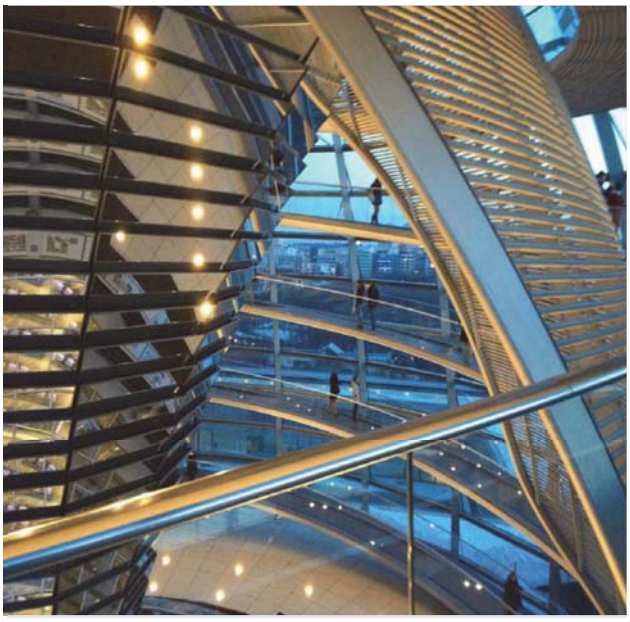


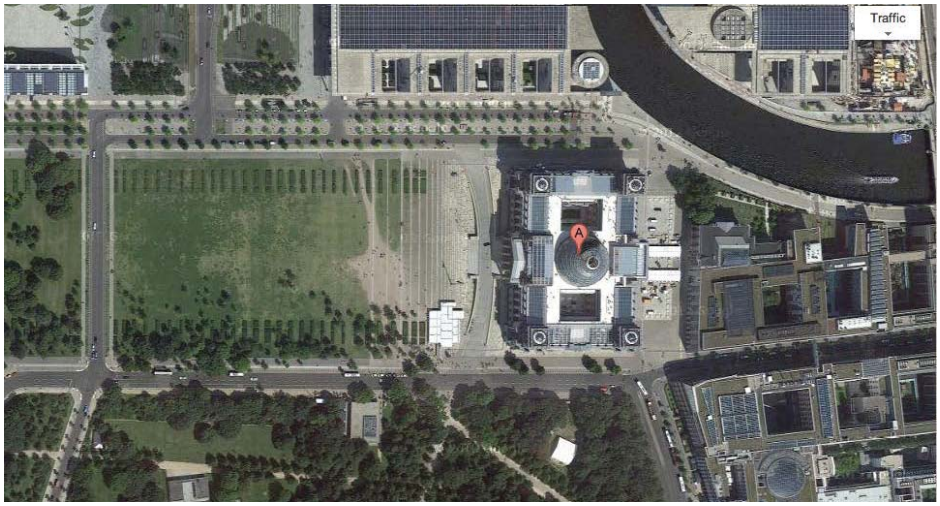
Reichstag, New German Parliament

Dave Waddoups, Jenette Danes, & Teara Lyons

Building History

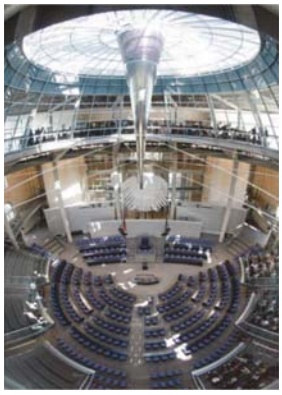
The Neo-Renaissance building was designed by Paul Wallot and the original design was completed in 1894. It was home of the Reichstag from 1894 to 1933, but was caught in a fire that nearly demolished the building one month after Adolf Hitler assumed chancellorship. The disused building sustained additional damage from an allied bombing taking place during World War II. Neglect from post war years lead to deterioration and by the 1970's is had been partially restored and was now known as the Museum of German History. The building under went further renovation under the British Architect Norman Foster, during the 1990's. The buildings huge glass dome, once the most recognizable feature, was rebuilt. An interior ramp spirals to the top of the dome, giving excellent views of the surrounding city. After the restoration was completed the building became one of Berlin's most prominent attractions to tourists.

