

The Use of Feed-in Tariffs for the Promotion of Renewable Energy: Applications in Colorado

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NREL/NARUC Grant

- State-specific assistance for solar energy
- Colorado Public Utilities Commission
 - Policy Research & Emerging Issues Group
 - Geri Santos-Rach, Section Chief
 - Rich Mignogna, Colorado Project Lead

Scope of Work

- Research:
 - International & domestic FIT programs
- Emphasis:
 - Solar power—primarily PV
 - Secondary focus—solar thermal, CSP
- Analysis:
 - Compared FITs with regulatory & incentive programs based on diverse success metrics

FITs Around the World

International

- Over 60 programs implemented in countries & sub-national bodies worldwide
- EU countries have the longest-running programs
- Focus: Germany, Spain, Italy, France, Ontario, South Africa, Denmark, Slovenia

Domestic

- Inception: PURPA (1978)
- First states: California & Vermont
- First utility: GRU
- At least 16 states have introduced legislation or opened a PUC docket to investigate FIT's
- Federal Legislation Introduced – H.R. 6401 (2008)

FIT Design Features: The Basics

- Required:
 - Purchase obligation
 - Guaranteed payment
 - Long-term contract
- Specify:
 - What technologies do you want to promote?
 - Who is eligible to receive a tariff?
 - How long should the contract last?

Obligations of Parties to the FIT

Utilities

- Purchase obligation
- Prioritization
- Probably required to pay for grid upgrades depending on national interconnection standards

Generators

- Measurement
- Forecasting (Spain)
- Usage charges
- Shallow OR deep interconnection costs depending on standards

Determining the Payment

- Cost Calculation Methodology
 - Percent-based cost
 - Avoided cost
 - Actual cost
- Pricing
 - Fixed vs. Premium payments

Differentiating the Payment

- Fuel
- Technology
- Size
- Peak/off-peak and seasonal
- Geographic
- Resource equalization
- Social responsibility
- Repowering
- High efficiency

Adjustment & Revision

Adjustment

- Changes rates by specified %
- New contracts
 - Degression
 - Annual
 - Capacity trigger
- Existing contracts
 - Inflation
 - Partial or total

Revision

- Major program revision
 - May change rates, technologies, etc.
- Occurs every 2-5 years

Funding FITs

- Equalized between utilities
- Passed-through to ratepayers
 - May be allocated differently among different classes of ratepayers

Other Incentive & Regulatory Programs to encourage Renewable Generation

- Financial Incentives
 - Rebates
 - CA's Solar Initiative (CSI)
 - CO – Public Service Company of CO & Black Hills
 - Grants
 - CT Clean Energy Fund
 - Production-Based Incentives (PBIs)
 - CA Solar Initiative
 - NJ Solar Alternative Compliance Payment (SACP)

Other Incentives & Regulatory Programs

- Regulatory Policies
 - Renewable Portfolio Standard (RPS) with Renewable Energy Credits (RECs)
 - Solar and DG Set-Asides
 - REC Multipliers
 - Net Metering
 - Distinctions from a FIT

Other Incentives & Regulatory Programs

- Federal Programs
 - Financial
 - Income Tax Programs – ITC
 - Grant Programs
 - Department of Agriculture and Treasury
 - Accelerated Method of Depreciation:
 - IRC § 167
 - Regulatory Policies
 - PURPA

Interactions of Other Financial Incentives & Regulatory Programs with FITs

Cooperative

- Rebates & Grants
- Tenders
- Loans
- RPSs
- RECs (if properly designed)
- Tax-Based Incentives

Competitive

- Net Metering (design dependent)



May need to reduce tariff if other subsidies are available

Legal Issues

- Jurisdiction & Federal Preemption
 - 2 Approaches to Avoid Preemption:
 - PURPA Avoided-Cost Calculation
 - FERC deference for rate setting calculations
 - Colorado's Implementation of PURPA
 - State REC/Green Energy Program
 - No FERC jurisdiction
 - State-created property rights

