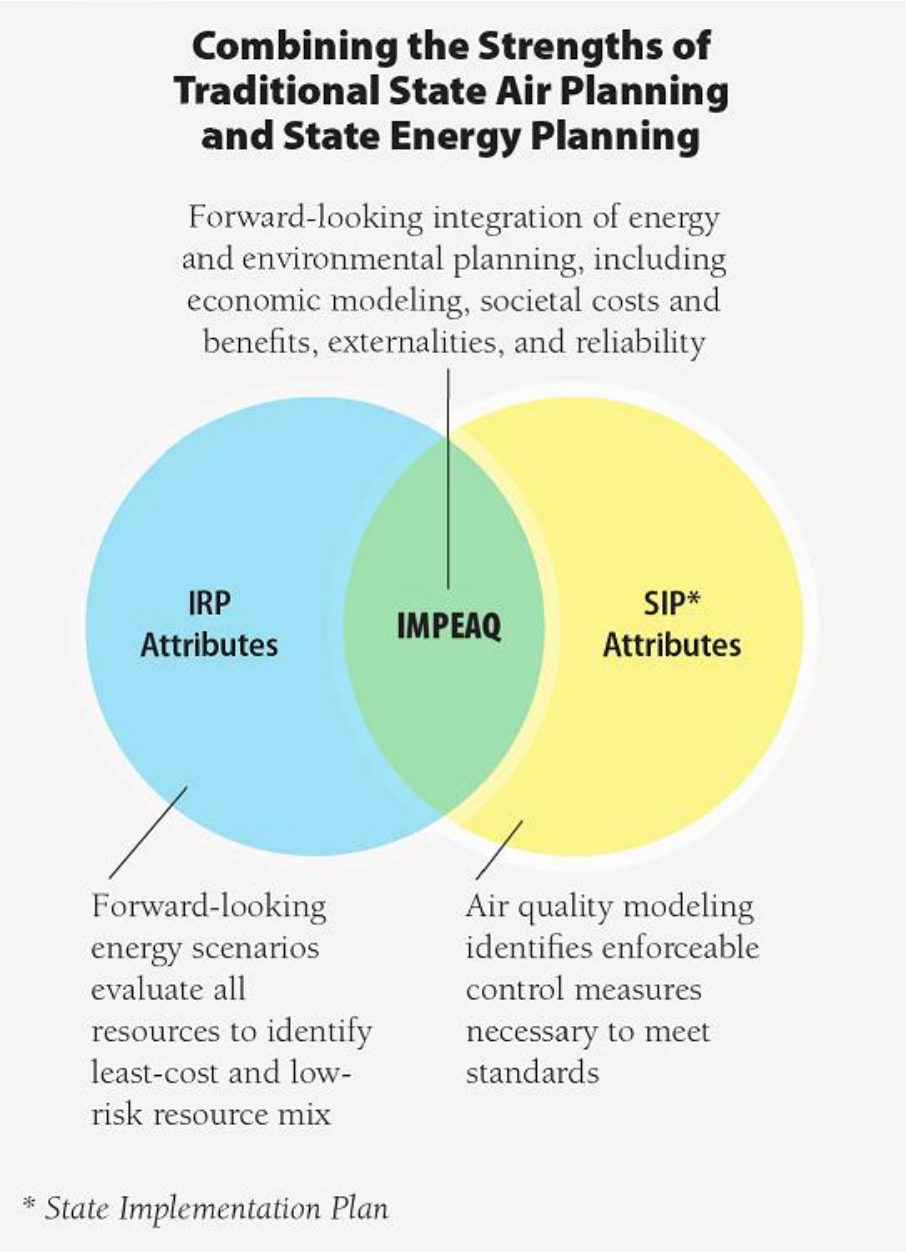


Costs vary regionally, but overall the lowest-cost resources are energy efficiency, wind, and large-scale solar PV (in that order). Source: Lazard, 2015.

Integrated Energy, Air, and Environmental Cost and Benefit Planning?

- Combined strength of traditional state energy planning and air planning
- Forward-looking integration to evaluate all resources to identify low-cost and low-risk resource mixes
- Ensure reliable and safe energy

Integrated Energy and Environmental Planning



Allowance/Credit Ownership

- Efforts to limit ownership can create markets subject to manipulation
- Buyer-side or supply-side market power
- Set up rules and review to ensure you know who your participants are (e.g., corporate affiliate disclosures to enforce market holding limits)
- Financial security for the primary auction

Minimizing Risk of Market Manipulation

- Transparency
- Oversight through registry and tracking
- Oversight by look at secondary market(s)
- Primary market participation requirements
  - Minimum and maximum purchase limits
  - Affiliate disclosure
  - Financial security

Minimizing Risk of Market Manipulation

- Maximize allowances available for purchase
- Market monitor (MM)
  - MM function well known in electricity markets
- Regular reports and accountability to the market
- Information exchange with financial and commodity market regulators (e.g., the CFTC)

Questions?

Concluding Best Practices

- Understanding of market rules by market participants
- Confidence in market rules, enforcement and oversight of the market
- Without transparency, effective oversight is difficult
- Show all model assumptions and inputs
- Design to minimize fraud/manipulation

About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power sector. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

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