Site Description



- Location: Berlin, Germany
- Reichstag is the meeting place of the Bundestag "federal Assembly", the lower house of Germany's national legislation.
- One of Berlin's most famous landmarks, it is situated at the northern end of the Ebertstrasse and near the south bank of the Spree River,
- Tietgarten park is directly west of the building, and the Brandenburg gate is to the south.
- There is a parking lot located on the East side of the site.
- And a giant lawn with a rose garden to the west side of the site.

Building Description: Current



Environmental Systems
The building was designed to optimize the use of passive systems whilst minimizing active systems. Both the artificial lighting and ventilation are controlled by a central BMS system and a heat exchanger recovers waste heat from the exhaust air.

Passive Design
The solar collector brings natural lighting into the heart of the building, whilst an automated solar shade protects against unwanted, direct solar gain. The main chamber of parliament is naturally ventilated via the cupola.

Water
Inside the building low flow fixtures and fittings were selected to help reduce the potable water requirements. All landscaping is either low maintenance or landscaping, to minimize water usage.

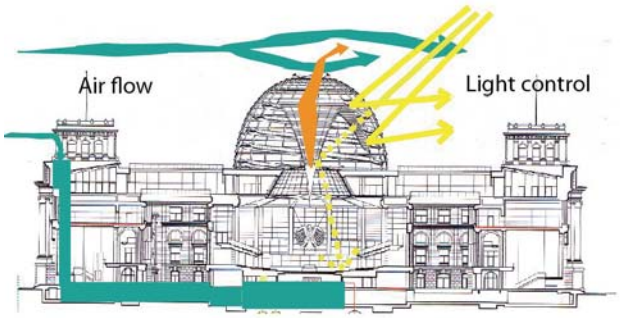
Renewable Energy
A biofuel powered, Combined Heat and Power (CHP) provides approximately 80% of the annual electricity and 90% of the heat load of the building. A large Ground Source Heat Pump (GSHP) acts as a seasonal store of both heat and cools. Photovoltaic's on the roof power the solar shade within the light sculpture.

Materials + Waste
The design aimed to protect and maintain the masonry shell of the heritage building, whilst redeveloping some of the core areas. By retaining most of the original building structure, construction and demolition waste was significantly reduced.

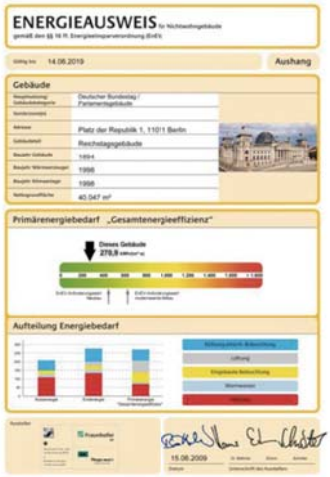
Energy Infrastructure
The CHP and GSHP units, at peak operation, provide energy to both the Reichstag and surrounding government buildings.

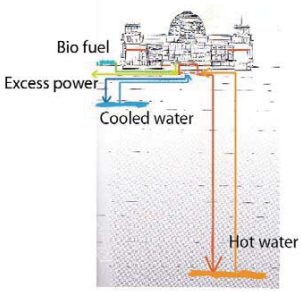
Energy Performance Certificate

- Public building that is a leading example for energy efficiency
- Excellent energy performance rating
- Optimum use of passive systems and minimal use of active.
- Dome provides natural day lighting and ventilation into center of building and interior glass walls allow light to penetrate through building. Roof PV panels power moving sun shield which blocks solar gain and glare.
- Modest energy requirements –270,9 kWh/m²a total primary energy use for heating, hot water, ventilation, cooling and lighting, 57% less energy than typical existing building (624.6 kWh/m²a) and 39% less than new building requirement (446.1 kWh/m²a).
- Cogenerator (combined heat and power) powered by biofuel provides 80% annual electricity and 90% heat load of the building. Provides energy to both the Reichstag and surrounding government buildings at peak operation.
- A ground source heat pump stores excess heat as hot water and chilled water underground for winter heating and summer cooling.
- Biofuel is grown and produced locally, is renewable, and is a cleaner fuel – 94% reduced CO2 emission. CO2 emissions for building is 24.9 kg/m²a.
- Central building management system controls artificial light and ventilation. Heat exchanger recovers waste heat from exhaust air.