Legal Issues

- Applicability to Utilities
 - Utility ownership structure
 - Overall customer size
 - Colorado RPS designations:
 - Qualifying Retail Utilities (QRUs)= IOUs, REAs, MOUs > 40,000 customers

Legal Issues

- Retail Rate Impact – Colorado's RPS:
 - 2% annual cap for all IOUs
 - 1% annual cap for REAs
 - No cap for MOUs

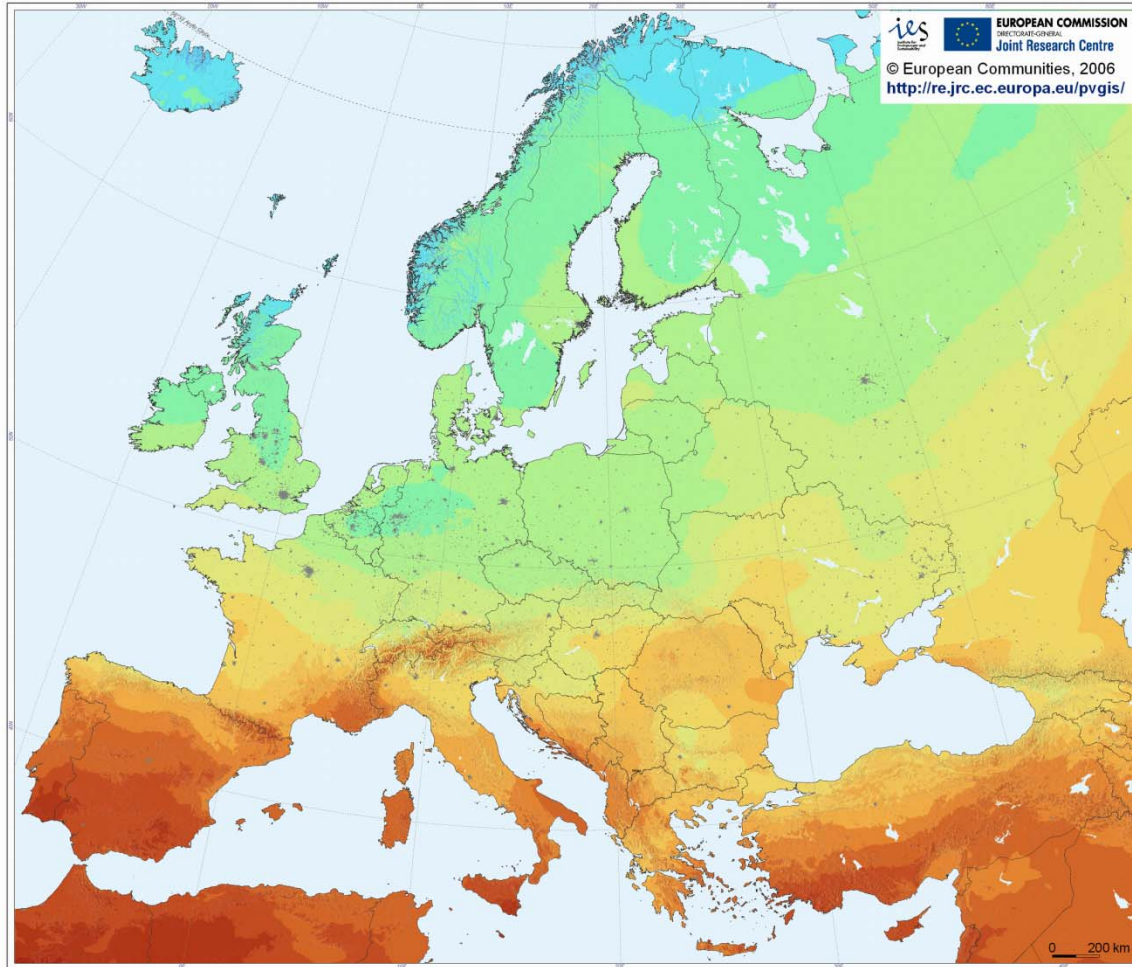
FIT Comparison Metrics

- Risk Reduction
 - For investors
 - For developers
 - For ratepayers
 - For utilities