Natural Ventilation and light





LEED Certification

- LEED Certification was not initially sought after, so no documentation was composed.
- However, there was evidence of some sustainability initiatives that enabled the Reichstag to be award points.
- Initial LEED Points according to our calculations totaled **43pts** which is LEED certified.

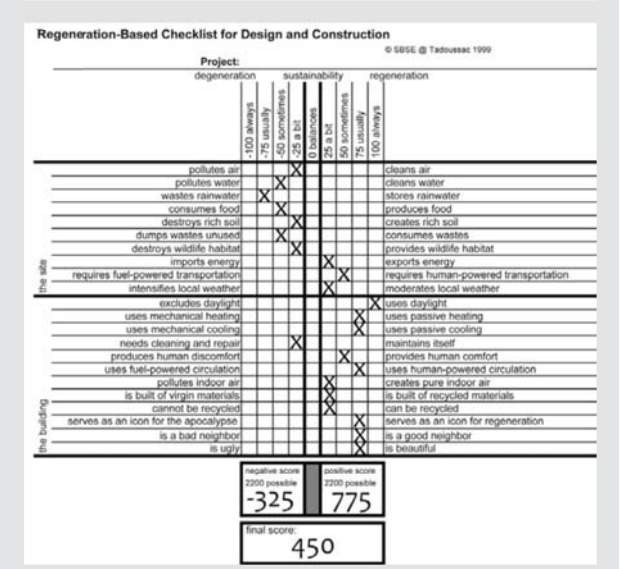
LEED 2009 FOR NEW CONSTRUCTION AND MAJOR RENOVATIONS PROJECT CHECKLIST

Sustainable Sites			**26 Possible Points**
☒	Prerequisite 1	Construction Activity Pollution Prevention	Required
☒	Credit 1	Site Selection	1
☒	Credit 2	Development Density and Community Connectivity	5
☐	Credit 3	Brownfield Redevelopment	1
☒	Credit 4.1	Alternative Transportation—Public Transportation Access	6
☒	Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
☐	Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
☒	Credit 4.4	Alternative Transportation—Parking Capacity	2
☒	Credit 5.1	Site Development—Protect or Restore Habitat	1
☒	Credit 5.2	Site Development—Maximize Open Space	1
☐	Credit 6.1	Stormwater Design—Quantity Control	1
☐	Credit 6.2	Stormwater Design—Quality Control	1
☐	Credit 7.1	Heat Island Effect—Nonroof	1
☐	Credit 7.2	Heat Island Effect—Roof	1
☐	Credit 8	Light Pollution Reduction	1
Water Efficiency			**10 Possible Points**
☒	Prerequisite 1	Water Use Reduction	Required
☒	Credit 1	Water Efficient Landscaping	2-4
☐	Credit 2	Innovative Wastewater Technologies	2
☐	Credit 3	Water Use Reduction	2-4
Energy and Atmosphere			**35 Possible Points**
☑	Prerequisite 1	Fundamental Commissioning of Building Energy Systems	Required
☑	Prerequisite 2	Minimum Energy Performance	Required
☒	Prerequisite 3	Fundamental Refrigerant Management	Required
☐	Credit 1	Optimize Energy Performance	1–19
☒	Credit 2	On-site Renewable Energy	1–7
☐	Credit 3	Enhanced Commissioning	2
☐	Credit 4	Enhanced Refrigerant Management	2
☐	Credit 5	Measurement and Verification	3
☒	Credit 6	Green Power	2
Materials and Resources			**14 Possible Points**
☑	Prerequisite 1	Storage and Collection of Recyclables	Required
☒	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors and Roof	1-3
☐	Credit 1.2	Building Reuse—Maintain Existing Interior Nonstructural Elements	1
☐	Credit 2	Construction Waste Management	1-2
☐	Credit 3	Materials Reuse	1-2
☐	Credit 4	Recycled Content	1-2
☒	Credit 5	Regional Materials	1-2
☒	Credit 6	Rapidly Renewable Materials	1
☐	Credit 7	Certified Wood	1
Indoor Environmental Quality			**15 Possible Points**
☑	Prerequisite 1	Minimum Indoor Air Quality Performance	Required
☑	Prerequisite 2	Environmental Tobacco Smoke (ETS) Control	Required
☐	Credit 1	Outdoor Air Delivery Monitoring	1
☒	Credit 2	Increased Ventilation	1
☐	Credit 3.1	Construction Indoor Air Quality Management Plan—During Construction	1
☐	Credit 3.2	Construction Indoor Air Quality Management Plan—Before Occupancy	1
☐	Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
☐	Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
☐	Credit 4.3	Low-Emitting Materials—Flooring Systems	1
☐	Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
☐	Credit 5	Indoor Chemical and Pollutant Source Control	1
☐	Credit 6.1	Controllability of Systems—Lighting	1
☐	Credit 6.2	Controllability of Systems—Thermal Comfort	1
☐	Credit 7.1	Thermal Comfort—Design	1
☐	Credit 7.2	Thermal Comfort—Verification	1
☒	Credit 8.1	Daylight and Views—Daylight	1
☒	Credit 8.2	Daylight and Views—Views	1
Innovation in Design			**6 Possible Points**
☒	Credit 1	Innovation in Design	1-5
☐	Credit 2	LEED Accredited Professional	1
Regional Priority			**4 Possible Points**
☐	Credit 1	Regional Priority	1-4