FIT Comparison Metrics

- Capacity Addition
 - Actual capacity vs. solar potential
 - Correlation between FIT revision and capacity addition
 - Spain (2007)
 - Italy, France, Greece (2008)

Photovoltaic Solar Electricity Potential in European Countries



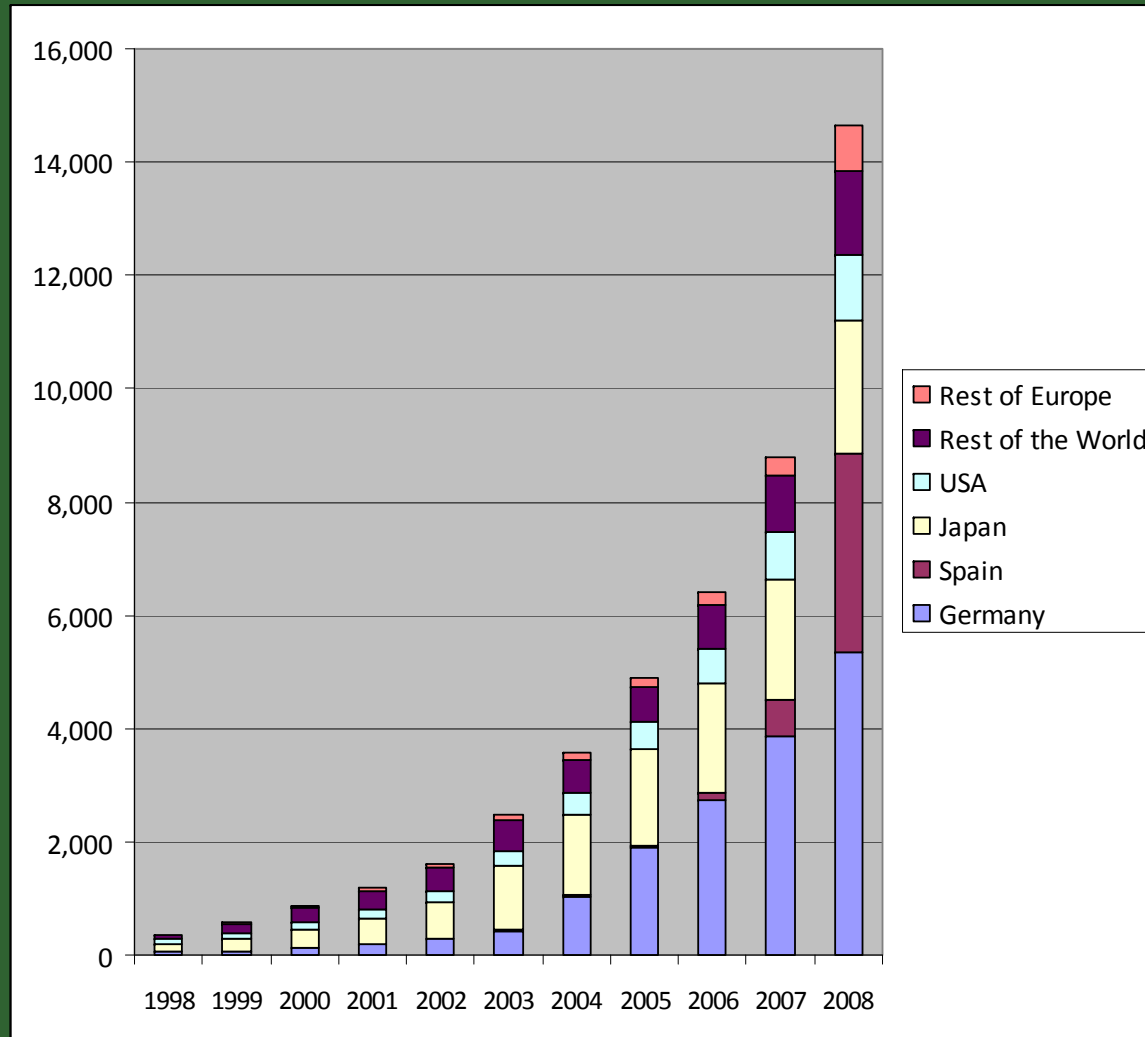
Yearly sum of global irradiation incident on optimally-inclined south-oriented photovoltaic modules

Global irradiation [kWh/m ²]
<600
800
1000
1200
1400
1600
1800
2000
2200>

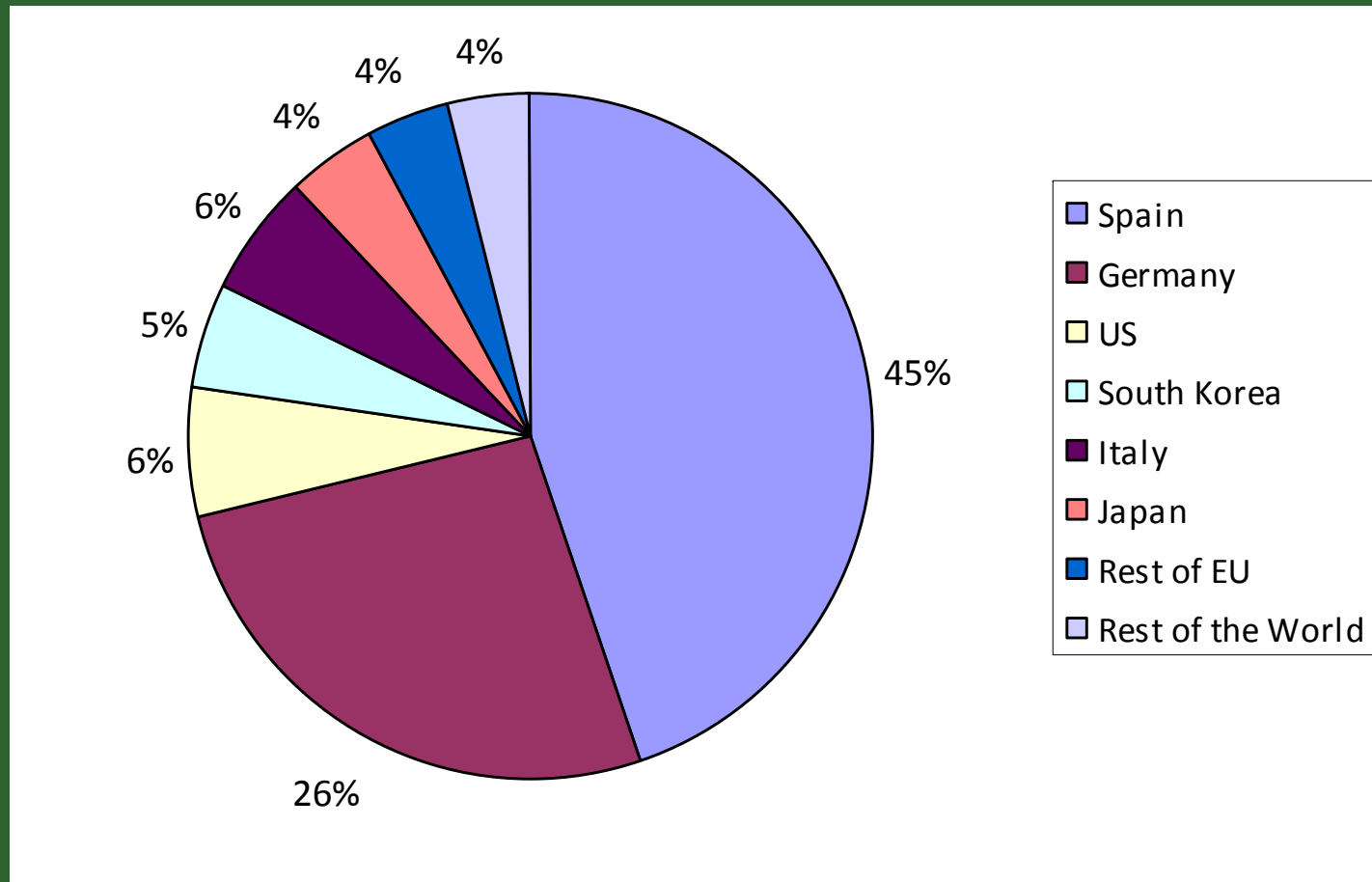
Yearly sum of solar electricity generated by 1 kWp system with optimally-inclined modules and performance ratio 0.75