LEED 2009 for New Construction and Major Renovations

100 base points; 6 possible Innovation in Design and 4 Regional Priority points

Certified	40–49 points
Silver	50–59 points
Gold	60–79 points
Platinum	80 points and above



Problematic Areas

- No rain water collection
- Building size and hardscape create a large amount of water runoff.
- No reuse of or treatment of grey water.
- On site café has no recycling strategies (to the best of our knowledge)
- 0 Green space within the structure.
- Due to the age of the building maintenance and repair are necessary

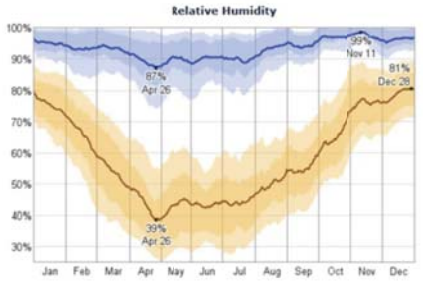
Key:

Hardscape With Heat retention Properties contributing to the Heat Island Effect

Hardscape roof space with Heat absorbing and reflective material.

Redesign Strategies

- **Storm Water Collection**
  - Cisterns providing water for the additional gardens and green spaces.
- **Gardens & Green Roofs**
  - Gardens provide additional food source for the café.
  - Green Roofs reduce the ambient heat, increase the air quality of the site, adds diversity and interest to the roof top, and creates shade for pedestrians.
- **Additional Harnessed Solar Energy**
  - By adding additional solar panels we have increased energy intake while reducing the heat island effect of the parking lot.
- **Grey Water Treatment Systems.**
  - Bio swale in the parking lot allows for excess storm water treatment and increases the habitat for natural wildlife
- **Replacement at appropriate times with New sustainable materials as necessary**
  - Windows, paint, carpets etc.
- **CO2 Monitoring**
  - Allows for monitoring of CO2 inside and outside of the building.



Redesign Strategies Continued…

Regeneration-Based Checklist for Design and Construction

© SBSE @ Tadoussac 1999

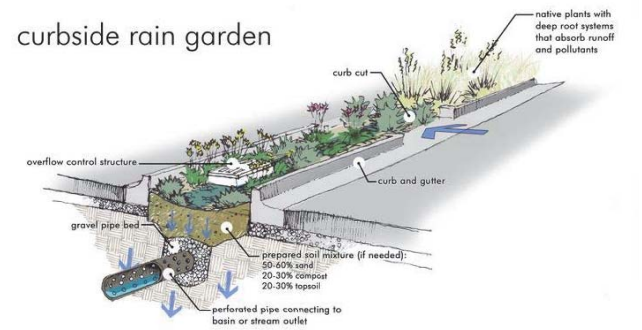
Project:

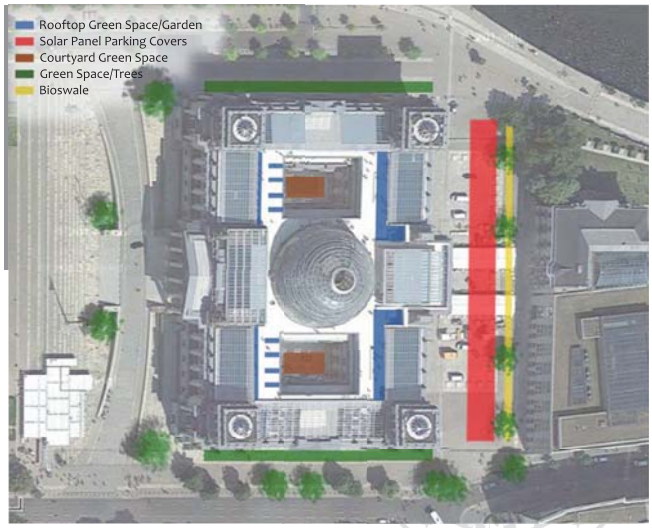
	degeneration	-100 always	-75 usually	-50 sometimes	-25 a bit	0 balances	25 a bit	50 sometimes	75 usually	100 always	regeneration
the site	pollutes air					X					cleans air
	pollutes water						X				cleans water
	wastes rainwater							X			stores rainwater
	consumes food						X				produces food
	destroys rich soil					X					creates rich soil
	dumps wastes unused					X					consumes wastes
	destroys wildlife habitat					X					provides wildlife habitat
	imports energy					X					exports energy
	requires fuel-powered transportation						X				requires human-powered transportation
	intensifies local weather						X				moderates local weather
	excludes daylight									X	uses daylight
	uses mechanical heating								X		uses passive heating
	uses mechanical cooling								X		uses passive cooling
	needs cleaning and repair				X						maintains itself
	produces human discomfort						X				provides human comfort
	uses fuel-powered circulation								X		uses human-powered circulation
	pollutes indoor air						X				creates pure indoor air
the building	is built of virgin materials					X					is built of recycled materials
	cannot be recycled					X					can be recycled
	serves as an icon for the apocalypse								X		serves as an icon for regeneration
	is a bad neighbor								X		is a good neighbor
	is ugly								X		is beautiful

negative score 2200 possible	positive score 2200 possible
-25	1075

final score: 1050

That makes for 600 point increase!





+ LEED Redesign

With our redesign we were able to obtain 53pts! Compared to our original score of 43pts. This now makes the Reichstag a LEED Silver Building.