Solar electricity [kWh/kWp]
<450
600
750
900
1050
1200
1350
1500
1650>

Cumulative Growth of Global Annual PV Market by Region (MW)



Capacity Additions by Country or Region in 2008 (% of Total MW)



FIT Comparison Metrics

- Deployment of PV
 - Grid-connected vs. off-grid
 - Distributed generation vs. utility-scale
 - Community ownership

FIT Comparison Metrics

- Domestic Industry Development
 - Job creation
 - Manufacture, installation, repowering
 - Germany
 - 2001: 4,000
 - 2007: 40,000

FIT Comparison Metrics

- Consumer Rate Impact
 - Can be controlled by FIT design:
 - Overall & annual program caps
 - Utility size
 - Ownership Structure
 - Still keep in mind Colorado's RPS retail rate cap:
 - 2% retail rate impact limit for IOUs
 - 1% retail rate impact limit for REA's

FIT Comparison Metrics

- Cost of Solar Electricity
 - US mean installed solar PV costs:
 - 1998: \$10.50/Watt
 - 2007: \$7.60/Watt
 - Costs reduced even further for Countries with large PV deployment programs:
 - Germany: \$6.60/Watt (2007)
 - Japan: \$5.90/Watt (2007)

FIT Comparison Metrics

- Ease of Implementation
 - Administrative hurdles
 - Identify goals in order to ensure corresponding FIT design
 - Grid Reliability & Management Issues
 - Political barriers
 - Legislative vs. administrative adoption
 - Utility cooperation (IOUs vs. MOUs vs. REAs)
 - Consumer Education

FIT Comparison Metrics

- Fulfillment of State RPS:
 - As currently formatted, is this an issue for Colorado's utilities?

FIT Lessons Learned

- Goals:
 - Capacity addition
 - Investor risk reduction
 - Ratepayer protection
 - Develop domestic industry
 - Distributed generation
 - Security of energy supply
 - Prevent NIMBYism

Suggested
Design
Approaches



Lessons Learned: Goals & Suggested Design Approaches

Capacity
Addition



- Base tariff on actual cost
- Guaranteed rate of return
- Purchase obligation
- Improve infrastructure

Investor Risk
Reduction



- Streamlined permitting & interconnection procedures
- Clear application process
- Purchase application
- No forecasting obligation

Lessons Learned: Goals & Suggested Design Approaches

Ratepayer
Protection



- Awareness of other incentives (federal, state, local)
- Capacity caps & depression triggers
- Tenders
- Provide for RECs to be allocated to & retired by utilities

Developing
Domestic
Industry



- Limit developer windfall to prevent boom-and-bust
- Government R&D funding
- Encourage repowering



Lessons Learned: Goals & Suggested Design Approaches

Distributed
Generation



- Promote community ownership structures
- Provide low-interest loans or up-front grants for small residential installations
- Reduce risk for small investors

Security of
Energy
Supply



- Forecast obligation for RE generators to encourage modeling
- Peak/off-peak pricing differentiation
- Encourage development in areas with better grid resources

Lessons Learned: Goals & Suggested Design Approaches

Prevent
NIMBYism



- Reduce risk for small investors
- Promote community ownership
- Resource equalization
- Public Awareness Campaign

Administrative
Simplicity



- Streamline applications/permits
- Clear interconnection rules
- Actual instead of avoided costs

Thank you for your attention!

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