LEED 2009 FOR NEW CONSTRUCTION AND MAJOR RENOVATIONS PROJECT CHECKLIST

Sustainable Sites			26 Possible Points
☒	Prerequisite 1	Construction Activity Pollution Prevention	Required
☒	Credit 1	Site Selection	1
☒	Credit 2	Development Density and Community Connectivity	5
☐	Credit 3	Brownfield Redevelopment	1
☒	Credit 4.1	Alternative Transportation—Public Transportation Access	6
☒	Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
☐	Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
☒	Credit 4.4	Alternative Transportation—Parking Capacity	2
☒	Credit 5.1	Site Development—Protect or Restore Habitat	1
☒	Credit 5.2	Site Development—Maximize Open Space	1
☒	Credit 6.1	Stormwater Design—Quantity Control	1
☒	Credit 6.2	Stormwater Design—Quality Control	1
☒	Credit 7.1	Heat Island Effect—Nonroof	1
☒	Credit 7.2	Heat Island Effect—Roof	1
☐	Credit 8	Light Pollution Reduction	1
Water Efficiency			10 Possible Points
☒	Prerequisite 1	Water Use Reduction	Required
☒	Credit 1	Water Efficient Landscaping	2-4
☐	Credit 2	Innovative Wastewater Technologies	2
☒	Credit 3	Water Use Reduction	2-4
Energy and Atmosphere			35 Possible Points
☑	Prerequisite 1	Fundamental Commissioning of Building Energy Systems	Required
☑	Prerequisite 2	Minimum Energy Performance	Required
☒	Prerequisite 3	Fundamental Refrigerant Management	Required
☐	Credit 1	Optimize Energy Performance	1–19
☒	Credit 2	On-site Renewable Energy	1–7
☐	Credit 3	Enhanced Commissioning	2
☐	Credit 4	Enhanced Refrigerant Management	2
☐	Credit 5	Measurement and Verification	3
☒	Credit 6	Green Power	2
Materials and Resources			14 Possible Points
☑	Prerequisite 1	Storage and Collection of Recyclables	Required
☒	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors and Roof	1-3
☐	Credit 1.2	Building Reuse—Maintain Existing Interior Nonstructural Elements	1
☐	Credit 2	Construction Waste Management	1-2
☐	Credit 3	Materials Reuse	1-2
☐	Credit 4	Recycled Content	1-2
☒	Credit 5	Regional Materials	1-2
☒	Credit 6	Rapidly Renewable Materials	1
☐	Credit 7	Certified Wood	1
Indoor Environmental Quality			15 Possible Points
☑	Prerequisite 1	Minimum Indoor Air Quality Performance	Required
☑	Prerequisite 2	Environmental Tobacco Smoke (ETS) Control	Required
☒	Credit 1	Outdoor Air Delivery Monitoring	1
☒	Credit 2	Increased Ventilation	1
☐	Credit 3.1	Construction Indoor Air Quality Management Plan—During Construction	1
☐	Credit 3.2	Construction Indoor Air Quality Management Plan—Before Occupancy	1
☒	Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
☒	Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
☒	Credit 4.3	Low-Emitting Materials—Flooring Systems	1
☐	Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
☐	Credit 5	Indoor Chemical and Pollutant Source Control	1
☐	Credit 6.1	Controllability of Systems—Lighting	1
☐	Credit 6.2	Controllability of Systems—Thermal Comfort	1
☐	Credit 7.1	Thermal Comfort—Design	1
☐	Credit 7.2	Thermal Comfort—Verification	1
☒	Credit 8.1	Daylight and Views—Daylight	1
☒	Credit 8.2	Daylight and Views—Views	1
Innovation in Design			6 Possible Points
☐	Credit 1	Innovation in Design	1-5
☐	Credit 2	LEED Accredited Professional	1
Regional Priority			4 Possible Points
☐	Credit 1	Regional Priority	1-4

LEED 2009 for New Construction and Major Renovations

100 base points; 6 possible Innovation in Design and 4 Regional Priority points

Certified	40–49 points
Silver	50–59 points
Gold	60–79 points
Platinum	80 points and above

Conclusion

With our redesign we found that there was very little improvement that was needed with the building itself. Foster took great initiative in designing the Reichstag to be sustainable as far as energy conservation and production and passive design for day lighting and ventilation.

However, the site itself neglected to address storm water treatment and heat island effects. With our redesign we were able to mitigate these issues bringing the Reichstag from a LEED Certified building to a LEED Silver. Our Malcolm-Wells checklist went from 450 pt. total to 1,050pts.

Citations

- German, B. (n.d.). *Registering to visit the dome of the reichstag building*. Retrieved from http://www.bundestag.de/htdocs_e/visits/kupp.html
- A view of Cities. (2014). *Reichstag*. Retrieved from http://www.aviewoncities.com/berlin/reichstag.htm
- Berlin.de. (n.d.). *Reichstag*. Retrieved from https://www.berlin.de/orte/sehenswuerdigkeiten/reichstag/index.en.php
- „Leading examples of public building;. German Reichstag recieves certificate with excellent energy performance." Buildup. 2010. Web. 5 Apr. 2014.
- Reichstag, New German Parliament." Foster + Partners. 2014. Web. 1 Apr. 2014.
- Catalogue Foster and Partners. Munich: Prestel, 2005. Print.
- Norman FosterWorks4. Munich: Prestel, 2004. Print.
- The Advertiser News. (2014). *Reichstag: symbol of sustainability*. Retrieved from http://www.adelaidenow.com.au/news/reichstag-symbol-of-sustainability/story-e6frebvu-1225900571715
- Weather Spark. (2014). *Average weather for berlin, germany*. Retrieved from http://weatherspark.com/averages/28621/Berlin-Brandenburg-Germany
- Frances, Walker. (2012). *Eagle creek water shed*. Retrieved from http://www.eaglecreekwatershed.org/involved/images/bioswale enlargement.jpg
- *2200 pv arra'ys for visitor parking at the springs preserve, with a bio-swale in the foreground.*. (2014). Retrieved from http://media-cache-ec0.pinimg.com/originals/d8/ea/11/d8ea11039dd0b1f6b96f5ee1efdee9d4.jpg